

	Halla A	Halla B	Samda A	Samda B	201A	202A
08:30	OPENING CEREMONY					
09:00	SCALA LECTURE: COMPOSITE MATERIALS : FROM STRUCTURAL TO MULTIFUNCTIONAL H. Thomas Hahn(Univ. of California, LA) (Chair: WI Lee)					
09:30	Break					
09:45	M1 NANOCOMPOSITES Chairs: R Nakamura/ D Tripathy M1-1 PREPARATION AND CHARACTERIZATION OF THERMOPLASTIC POLYURETHANE/CARBON NANOTUBE NANOCOMPOSITES AK Barick, DK Tripathy(Indian Inst. of Technology Kharagpur) Thermoplastic polyurethane (TPU) nanocomposites with multi-walled carbon nanotube (MWCNT) were melt compounded to estimate the effects of carbon nanotubes (CNT) on the nanostructure morphology and material properties of the TPU matrix. The field emission scanning electron microscopy (FESEM) observations indicated that the CNTs were uniformly dispersed within the TPU matrix.	M2 SYMPOSIUM ON MULTIFUNCTIONAL COMPOSITE MATERIALS FOR ENERGY APPLICATIONS Chairs: Les Lee/ D Inman M2-1 MULTIFUNCTIONAL COMPOSITES WITH APPLICATIONS TO ENERGY PERFORMANCE AND EFFICIENCY JP Thomas, MH Merrill, KM Metkus, A Pique, RK Everett(US Naval Research Laboratory) A new class of multifunctional composites called "poro-vascular" composites are being developed with an ionic liquid (IL) phase whose height and meniscus shape at the surface pores can be controlled to vary the meso-scale surface morphology from dimples to domes. Applications to skin-friction drag control are being investigated.	M3 GREEN COMPOSITES Chairs: H Takagi/ N Tran M3-1 CREEP AND DYNAMIC MECHANICAL BEHAVIOR OF NATURAL FIBER/FUNCTIONALIZED CARBON NANOTUBES MODIFIED EPOXY COMPOSITES CZ Chen, Y Li and Xu(Tongji Univ.) In this paper, the creep and dynamic mechanical behavior of ramie fiber/epoxy composites with and without MWCNTs were investigated. The results showed that the creep resistance and dynamic mechanical properties of natural fiber reinforced composites was greatly improved by the addition of MWCNTs.	M4 APPLICATIONS OF COMPOSITES Chairs: HJ Chun/ L Kollar M4-1 LOCAL DESIGN OF COMPOSITE RISER UNDER BURST, TENSION AND COLLAPSE CASES C.Wang, K Shankar, EV Morozov (Univ. of New South Wales) Local design of composite riser tubular with various laminate structures and material combinations was performed to reduce the weight of risers. The results show that composite riser provide significant weight saving than steel riser, especially those reinforced with high-strength carbon fibre considering the effects of fibre orientations and stacking sequences.	M5 HIGH PERFORMANCE COMPOSITES Chairs: BI Yoon/ CS Han M5-1 PHOTOENHANCEMENT OF QUANTUM DOT NANOCOMPOSITE VIA UV ANNEALING AND ITS APPLICATION TO WHITE LED CS Han, KN Kim, JY Woo, SH Jeong(Korea Inst. of Materials Science) We have firstly reported the irreversible PL enhancement that occurs due to ultraviolet (UV) annealing of a QD nanocomposite, which is a mixture of thermo-curable polymer and core-multishell QDs. After UV irradiation for 30min at 70W, the QD nanocomposite caused 1.6 times enhancement in the PL intensity.	M6 JOINTS AND BEARING BEHAVIOR Chairs: G Yuan/ K Jacob M6-1 FAILURE PROBABILITY OF PIN JOINT IN CFRP LAMINATE M Nakayama, N Uda, K Ono(Kyushu Univ.) An approach combining finite element damage analysis and a stochastic technique was applied to pin joints in CFRP laminates to analyze the probabilistic strength. Strength parameters and controllable dimension parameters were evaluated and compared for their effects on the strength. Failure probability of the joint and deterministic designs were interrelated.
10:05	M1-2 IMPROVEMENTS AND MECHANISMS OF THE INTERFACE STRENGTH BETWEEN FIBER AND EPOXY RESIN MODIFIED BY THE ALUMINA NANOPARTICLES LC Tang, XP Wu(Univ. of Science and Technology of China), H Zhang, H Zhang, Z Zhang(National Center for Nanoscience and Technology) The effect of alumina nanoparticles on the interfacial properties between fiber and epoxy resin was investigated. Well-dispersed nanoparticles enhanced significantly the interface strength between fiber and matrix. The fracture surface analysis demonstrated that the quality of fiber/matrix interface was improved after the addition of alumina nanoparticles.	M2-2 MICROVASCULAR HYBRID COMPOSITES FOR THERMAL ENERGY COLLECTION DM Phillips, RM Pierce(Wright-Patterson Air Force Base), JW Bauj(Air Force Research Laboratory) We investigated the internal thermal transport properties of 8-ply, autoclave-cured, IM-7/977-2 carbon-fiber epoxy, quasi-isotropic laminates with metallic-lined microchannels as means for thermal energy collection. In cases where widespread incorporation of thermal harvesting devices is prohibited by cost, design or processing complexity, the overall amount and efficiency of thermal energy conversion...	M3-2 BAMBOO-GUADUA ANGUSTIFOLIA KUNT FIBERS FOR GREEN COMPOSITES F Ramirez, A Maldonado, JF Correal, M Estrada(Univ. of Los Andes) Extraction and tensile properties of fiber bundles of bamboo Guadua are explored. Fiber bundles are extracted through chemical digestion and their modulus of elasticity and tensile strength were determined. Numerical simulations were performed and evidence of the Guadua angustifolia kunt fibers potential use as reinforcement for polymers was found.	M4-2 COMPARISON OF MICROWAVE AND CONVENTIONAL SINTERING OF AL₂O₃-ZRO₂ COMPOSITES T Thongchai, S Larpkiattaworn, D Atong, M Kitivan(Naresuan Univ.) Microwave processing is generally believed to be highly efficient of production. In this research the two different heating process produce different phase transformation, microwave promoted the formation of t-ZrO ₂ , while this did not occur with conventional at 1300°C. Microwave firing results in higher densities, flexural and compressive strength.	M5-2 BALLISTIC PERFORMANCE OF KEVLAR FABRIC PANELS CONTAINING SHEAR THICKENING FLUID JL Park, TJ Kang(Seoul National Univ.), BI Yoon, JG Paik(Agency for Defense Development) The increase in ballistic performance of the N/S-panel than the other panels was assumed to be due to the higher synchronization of elongation of facing yarns in frontal layers and those in following rear layers during the impact, and this was supported by the method of accumulating successive line segments.	M6-2 BOLTED JOINTS WITH MOULDED HOLES FOR TEXTILE THERMOPLASTIC COMPOSITES W Hufenbach, R Gottwald(Technische Univ. Dresden), B. Kufner(Leichtbau-Zentrum Sachsen GmbH) In thermoplastic composites holes for bolted and riveted joints can be efficiently moulded during manufacturing by locally shifting the fibers aside. In this paper the structural phenomena and bearing behaviour of moulded joining zones in fabric reinforced GF/PP are analysed experimentally and numerically.
10:25	M1-3 MANUFACTURING CARBON NANOTUBES TOUGHENED GLASS FIBER/EPOXY RESIN LAMINATES USING DOUBLE VACUUM ASSISTED RESIN INFUSION MOLDING Y Guo, M Li, SK Wang, YK Li, ZG Zhang(Beihang Univ.) Unidirectional glass fiber fabric/epoxy laminates with 0.05wt% carbon nanotubes were prepared using VARIM and double VARIM (DVARIM). It shows that the mechanical properties of the laminates with CNTs processed by DVARIM are obviously higher than those processed by VARIM, resulting from the differences of CNTs distribution and fiber/resin interfacial bonding.	M2-3 MULTIFUNCTIONAL COMPOSITES FOR THERMAL ENERGY MANAGEMENT V Prakash, MFP Bifano, PB Kaul, G Chen(Case Western Reserve Univ.) In the present work vertically aligned multi-walled carbon nanotube based thermal interface materials (TIMs) are developed to enhance the through-thickness thermal energy transport in adhesively bonded joints. In this regards thermal transport in individual components of the composite as well as the overall TIM are evaluated and will be presented.	M3-3 THE EFFECT OF FIBER TWIST ON THE MECHANICAL PROPERTIES OF NATURAL FIBER REINFORCED COMPOSITES Y Li, H Ma, Y Luo(Tongji Univ.) In this paper, the effect of fiber twist on the mechanical properties of sisal fiber yarns reinforced composites was investigated. A theoretical model was proposed to predict the tensile strength of sisal fiber twisting yarns reinforced composites and showed good agreement with the experimental results.	M4-3 ANALYSIS OF FRP CONFINED CONCRETE COLUMNS BY A NEW CONFINEMENT SENSITIVE MODEL B Csuka, LP Kollar(Budapest Univ. of Technology and Economics) A new model for FRP confined concrete columns based on a sophisticated material model is presented. It was found that, on the contrary to most of available literature - the stiffness of the confining material may have significant effect on the concrete strength. The results are verified by experiments.	M5-3 STUDY OF A NOVEL KIND OF THERMORESIST BISMALLEIMIDE RESIN L Feng, Z Tong(Chinese Academy of Science) A novel kind of bismaleimide resin modified by active diluent was synthesized. The bismaleimide resin presented good processability such as low cure temperature and melting viscosity. The thermal property of the cured resin was characterized by TGA and DMA. The result indicated that the glass transition temperature of the cured...	M6-3 MICROSCOPIC DAMAGE EVOLUTION OF BOLT JOINT IN CARBON FIBER REINFORCED METAL LAMINATE T Matsubara, Y Takao, WX Wang(Kyushu Univ.) The damage evolution of a carbon fiber metal laminates (Carall) [AI/O/S0] is studied by an optical microscope for a single bolted double lap joint. Both the same and different characteristics between a bolt and pin joint are presented such as the load-stroke curve and damage evolution.
10:45	M1-4 PREPARATION OF AL₂O₃/CU NANOCOMPOSITE POWDER BY ELECTROLESS PLATING AND SUBSEQUENTLY SINTERING H Bevgi, SA Sajadi, SM Zebardad, A Babakhan(Ferdowsi Univ. of Mashhad) In this study Al ₂ O ₃ /Cu core-shell structural composites are fabricated through two step electroless coating process of pre-treatment and Electroless deposition. The influence of various electroless parameters on the thickness and uniformity of coated layer are investigated and because of numerous experiments needed an experiment design based on Taguchi robust design...	M2-4 CARBON NANOTUBE COMPOSITE FOR EMI SHIELDING AND THERMAL SIGNATURE REDUCTION JH Kim, GE Fernandes, M Jokubaitis, JM Xu(Brown University), HM Kim, KB Kim(Seoul National Univ.) Our research on CNT composites is set up to explore feasibility of incorporating some or all desired functionalities such as EMI shielding, cooling, thermoelectricity, optical transparency, and a spectral band selective transmission and blocking into one or more composites, with emphasis on understanding the mechanisms and parameters affecting these functionalities.	M3-4 EFFECT OF CARBON NANOTUBE FUNCTIONALIZATION ON THE STRUCTURE AND PROPERTIES OF POLY(3-HYDROXYBUTYRATE)/MWCNT BIOCOMPOSITES MH Jung, SI Yun, MY Huh, YS Park, SJ Kang(Jeonju Inst. of Machinery and Carbon composites), RA Russell, PJ Holden(Australian Nuclear Science & Technology Organization) The biodegradable polymer, PHB and MWNT functionalized with the alyr/CPBS composites was casted from the solutions. It was found that PHB composites of CNTs functionalized with alkyl groups showed a better solubility in PHB/chloroform solutions and casted films, which resulted in higher mechanical strength.	M4-4 PROCESSING POLYETHYLENE/CLAY NANOCOMPOSITES FROM BENTONITE PREPARED FROM PERSIAN CLAY AJ Zadeh, A Sarrafi, MZ Rahimi(Shahid Bahonar Univ. of Kerman), S Soltaninejad(Kerman Gas Company) Na-type Bentonite that supplied from Kheirbad mine benefited before treating with two types of quaternary ammonium salts. After the treatment, the powder was characterized by X-ray diffraction and scanning electron microscopy. Nanocomposites containing polyethylene (PE) and oligomerically modified clay (OMC) were obtained via direct melt intercalation. The mechanical properties	M5-4 LOW-OBSERVABLE RADOMES COMPOSED OF ARAMID/EPOXY COMPOSITE SANDWICH STRUCTURES AND FREQUENCY SELECTIVE SURFACE IB Choi, JG Kim, DG Lee(Korea Inst. of Science and Technology), IS Seo(Agency for Defense Development) The weapon systems such as aircrafts, warships and missiles have radar antennas for their performance. The radome (radar + dome) is a protective cover of radar antennas. In this work, a composite sandwich radome structure including the stealth technology for a low-observable radome has been investigated.	M6-4 STUDY OF COAXIAL FRP SLEEVE / EXPANSION CEMENT CONNECTION OF FRP REBARS GQ Yuan, GH Dong(Tongji Univ.), J Ma(Shenzhen Huangjintai Electronic Co.,Ltd) Owing to limit in transportation and production, connection of FRP rebars is an unavoidable problem in application. A coaxial connecting method of FRP rebars with coaxial FRP sleeve filled with expansion cement is presented in this paper. It is simple in construction, light weight, high strength, corrosion resistance.
11:05	M1-5 THERMALLY CONDUCTIVE OF CARBON-BASED POLYMER COMPOSITES JH Kim, YH Cho, SR Kim(Chungju National Univ.), SG Lee(Korea Research Inst. of Chemical Technology) Thermal conductivities of carbon nanotube (CNT) and graphene filled poly (methylmethacrylate) (PMMA) and polystyrene(PS) composites were investigated. CNT/polymer composites were prepared by coagulation and atom transfer radical polymerization method and the latter gave a higher thermal conductivity.	M2-5 ACCURATE MODELING OF ELECTROMAGNETIC WAVE PROPAGATION PHENOMENA IN MULTILAYER MAGNETOELECTRIC THIN FILMS IA Osarethin, BG Bojag(The Ohio State Univ.) The magnetolectric effect is the induced electric polarization of composite piezoelectric and piezomagnetic thin films in an applied magnetic field, or its induced magnetization in an applied electric field. We present accurate and robust theoretical models for the effective material parameters, and the electromagnetic propagation phenomena within the composite layers...	M3-5 FLAX FIBER REINFORCED ARYLATED SOY PROTEIN ISOLATE R Kumar, R Anandjiwala(CSR Materials Science and Manufacturing) We are reporting damage-sensitive composites prepared from arylated soy protein (as brittle-matrix) and flax fabric. Bio-composites were successfully prepared by reinforcing soy protein isolate with different weight fractions of woven flax fabric. Flax fabric reinforced soy protein composites were then arylated with DPHEAc for 4h to get arylated bio-composites.	M4-5 IMPACT OF COMPOSITE MANUFACTURING CONSTRAINTS ON AEROSPACE STIFFENED PANEL DESIGN D Quinn, A Murphy, M Price, M Mullan(Queen's Univ. Belfast) This paper reports on a design study assessing the impact of laminate manufacturing constraints on the structural performance and weight of composite stiffened panels. It demonstrates that maximizing ply continuity results in weight penalties, while various geometric constraints related to manufacture and repair can be accommodated without significant weight penalties.	M5-5 ANISOTROPIC PROPERTIES OF NEEDLE PUNCHED CARBON/CARBON COMPOSITES JL Lee, N Yun, J Park(Agency for Defense Development) With the needle punched carbon/carbon composites, it is found that the mechanical properties such as tensile strength and compressive strength are anisotropic, in other words, there are big differences along the in-plane and through-the-thickness directions. The results of thermal conductivities are not so anisotropic.	M6-5 FASTENER PULL-THROUGH FAILURE IN GFRP LAMINATES G Catalanotti, PP Camanho, AT Marques(Univ. of Porto), P Ghys(Astom Transpor) An experimental and numerical study on the pull-through failure mode for glass-fiber reinforced plastic (GFRP) laminates using both phenolic and vinylster resins is presented. Moreover, considering that the joint is considering to fail when the sub-critical failure load is reached, a methodology to predict the pull-through failure is proposed.
11:25	M1-6 DEVELOPMENT AND APPLICATIONS OF CARBON NANOTUBE NANOCOMPOSITES SH Hong, BK Lim, DH Nam, YK Kim(KAIST) Multi-functional CNT nanocomposites are fabricated by a novel fabrication process, with homogeneous distributed CNTs with strong interfacial strength i.e. molecular-level mixing process. CNT nanocomposites can be applied to structural applications due to their excellent mechanical properties and also used as functional applications such as solar cell, supercapacitor and secondary battery.	M2-6 ENERGY HARVESTING ON SPACECRAFT USING ELECTRODYNAMIC TETHERS JK Mcternan, SG Bilen(The Pennsylvania State Univ.), IC Bell, BE Gilchrist(Univ. of Michigan), RP Hoyt, NR Voronka(Technology Unlimited, Inc.) EDTs can be used to generate power onboard spacecraft orbiting the Earth, essentially "harvesting" energy from the orbital energy of the spacecraft. Reciprocally, the same system can be used to provide orbit-raising propulsion or to change inclination if current is supplied to the tether.	M3-6 MECHANICAL PROPERTIES OF SHORT COIR/PBS BIODEGRADABLE COMPOSITES: EFFECT OF ALKALI TREATMENT AND FIBER CONTENT NH Tran, S Ogihara(Tokyo Univ. of Science), S Kobayashi(Tokyo Metropolitan Univ.) The coir/PBS composites with fiber contents from 10 to 50 wt% were developed. Effect of alkali treatment on mechanical properties of the composites was studied. Mechanical properties of alkali-treated coir/PBS composites were improved. The best strength of coir/PBS composites was achieved at fiber content of 20 wt% in this study.	M4-6 OPTIMUM DESIGN OF COMPOSITE ROLL BAR FOR IMPROVEMENT OF BUS ROLLER CRASHWORTHINESS K Kang, H Chun, J Lee, HJ Chun, H Hong(Yonsei Univ.), W Na, J Park(Hyundai Motor Corp.) The bus structure is attempted to meet the stiffness and strength requirements with maintaining the initial traditional metallic structural parts reinforced by the composite roll bar. The performance of the bus structures regarding ECE R66 was compared between the initial bus model and the composite roll bar bus ...	M5-6 HIGH PERFORMANCE OF CORE-SHELL (DEN-DRIMER) NANOPARTICLES IN CARBON FIBER/EPOXY COMPOSITES EN Nguyen, K Yoshioka (Toray Composites (America), Inc.), N Natsume, N Ara(Toray Industries, Inc.) This paper presents a new hard-core/soft-shell nanoparticle toughening technology being developed at Toray Composites (America), Inc. in Tacoma, Washington, USA for carbon fiber/epoxy composites. High room-temperature and hot-wet performances of a particle-toughened carbon fiber/epoxy composites are discussed.	M6-6 MODELING OF COMPOSITES INTERFACE USING COMPUTATIONAL TECHNIQUES KJ Jacob, Y Li(Georgia Inst. of Technology), J Hinkley, K Weiss(NASA Hampton Research Center) Behavior of composite interfaces are analyzed using molecular modeling techniques such as molecular dynamics for various conditions and the results are formalized within a continuum framework. The behavior of the interface depends on the molecular structure of the interface, and the dependence of the behavior on structure is identified and...
11:45	Lunch					

	202B	203	301	302	401	402A
08:30						
09:00						
09:30	Break					
09:45	<p>M7 POLYMER COMPOSITES WITH SHAPE MEMORY FUNCTION Chairs: J Karger-Kocsis/ BK Kim</p> <p>M7-1 MICROWAVE ACTIVATED SHAPE MEMORY POLYMER ZH Xu, Y Zhang(Nanjing Univ. of Science and Technology) The T-ZnOw filled shape memory polymer composite, which can absorb and transfer microwave energy to heat efficiently, was involved. The thermo-mechanic properties, shape memory characters, microwave-heating transfer efficiency of the T-ZnOw/SMP and the feasibility to activating the T-ZnOw/SMP device by microwave were studied.</p>	<p>M8 NANOCOMP. AND POLYMER NANOCOMP. INCLUDING CARBON NANOTUBES OR GRAPHENE Chairs: CR Park/ MS Kim</p> <p>M8-1 GRAPHENE OXIDE REINFORCED POLY (VINYL ALCOHOL) NANOCOMPOSITES S.Morimune, T Nishino (Kobe Univ.), T Gotō(Mitsubishi Gas Chem. Inc.) We prepared Poly(vinyl alcohol)(PVA)/Graphene oxide(GO) nanocomposites by a simple casting method from aqueous medium.The mechanical properties dramatically increased by the incorporation of GO. It was revealed that GO was dispersed well in the PVA matrix and GO bound strongly with PVA mainly by hydrogen bonding.</p>	<p>M9 STRUCTURAL RESPONSE AND DESIGN Chairs: C York/ C Soutis</p> <p>M9-1 FULL SCALE EXPERIMENTAL CHARACTERISATION AND NON-LINEAR FINITE ELEMENT MODELING OF LOAD RESPONSE OF A COMPOSITE WIND TURBINE BLADE S.Laustsen, E Lund, OT Thomsen(Aalborg Univ.), L Kuhlmeier(Suzlon Blade Technology B.V.) A wind turbine blade has been monitored in terms of induced loads and displacement responses, and more closely monitored in terms of full field displacements on a substructure of interest. The results are used to correlate a non-linear FEM model intended as a tool for calculation of local load/stress responses.</p>	<p>M10 MULTI-FUNCTIONAL COMPOSITES Chairs: L Asp/ A Horoschenkoff</p> <p>M10-1 USE OF CARBON-FIBRE SENSORS TO DETERMINE THE DEFLECTION OF COMPOSITE BEAMS A.Horoschenkoff, T Mueller, C Stroessner(Univ. of Applied Sciences Munich), Kerstin Farmbauer(Siemens AG) Carbon-Fibre Sensor (CFS) consists of a standard carbon fibre roving with electrically connected endings, which is embedded in a GFRP-patch. Based on the piezoresistive effect of carbon fibres, the CFS can be used for strain measurement to determine the deflection of composite beams with an accuracy of +/-0.2 mm.</p>	<p>M11 PROCESSING AND MANUFACTURING TECHNOLOGIES Chairs: A Loos/ L Lessard</p> <p>M11-1 CARBON FIBRE REINFORCED PLASTICS MACHINING: SURFACING STRATEGY FOR REDUCING CUTTING FORCES A.Morandau, R Leroy(Francois-Rabelais Univ.), J Bohlmark, D Bonhoure, H Chibane, A Bouchou(CEROC) The anisotropic structure of composite causes severe challenges when machining. The analysis of the cutting forces in face milling condition helps us to develop cutting strategy to increase tool life and reduce part defects.</p>	<p>M12 DAMAGE AND FRACTURE Chairs: F Helenon/ Y Jia</p> <p>M12-1 MODELLING THE INITIATION AND EVOLUTION OF DAMAGE WITHIN GFRP BY INCLUDING REAL GEOMETRIC VARIABILITY JM Gan, S Bickerton, M Battley(The Univ. of Auckland) This paper presents a methodology capable of including real geometric variability when predicting the initiation and evolution of damage within single layer glass fibre laminates. Damage events including the initiation, progression and location of failure have been predicted and compared to experiment, showing good agreement.</p>
10:05	<p>M7-2 TRIPLE-SHAPE PROPERTIES OF MAGNETO-SENSITIVE NANOCOMPOSITES DETERMINED IN TENSILE TESTS K.Kratz, UN Kumar, A Lendlein(Helmholtz Zentrum Geesthacht) Excellent triple-shape properties were obtained for multiphase AB polymer networks and magnetic composites thereof, when activated by environmentally heating. A distinct two-step shape change was achieved during stress-free recovery, while under constant strain recovery conditions a maximum in recovery stress was obtained, which increased by incorporation of nanoparticles.</p>	<p>M8-2 RELATING PERFORMANCE AND STRUCTURE OF NANOCOMPOSITES BY NEW METHODS IN TIME-RESOLVED X-RAY SCATTERING N.Striebeck, A Zeinolebadi, MG Sar(Univ. of Hamburg) Small-angle X-ray scattering (SAXS) of samples with uniaxial orientation has been monitored recently in mechanical tests. Data are analyzed using automated methods referenced in the abstract. Relations between mechanical load and nano-structure response will be communicated. Polypropylene (PP), thermoplastic polyurethane (TPU), and their composites with CNT have been investigated.</p>	<p>M9-2 PREDICTION OF COMPRESSION-AFTER-IMPACT (CAI) STRENGTH OF CFRP LAMINATED COMPOSITES JH Lee, C Soutis(The Univ. of Sheffield), C Kong(Chosun Univ.) The compression-after-impact (CAI) behaviour of laminates is a major concern in the design of primary composite structures since impact damage can significantly degrade the compressive strength of a composite structure. Considerable attention has been drawn to problems relating to the prediction of CAI strength with most of the research using...</p>	<p>M10-2 AUTONOMOUS SELF-HEALING FUNCTIONALITY IN ADVANCED FIBRE REINFORCED POLYMER COMPOSITE MATERIALS T.Coope, I Bond (Univ. of Bristol) A novel Lewis acid-catalysed self-healing system is investigated for implementation in epoxy-based fibre reinforced polymer composite materials. Healing is initiated when microcapsules are ruptured at the onset of crack propagation. Results show that a material recovery value of greater than 80% fracture strength is achieved when using a TDCB geometry.</p>	<p>M11-2 SELECTION OF MACHINING CONDITIONS FOR AERONAUTIC COMPOSITE USING VIBRATION ANALYSIS H.Chibane, R Serra, A Morandau, R Leroy(Francois-Rabelais Univ.) The objective of this study is to characterize the cutting conditions using vibration analysis in order to avoid the defects when machining a composite material (carbon/epoxy). The machining parameters are; cutting speed, depth of cut and feed, and the vibration levels were measured for each case.</p>	<p>M12-2 MESO-MECHANICAL PERFORMANCE OF UNIDIRECTIONAL FIBER COMPOSITES WITH MATRIX SHEAR BAND EFFECT Y.Jia, FD Ma, GW Zhu, P.Ou, JQ Nie(Shandong Univ.) The intrinsic character of "post-yield softening" in glassy polymer makes it possible to promote shear bands emanating from matrix crack tips. The overstress zone in the adjacent fiber becomes like a plateau in case of shear band existing, as a result of the stress concentration caused by shear bands.</p>
10:25	<p>M7-3 SHAPE MEMORY EFFECT OF A THERMOSET POLYMER AND ITS FIBER REINFORCED COMPOSITES C.Ayranç, F Ko(Univ. of British Columbia), T Howie, M Taya(Univ. of Washington) This paper reports on the initial investigation of the shape memory effect (SME) characterization of a commercially available ordinary thermoset polymer epoxy resin/hardener system and its fiber reinforced composites. The effect of reinforcement angle on SME characteristics was of particular interest during the study.</p>	<p>M8-3 PREDICTION OF MECHANICAL PROPERTIES OF CARBON NANOTUBE/POLYVINYLIDENE FLUORIDE COMPOSITES BY HANSEN SOLUBILITY PARAMETERS METHOD J.Ma, RM Larsen(Aalborg Univ.) Purified, HNO₃ and ODA modified SWNTs as well as MWNTs are embedded into PVDF to reinforce the polymer. Hansen solubility parameters are used to predict the dispersion state of the carbon nanotubes in polymer, and the dispersion of carbon nanotubes in polymer effects the mechanical properties of the composites.</p>	<p>M9-3 MODELLING THE BLAST BEHAVIOUR OF FIBRE METAL LAMINATES C.Soutis, G Mohamed, A Hodzic(The Univ. of Sheffield) This paper will provide an overview of the fracture characteristics of advanced reinforced plastics used in the aerospace industry and in more detail that of GLARE, based on an extensive experimental and numerical work by the authors and their co-workers. Multi-material ALE formulation for fluid-structure interaction is employed.</p>	<p>M10-3 CARBON FIBRE COMPOSITES CAPACITORS FOR SHORT TERM ELECTRIC ENERGY STORAGE IN STRUCTURAL APPLICATIONS T Carlson, LE Asp(Swerea SICOMP) This paper presents an approach towards realising novel multifunctional polymer composites. A series of structural capacitor materials made from carbon fibre reinforced polymers have been developed, manufactured and characterised for its multifunctional performance.</p>	<p>M11-3 CO-INJECTION OF SANDWICH STRUCTURE XPP/XHDPE/XPP T.Norrapateep, U Meekum(Suranaree Univ. of Technology) x-polypropylene/x-high density polyethylene/x-polypropylene (xPP/xHDPE/xPP) sandwich injection moulding products were prepared and investigated by mean of service temperature, mechanical properties, and morphology. The PP skin and HDPE core were crosslinked using dicumyl peroxide(DCP) and VTMS silane before injection.</p>	<p>M12-3 PLASTIC DAMAGE MODEL FOR PROGRESSIVE FAILURE ANALYSIS OF COMPOSITE STRUCTURES JF Chen, EV Morozov, K Shankar(Univ. of New South Wales) A plastic damage model has been developed for the progressive failure analysis of composite laminates. This model takes into account both the plasticity effects and the material properties degradations exhibited by composite materials. It was shown that the proposed model provided the sufficient accuracy in the prediction of failure loads.</p>
10:45	<p>M7-4 ORGANIC-INORGANIC NANOCOMPOSITE MONOLAYERS AND BILAYERS HAVING DUAL AND TRIPLE SHAPE MEMORY EFFECTS BK Kim, CY Bae(Pusan National Univ.) Polyurethane-silica nanocomposites have been synthesized via sol-gel reactions between the silanols of silica particle and 3-aminopropyltriethoxysilane (APTES) terminated polyurethane, and identified for the dual and triple shape memory effects with their monolayer and bi-layer, respectively.</p>	<p>M8-4 EFFECT OF REACTIVE NANO-REINFORCEMENT ON MECHANICAL PROPERTIES OF PBO FIBER/EPOXY COMPOSITES G.Sui, X.Jia, X.Li, X.Yang(Beijing Univ. of Chemical Technology) The epoxy matrix containing 0.5wt% reactive multi-walled carbon nanotubes was reinforced by poly-p-phenylene benzobisthiazole (PBO) fibers and the NOL-rings were prepared on a filament winding machine. The wettability of uncured epoxy was evaluated by measuring the surface energy and viscosity. The mechanical properties of the composites were analyzed.</p>	<p>M9-4 AERODYNAMIC AND STRUCTURAL DESIGN OF A HIGH EFFICIENCY SMALL SCALE COMPOSITE VERTICAL AXIS WIND TURBINE BLADE CD Kong, HS Lee, MW Kim(Chosun Univ.) The energy crisis have faced and the environmental problems have recently raised. In this situation, the interest in wind power has been risen as an important energy source. The trend of the wind turbine system development has become much larger scale over several MW class. However, because the small-scale wind...</p>	<p>M10-4 DESIGN AND FABRICATION OF RAS WITH GRAPHENE ADDED KEVLAR FIBER REINFORCED COMPOSITE JH Shin, HK Jang, WH Choi, TH Song, CG Kim(KAIST), WY Lee(Agency for Defense Development) In this paper, an RAS with Graphene added Kevlar fiber reinforced composite was designed and fabricated. The target frequency of the RAS was 12.4-18 GHz(ku-band). MATLAB and MWS CST were used to design the RAS and predict the reflection loss of the RAS. Finally, the reflection loss was measured.</p>	<p>M11-4 3D-HEXAGONAL BRAIDING: POSSIBILITIES IN NEAR-NET SHAPE PREFORM PRODUCTION FOR LIGHTWEIGHT AND MEDICAL APPLICATIONS F.Schreiber, ES Suedhoff, HY Lee, T Gries(RWTH Aachen Univ.), K Theelen, F Ko(Univ. of British Columbia) Common 3-D rotary braiding machines are mainly capable of producing coupled square shapes, which can be enlarged to L- or I-beams. This work presents the possibility to braid the same structures with a 3-D hexagonal braiding machine. Further other patterns and shapes possible with 3-D hexagonal braiding are introduced.</p>	<p>M12-4 PREDICTING FAILURE MECHANISMS IN T-SHAPED AEROSPACE COMPOSITE STRUCTURES F.Helenon, RS Trask, MR Winsom, SR Hallett(ACCIS) This paper deals with the fundamental issue in predicting damage resistant capability and failure mechanisms in composite structures. Experimental and numerical investigations were conducted on T-shaped composite specimens manufactured from IM7/8552 carbon/epoxy pre-impregnated laminates.</p>
11:05		<p>M8-5 MICROMECHANICAL MODELING OF DOUBLE-WALLED CARBON NANOTUBE PULLOUT FROM A MATRIX LJ Zhou, YJ Kang, JG Guo(Tianjin Univ.) A micromechanical model of DWCNT pullout from a matrix is presented with the interfacial residual stress and van der Waals force taken into account. The influences of temperature change, interfacial friction coefficient, DWCNT aspect ratio, DWCNT volume fraction and the relative modulus between DWCNT and matrix are illustrated and discussed.</p>	<p>M9-5 SHEARING-WRINKLING BEHAVIOR OF CREASED RECTANGULAR MEMBRANE W.Changguo, D.Zhenyong, T.Huifeng(Harbin Inst. of Technology) In this paper, the wrinkling behavior of a rectangular creased membrane under shearing is analyzed by using the Direct Perturb-Force method to deeply understand the wrinkle-crease interactions. The effects of the crease location on the wrinkling are also analyzed in the end.</p>	<p>M10-5 EFFICIENT HIGHER ORDER ZIG-ZAG THEORY FOR COUPLED MAGNETO-ELECTRO-ELASTIC COMPOSITE LAMINATES JH Lee, MH Cho(Seoul National Univ.), JS Kim(Kumoh National Inst. of Technology) An efficient higher order zigzag theory for multilayered magneto-electro-elastic plates is proposed. In-plane displacement, electric potential and magnetic flux are assumed as a cubic zigzag functions. The layer-dependent variables are expressed in terms of the primary variables by imposing top/bottom boundary conditions and interface continuity conditions.</p>	<p>M11-5 CURVED COMPOSITE STRUCTURES AND COMPROMISE BETWEEN PROCESS-INDUCED DEFORMATION AND STRUCTURAL PERFORMANCE H.Ghiasi, M Rahmat, P Hubert, L.Lessard(McGill Univ.) Undesired residual stresses and strains deteriorate the structural performance of a curved composite structure. In this paper, structural and processing parameters are studied regarding their control over the process-induced stresses. Case studies are used to demonstrate a significant weight reduction can be realized by using an integrated structural-processing design approach.</p>	<p>M12-5 CALCULATION OF STRESS INTENSITY FACTORS WITH THE MODIFIED VIRTUAL CRACK CLOSURE TECHNIQUE ZH Liang(Chinese Academy of Engineering Physics) The modified equations of VCCT with different element lengths in front of the crack tip and behind are given out in the paper.</p>
11:25		<p>M8-6 CU@SiO₂-BaTiO₃-EPOXY COMPOSITES WITH HIGH PERMITTIVITY FOR EMBEDDED CAPACITORS SH Yu, SB Luo, R Sun(Chinese Academy of Sciences) Cu@SiO₂ core-shell structured particles were introduced to the BaTiO₃-epoxy host material. A high dielectric constant of 880 and a relatively low loss were obtained in the derived Cu@SiO₂-BaTiO₃-epoxy composite films. Effects of Cu@SiO₂ loading amount and SiO₂ insulating layer on the dielectric properties the composites were investigated.</p>			<p>M11-6 STUDY OF INTERPLY SLIP DURING THERMOFORMING OF CONTINUOUS FIBER COMPOSITE MATERIALS EG Hanna, A.Poitou(Ecole Centrale de Nantes), P Casari(Univ. de Nantes), L.Juras(Cetim de Nantes) Interply slip is an important phenomenon in composite forming processes and the resulting product geometry, fiber orientations and fiber stresses. In this work, a model was developed that predicts friction between 2 plies. The model is based on the Reynolds equation for thin film lubrication.</p>	
11:45	Lunch					

	Halla A	Halla B	Samda A	Samda B	201A	202A
12 : 45	PL1: TO UNCOVER THE UNEXPECTED FROM THE UNBALANCED AND UNSYMMETRIC Stephen W. Tsai(Stanford University) (Chair: SW Sohn)		PL2: KEY TECHNOLOGY OF CFRP COMPOSITES FOR THE CONTRIBUTIONS TO GLOBAL ENVIRONMENTAL ISSUES Yasuo Suga(TORAY Industries, Inc.) (Chair: N Takeda)			
13 : 15	PL3: COMPOSITES DEFINING THE FUTURE OF AEROSPACE Gerould K. Young(Boeing) (Chair: TW Chou)		PL4: SMART COMPOSITE MATERIALS AND THEIR APPLICATIONS Sharyu Du(Harbin Institute of Technology) (Chair: BS Kim)			
13 : 45	Break					
14 : 00	M13 NANOCOMPOSITES Chairs: JK Kim/ J Pandey	M14 SYMPOSIUM ON MULTIFUNCTIONAL COMPOSITE MATERIALS FOR ENERGY APPLICATIONS Chairs: J Thomas/ M Taya	M15 GREEN COMPOSITES Chairs: RC Neagu/K Takemura	POSTER SESSION -1 Min. Speech (201A) - Presentation (3F LOBBY) Chairs: NS Choi	M16 APPLICATIONS OF COMPOSITES Chairs: L Kollar/ M Kumosa	M17 JOINTS AND BEARING BEHAVIOR Chairs: L Liu/ WS Kim
	M13-1 SOUNDPROOFING EFFECT OF PP/CLAY AND PP/CNT NANOCOMPOSITES J.Yap, MS Kim, YJ Kang, SH Ahn, KM Kang(Seoul National Univ.) Sound transmission loss must be maximized to minimize transmitted energy. In this research, specimens made of PP/ Clay and PP/CNT composites were fabricated to understand their soundproof insulation property. The soundproof effect of specimens was measured through impedance tube method and investigated at different filler loads of original clay and CNT.	M14-1 NANOSTRUCTURED MATERIALS FOR POWER AND ENERGY APPLICATIONS B Bailey, G Bazzan, J Bensaout, J Haag, TS Kang, G Pattanaik, M Dustock(Air Force Research Lab) The development of low-cost, lightweight, and flexible energy harvesting and storage devices are an enabling technology for many different applications. The fabrication of highly efficient power conversion and energy storage devices with high power and energy density are highly dependent on the materials and device structures used to make up...	M15-1 NOVEL BIODEGRADABLE WOOD FIBRE POLYLACTIC ACID FOAM SANDWICH COMPOSITES RC Neagu, CI Boissard, P Bourban, JE Manson(Ecole Polytechnique, Federale de Lausanne), I Bertola, F Berthold, EK Gamstedt(Inventia AB) Stratified wood fibre/PLA compounds were foamed with supercritical CO ₂ under confined conditions. Foam expansion decreased with increasing wood fibre content in the foam core, but the number of cells and homogeneity increased. The bending stiffness of the resulting sandwich materials was considerably higher compared to neat foams at same density.		M16-1 DEVELOPMENT OF A COMPOSITE FIREWALL FOR MASS TRANSIT APPLICATIONS AA Komus, S Pottar, Z Yu, M Townsley(Composites Innovation Centre) This paper investigates the feasibility of building a firewall from composite materials for mass transit vehicles. A series of tests, including ASTM E162 and E119, were performed to determine the effectiveness of various fabrics, laminate schedules, and coatings for fire protection. Initial results were promising although further testing is required.	M17-1 ENHANCEMENT OF COMPOSITE-METAL ADHESION STRENGTH BY MICRO-PATTERNING OF METAL SURFACES WS Kim, DS Hwang(Korea Aerospace Research Inst.) The purpose of the present work is to demonstrate the effect of micro-morphological modification of metal surfaces on adhesion strength. While former studies have investigated surface morphological changes after employing various surface treatment methods, this study proposes a micro-patterned morphology on metal surfaces as a designed surface topography.
14 : 20	M13-2 CONTROL OF OUTPUT MODE IN TRANSPARENT FLEXIBLE PIEZOELECTRIC NANOGENERATORS DH Choi(Kyunghee Univ.) In this work, we first report the charge-generating mode control in transparent flexible nanogenerators (TF-NGs) with a same device structure only according to the morphology of the ZnO nanorods without any use of an AC/DC converter.	M14-2 BISCROLLED CARBON NANOTUBE COMPOSITE YARNS FOR MULTIFUNCTIONAL APPLICATIONS IN ENERGY CONVERSION AND STORAGE MD Lima, S Fang, X Lepro, C Lewis, R Ovalle-robles, R Baughman(Univ. of Texas at Dallas Alan G MacDiarmid NanoTech Inst.) Generally applicable methods are demonstrated for producing weavable composite yarns comprising up to 99 wt % of otherwise unspinnable nanopowders or nanofibers that remain highly functional. This new technology is used to make yarns of graphene ribbons, superconductors, high performance battery materials, and catalytic oxygen electrodes for fuel cells.	M15-2 RADIATION SYNTHESIS OF POLY(ETHYLENE GLYCOL)-CHITOSAN NANOPARTICLE: A MODIFIED BIODEGRADABLE POLYMER FOR PLA BLENDS P Rimdust, W Pasanphan(Thailand Inst. of Nuclear Technology), P Suwanmaia(Kasetsart Univ.) Poly (ethylene glycol) (PEG) can be radiation grafted onto chitosan to obtain PEG-g-CSNPs. FTIR and ¹ H NMR confirmed the successful grafting. The particle size of PEG-g-CSNPs of 79.58 nm can be achieved when the γ -ray dose of 2 kGy was used to synthesize. The PEG-g-CSNPs exhibit compatibility with PLA.		M16-2 POLYMER MATRIX COMPOSITES IN HIGH VOLTAGE TRANSMISSION LINE APPLICATIONS M Kumosa, D Armentrout, B Burks, J Hoffman, J Middleton, P Predecki(Univ. of Denver) In high voltage (HV) applications, Polymer Matrix Composites have been widely used in the designs of composite transmission line insulators, conductors, towers, and in substation applications. In this review paper the most important accomplishments from our PMC conductor and insulator research have been presented.	M17-2 FAILURE MODELLING OF WOVEN GFRP BOLTED JOINTS UNDER QUASI-STATIC LOADING H Ahmad, AD Crocombe, PA Smith(Univ. of Surrey) A 2-D finite element model has been developed to simulate crack growth (net-tension and shear-out failures) in composite bolted joints. Results from the model have been compared with a similar approach from the literature and experimental data for a woven fabric system. Agreement is reasonable in each case.
14 : 40	M13-3 NANOPOROUS MEMBRANE FOR IMMUNO-PROTECTION BIOFILTER SM Lee, YA Kim, M Park, HS Park, SW Cho, JH Cho, JS Park, WH Hwang(Pohang Univ. of Science and Technology) We report a PEO-functionalized straight nanochannel array based on a self-organized porous alumina for a novel biofilter with superior immunoprotection antifouling. Since our nanochannel biofilter was designed from self-organized porous alumina, the biofilter can provide a high-throughput and cost-effective fabrication process.	M14-3 STRUCTURE, THERMAL, AND MECHANICAL PROPERTIES OF INTERFACES IN PMC: A MOLECULAR SIMULATION STUDY K Sebeck, C Shao, J Kieffer(Univ. of Michigan) Using atomistic simulations we generate realistic models of the interfacial structures by reproducing the underlying reaction and transport processes. These models serve to understand and predict interfacial behaviors. We observe pronounced polymer chain layering and the formation of an incompatibility gap near the interface that govern their thermo-mechanical properties.	M15-3 GAMMA-RAY INDUCED STEARYL-GRAFTED-CHITOSAN AS A NOVEL NANOFILLER FOR PLA BLENDS T Ratanawongwiboon, W Pasanphan(Kasetsart Univ.) The synthesis of the stearyl-grafted-chitosan as a nanofiller for polylactic acid (PLA) was accomplished by grafting stearyl methacrylate (SMA) onto chitosan (CS) via γ -irradiation. The SMA-g-CSNPs with core-shell structure in nanoscale size of ~80 nm can be achieved. The SMA-g-CSNPs can be miscible blended with PLA.		M16-3 SYNTHESIS, CHARACTERIZATION AND PHOTOCATALYTIC ACTIVITY OF VISIBLE-LIGHT TITANIA/SILICA PHOTOCATALYST N Srinivasan, S Jeyanthiraj, S Jeyanthiraj, DP Kashima, S Jeyawathi(Chulalongkorn Univ.), C Kalambathal(Science, PTT Research & Technology Inst.) Metal ions doped TiO ₂ /SiO ₂ photocatalysts were synthesized by a controlled hydrolysis of TiCl ₄ in presence of SiO ₂ substrate and nitrate solution. The powders were characterized by XRD, particle size, BET techniques, and UV-VIS spectrophotometer, respectively. The large adsorption of the composites are very interesting to further development in adsorption-assisted photocatalysts.	M17-3 STRUCTURAL BEHAVIOR OF PFRP CONNECTION WITH SINGLE BOLT YG Lee, SY Park, JS Park, JH Nam, DJ An, SJ Yoon(Hongik Univ.) This study was focused on the structural behavior of bolted lap-joint connections in PFRP structural members. Specimens with single bolt-hole have been tested in tension under bolt-loading conditions. The failed specimens were examined for failure load, bearing stress, cracks, and fracture patterns.
15 : 00	M13-4 MORPHOLOGY AND STRUCTURE OF PT-NI NANO COMPOSITE POWDER FABRICATED BY PULSED WIRE EXPLOSION PROCESS DW Jang, DH Kim(Chungnam Univ.), HS Lee, TK Jung, MH Lee(Korea Inst. of Industrial Technology) In this work, we tried to research if it reduced Pt amount for catalytic converters using Pt-Ni nano composite powder by wire explosion process and investigated the morphology how the Pt-Ni powder composed.	M14-4 CRACK FORMATION AND AUTONOMIC RESTORATION OF CONDUCTIVITY IN BATTERY ANODES NR Santos, BJ Blasizak, S Kang, E Jones, JS Moore, SR White(Univ. of Illinois at Urbana-Champaign) Complex damage mechanisms in Li-ion batteries can lead to a significant loss of conductivity and eventual system failure. In this paper, we report on the encapsulation of several types of conductive particles and the integration of these capsules into commercially available anode materials with the goal of autonomic restoration.	M15-4 TWISTING OF FIBRES IN YARNS FOR NATURAL FIBRE COMPOSITES M Rask, B Madsen(Technical Univ. of Denmark) Natural fibre composites are traditionally based on spun yarns. This spinning causes off-axis misalignment in the fibres, the effect of which is investigated in this study. Based on a wrap-spun zero-twist yarn, yarns of different twisting angles were produced, and used for composite production. The stiffness of these were determined.		M16-4 STRENGTH OF SELF-PIERCING RIVETED JOINTS FOR CFRP/ALUMINUM SHEETS I Kroll, S Mueller(Chemnitz Univ. of Technology), R Mauerermann, R Grutzeier(Fraunhofer Inst. for Machine Tools and Forming Technology) Self-piercing riveting can be used effectively to join CFRP laminates and aluminum alloy sheets. A micro section analysis shows the damaged internal structure of the laminate after riveting. Then, the mechanical behaviour of the joint was investigated experimentally and compared to numerical results of a FE analysis.	M17-4 AN ANALYTICAL TOOL TO PREDICT LOAD DISTRIBUTION OF MULTI-BOLT SINGLE-LAP THICK LAMINATE JOINTS LLiu, Y Mao, R Wei(Shanghai Jiaotong Univ.) A fast tool getting load distributions of thick-laminate multi-bolt single-lap joint was developed based on analysis of fasteners flexibility on thick-laminate single-lap joint and the load transfer relationship in multi-bolt joint. The tool was validated to be accurate and efficient by test results, and used to analyze the load distributions.
15 : 20	M13-5 FABRICATION OF SUPER-HYDROPHILIC/HYDROPHOBIC SURFACE AND DRAG REDUCTION EFFECTS SM Lyu, WB Hwang (Pohang Univ. of Science and Technology), BS Yoon(Univ. of Ulsan) Super-hydrophilic surface was fabricated by anodizing method and using SAM(Self Assembly Monolayer) method to the super-hydrophilic surface, we could get super-hydrophobic surface. And from water flow experiment, we could see the drag reduction effect of super-hydrophobic surface.	M14-5 CORE-SHELL ELECTROSPUN CARBON NANOFIBER/SILICON NANOPARTICLE COMPOSITE FOR LITHIUM ION BATTERY APPLICATION N Lee, E Fok, HJ Yang, J Madden, F Ko(The Univ. of British Columbia) Membrane consisting core-shell structure of nanofiber composite fiber of carbon and silicon nanoparticles has been successfully fabricated by coelectrospinning technique. Subsequent carbonization process resulted in highly porous electrically conductive membrane. This study successfully demonstrates fabrication and characterization of composite fiber membrane for rechargeable lithium ion batteries application.	M15-5 A COMPARATIVE STUDY FOR THE PROPERTIES OF MONTMORILLONITE(MMT) AND CARBON NANOTUBE(CNT) IN RAMIE/POLY(LACTIC ACID)(PLA) TERNARY COMPOSITES TLiu, Y Li, Y Chen(Tongji Univ.) In this study, ramie/PLA composites were prepared. The effect of MMT and CNT on the mechanical and thermal properties of the composites was investigated. According to the results, the mechanical properties and the thermal properties of ramie fiber/PLA composites can be improved through adding MMT, CNT-OH and CNT-COOH.		M16-5 CONDUCTIVE POLYTHIOPHENE/POLYMER COMPOSITES AS ELECTROACTIVE MATERIAL APPLICATION D Pattavarakorn, K Jaitang, P Kumchajai, P Chaimongkol, S Thongbor(Chiang Mai Univ.) The conductive polythiophene/polymer composites were prepared with two matrices: poly(dimethyl siloxane) and poly(vinyl alcohol). The results of electromechanical tests showed that composites response well to the electric field. In which, the storage modulus response and bending response of composite increased with increasing in both polythiophene particle concentration and electric field strength.	
15 : 40	M13-6 EFFECT OF DEGUMMING ON TUSSAH SILK FIBRE HM Po, JK Tak(Univ. of Southern Queensland) Silk fibre is well recognized for bio-medical engineering application because of its superior mechanical and bioresorbable properties. However, when producing silk fibre reinforced composites, hydrophilic sericin has been found to cause poor interfacial bonding with polymer.	M14-6 INFLUENCE OF NANOPARTICLES ON THERMOELECTRIC PROPERTIES OF ORGANIC COMPOSITES KW Choi, YT Ryu, I Grunlan, CH Yuj(Texas A&M Univ.) The electrical conductivity of the composites was increased over 10 ⁵ S/m with a thermopower of typical CNTs and a thermal conductivity of typical polymers. Gold particles were introduced to increase the electrical conductivity of the nanocomposites by increased carrier concentration.	M15-6 WATER-SOLUBLE CHITOSAN-GOLD COMPOSITE NANOPARTICLES: PREPARATION BY RADIOLYTIC METHOD S Choofong, W Pasanphan(Kasetsart Univ.), P Suwanmaia(Thailand Inst. of Nuclear Technology) Gold-water soluble chitosan composite nanoparticles (Au-WSCS-CNPs) was successfully prepared under mild condition via radiolytic methodology using γ -ray irradiation. The particle size of Au-WSCS-CNPs can be controlled by γ -ray dose. The average particle size of Au-WSCS-CNPs obtained is as small as 7 nm with spherical shape.		M16-6 DESIGN, ANALYSIS AND MANUFACTURING OF STIFFENED COMPOSITE DEFLECTOR FOR AEROSPACE APPLICATIONS PR Babu, P Ravinder(Osmania Univ.) Nowadays, aerospace supporting structures are tended to be designed using composite stiffened panels due to their load bearing capabilities. The shape is usually selected based on the manufacturing and cost. 3D layered analyses of composite stiffened deflector have been performed to predict the behavior of the structure.	
16 : 00	Break					

	202B	203	301	302	401	402A
12:45						
13:15						
13:45	Break					
14:00	<p>M18 KASHMOS (KOREAN AERO-VEHICLE STRUCTURAL HEALTH MONITORING SYSTEM) Chairs: CI Park/G Park</p> <p>M18-1 KOREAN AERO-VEHICLE STRUCTURAL HEALTH MONITORING SYSTEM CY Park, JH Kim, SM Jun(Agency for Defense Development) This paper briefly describes an investigation into the structural health monitoring of composite wing using multiple types of sensors.</p> <p>M18-2 MANUFACTURING PROCESS OF SENSOR INSTALLATION COMPOSITE WING BOX YG Kim, JW Han, JH Kim, JW Kim, JS Kim(DACC), CY Park(Agency for Defense Development) Structure Health Monitoring (SHM) System does real-time detection the occurrences of structure such as load, impact, damage and so on. SHM system needs to install the sensors like fiber bragg grating (FBG) sensor, lead zirconate titanate (PZT) sensor and strain-gage.</p> <p>M18-3 DETECTION OF IMPACT LOCATIONS FOR A COMPOSITE WING BOX UNDER BENDING LOADS BW Jang, YG Lee, JH Kim, YJ Kim, CG Kim(KAIST), CY Park(Agency for Defense Development) For impact identifications in composite structures, the RMS(root mean squared value) method was suggested and verified. In order to enhance the applicability of this method to real environments, the low velocity impact experiments under bending loads were performed. Finally, this study shows relatively good results compared to previous research.</p> <p>M18-4 AIRCRAFT WING STRUCTURE MONITORING USING AN INTEGRATED IMPEDANCE AND GUIDED WAVE TECHNIQUE YK An, HS Sohn(KAIST), CY Park(Agency for Defense Development) This study presents an integrated impedance and guided wave (IG) based damage detection technique for aircraft wing structure monitoring. The developed system is validated through full scale tests for an aircraft wing segment under varying temperature and external loading conditions.</p> <p>M18-5 APPLICATION OF ANOMALOUS WAVE PROPAGATION IMAGING METHOD WITH ADJACENT WAVE SUBTRACTION TO ACTUAL DAMAGES IN COMPOSITE WING GC Cho, JR Lee(Chonbuk National Univ.), CY Park(Agency for Defense Development) Anomalous wave propagation imaging method was applied for the on-site in-situ nondestructive evaluation of actual debonding and impact damages in a composite wing with high density of structural elements. The promising results showed that it has high potential as on-site nondestructive evaluation method of other complex engineering structures.</p> <p>M18-6 "SHMTTOOLS" FOR SHM AND SENSOR DIAGNOSTICS: LUG ASSEMBLY APPLICATIONS HJ Shin, CY Yun, JR Lee(Chonbuk National Univ.), GH Park, CR Farrar(Los Alamos National Lab.), CY Park, SM Jun(Agency for Defense Development) SHMT Tools is a free, open-source set of standardized MATLAB software tools for Structural Health Monitoring (SHM) research. The software package includes a library of compatible SHM algorithms. This paper is a report of an initial investigation into application of SHMtools for tracking and monitoring the integrity of bolted joints...</p>	<p>M19 NANOCOMP. AND POLYMER NANOCOMP. INCLUDING CARBON NANOTUBES OR GRAPHENE Chairs: JH Lee/ KS Yang</p> <p>M19-1 THE EFFECTS OF THE MULTI-WALLED CARBON NANOTUBE(MWNT)/CELLULOSE NANOCOMPOSITES ON THEIR PHYSICAL PROPERTIES DH Kim, CI Kim, JH Park, HU Ha, SY Park(Kyungpook National Univ.) The multi-walled carbon nanotube (MWNT)/cellulose nanocomposites were prepared using monohydrated N-methylmorpholine-N-oxide (NMMO) as a solvent for dispersing the acid-treated MWNT (A-MWNT) as well as dissolving cellulose. The A-MWNTs were well dispersed in both monohydrated NMMO and the nano-composite films. The A-MWNT/cellulose nanocomposites were a promising material in all properties.</p> <p>M19-2 BOND BEHAVIOR AND PERFORMANCE OF THE SPRAYED FRP ON CONCRETE SURFACE SK Ha, S Na, HK Lee(Korea Advanced Institute of Science and Technology) Up to date, no attempt has been made to investigate the pull-off bond strength between sprayed fiber-reinforced polymer (sprayed FRP) and concrete. The technique of sprayed FRP used in this study was firstly introduced from the University of British Columbia [5, 6]. In this study, the pull-off bond behavior and ...</p> <p>M19-3 SELECTIVE REINFORCEMENT OF THE HARD SEGMENT OF POLYURETHANE WITH GRAPHENE OXIDES P Park, DS Lee, DW Lee(Chonbuk National Univ.) We prepared composites from reactive in-situ polymerization of polyurethane with GO. Grafting of MDI on the GO, showed markedly altered the crystallization of the hard segment. The composites shows 138.5 % increased in Young's modulus at 1 wt.% and ~55% increased the tensile strength at 0.5 % loading of GO.</p>	<p>M20 STRUCTURAL RESPONSE AND DESIGN Chairs: CD Kong/ C Soutis</p> <p>M20-1 PRACTICAL APPLICATION OF FAILURE MODELS TO PREDICT THE RESPONSE OF COMPOSITE STRUCTURES R Gutkin, ST Pinho(Imperial College London) Three damage models based on several failure criteria and methods to damage propagation are presented. The models are either based on implicit or explicit formulations. The models are compared in terms of failure onset then in terms of strength and failure pattern prediction of an OHT test.</p> <p>M20-2 A STUDY ON IMPACT DAMAGE ANALYSIS AND TEST OF COMPOSITE LAMINATE FOR AIRCRAFT REPAIRABLE DESIGN HB Park, CD Kong, SJ Lim, KS Lee(Chosun Univ.) As constantly increasing air traffic need for the general aviation aircraft, many countries have been developing various types of the general aviation aircraft. In Korea, the KC-100, which is a small scale piston propeller general aviation aircraft, has been developed to establish domestic certificate infrastructure and system through the BASA...</p> <p>M20-3 NONLINEAR CONSTANT LIFE MODEL FOR FATIGUE LIFE PREDICTION OF COMPOSITE MATERIALS TH Park, JS Park, BW Jang, MJ Kim(Korea Aerospace Univ.) In this study, a nonlinear constant life diagram formulation is proposed and the influence of the constant life diagram formulation on the prediction of the fatigue life was examined. The proposed model needs three or more S-N curves and requires nonlinear regression process.</p>	<p>M21 MULTI-FUNCTIONAL COMPOSITES Chairs: NS Goo/ IP Kang</p> <p>M21-1 MULTISCALE HYBRID COMPOSITES FOR EMI SHIELDING JN Gindakoung, YB Park(Ulsan National Inst. of Science and Technology), KW Jong, JH Soon, JY Bok(Young Kwang P.M.S Co.,Ltd) Atomized MWNT sprayed from a pressurized nozzle were deposited as thin coatings on woven carbon and glass fiber fabrics. A SE level of greater than 80 dB in the range of 30-1,500MHz was obtained for carbon fiber based composites as well as composites with alternating and sandwich structures.</p> <p>M21-2 STUDY ON FABRICATION OF CARBON NANO-COMPOSITE SHEETS AND APPLICATION TO THE MICROWAVE ABSORBERS JB Kim, JG Nam, DW Lim(Korea Inst. of Materials Science) This study investigated the influence of the fabrication process on the electrical property of carbon nanocomposite sheets and presents the radar absorbing structure composed of the composite sheet of about 0.2 mm thick.</p> <p>M21-3 EXPERIMENTAL STUDY ON SHEAR STRENGTH FOR ULTRA-HIGH PERFORMANCE CONCRETE BEAM MOLDING JM Son, BI Bae, CS Choi(Hanyang Univ.) UHPC has problem that is weak for brittle fracture due to shear strength. This study aims to effect on shear strength about steel fiber in UHPC through experiment. Also steel fiber is how to effects at the strength and ductility of Ultra-High Performance Concrete.</p> <p>M21-4 ELECTRICAL AND OPTICAL PROPERTIES OF COMPOSITE TRANSPARENT CONDUCTING OXIDE THIN FILMS KS Hui, L Li, JY Lee, HW Park, PK Song, YR Cho, HS Lee(Pusan National Univ.), SK Lee(Korea Inst. of Energy Research) This paper investigates the electrical and optical properties of a single layer tCO thin (NiO/AZO) with different molar ratios of NiO doped into AZO thin films by sol-gel solution method. The results indicate that the enhancement of conductivity could be achieved by annealing the NiO-AZO films in N₂/H₂ forming gas.</p> <p>M21-5 CHARACTERISTICS OF A PIEZOCOMPOSITE GENERATING ELEMENT HT Luong, CMT Tien, NS Goo(Konkuk University) In this paper, we investigate performance and characteristics of a Piezocomposite Generating Element (PCGE). The results of battery charging by using the PCGE in small scale wind mill shows that the potential application of the PCGE in wind energy harvesting.</p> <p>M21-6 NANO CARBON MATERIAL BASED ELECTRO-CHEMICAL ACTUATORS IP Kang, JY Cho, JM Kim(Pukyong National Univ.) The electrochemical actuation property of nano carbon materials was studied and graphene actuator was shown for the first. The electrochemical actuation mechanism based on the expansion of the film due to the ions attachment on the surface is available to most of nano carbon porous films immersed in an electrolyte.</p>	<p>M22 PROCESSING AND MANUFACTURING TECHNOLOGIES Chairs: A Loos/ H Hira</p> <p>M22-1 INDICATORS FOR OPTIMIZING CURE TEMPERATURE OF PASTE ADHESIVES A Sanchez, M Zogg, P Ermanni(ETH Zurich) This contribution, in the frame of 'Clean Sky' JTI, is presenting the results of a research program investigating the influence of fast curing with high temperature on the quality of paste adhesives. Results show a method to assess the quality of paste adhesives, through the analysis of different physical properties.</p> <p>M22-2 STUDY ON CUTTING OF CFRP PLATE BY FIBER LASER H Hirohito(Daido Univ.), T Akihiko(Laser X CO. Ltd.) This study is focused to the feasibility of fiber laser beam cutting process to composite plate of up to 9.1 mm thick. Very high speed cutting was realized by fiber laser. Heat affected zone degraded mechanical properties, however it recovered by removing thin area.</p> <p>M22-3 NON-UNIFORMITY OF THE FILAMENT DISTRIBUTION IN FIBRE BUNDLES AND ITS EFFECT ON DEFECT FORMATION IN LIQUID COMPOSITE MOLDING F Gommer, A Endrueweit, AC Long(Univ. of Nottingham) Based on stochastic modelling of experimentally observed non-uniform filament distributions in fibre bundles, local permeability distributions were reconstructed, and flow through fibre bundles was simulated at the micro-scale. The results obtained employing both approaches indicate how local fibre volume fraction and filament arrangement determine the formation of dry spots.</p> <p>M22-4 SIMULATION OF RESIN INFUSION IN THE MANUFACTURE OF FIBER METAL LAMINATES BY VARTM G Tuncol, AC Loos(Michigan State Univ.), RJ Cano(NASA Langley Research Center) Fiber metal laminates (FMLs) have been successfully manufactured by the VARTM process. A simulation model of the VARTM FML infusion process was developed. The model was used to predict the flow patterns and the infiltration times at the top and bottom surfaces of the hybrid perform during resin infusion.</p> <p>M22-5 EFFECT OF PROCESSING METHODS ON CONSOLIDATION OF COBONDING T-STIFFENED SKIN STRUCTURE USING AUTOCLAVE XG Ma, M Li, YZ Gu, YK Li, ZG Zhang(Beihang Univ.) In this article, a typical integral structure, T-stiffened skin structure was chosen and manufactured using carbon fiber/epoxy resin prepreg with cobonding autoclave process. The influences of debulking tool assembly, curing and cobonding sequence on the consolidation quality of T-stiffened skins were studied.</p> <p>M22-6 DEFECT PREDICTION IN COMPOSITES BASED ON NUMERICAL SIMULATION AND EXPERTISE KNOWLEDGE YX Liu, M Li, YZ Gu, S Jing, ZG Zhang(Beihang Univ.) During the manufacturing process, various defects inevitably appear as results of curing schedule, environment, materials, and unreasonable structure design. Based on the numerical module, combined with the model of pore growth and the expertise knowledge, the probability of generation of pore is predicted in this paper.</p>	<p>M23 DAMAGE AND FRACTURE Chairs: J Wang/ V Silberschmidt</p> <p>M23-1 ENHANCING PREDICTION ACCURACY IN SIFT THEORY J Wang(Defence Science and Technology Organisation), W. K. Chiu(Monash Univ.) In SIFT theory, for the matrix failure prediction, two properties, namely the first invariant of the strain tensor and the second invariant deviator, are considered to be able to indicate matrix initial failure due to volume increase and distortional strains respectively. When either of these reaches its critical value, failure...</p> <p>M23-2 DAMAGE IN FIBRE-REINFORCED COMPOSITE LAMINATES SUBJECTED TO DYNAMIC LOADING G Tsigourakos, H Ullah, IA Ashcroft, V Silberschmidt(Loughborough Univ.) This study deals with analysis of damage in carbon fibre-reinforced polymer laminates exposed to conditions of impact fatigue - a repetition of low-energy impacts. The paper studies various types of damage and their evolution in specimens using a combination of mechanical testing, X-ray micro computed tomography and finite-element analysis.</p> <p>M23-3 INFLUENCE OF FIBER-MATRIX ADHESION ON MECHANICAL PROPERTIES OF GLASS/POLYBUTYLENE TEREPHTHALATE UNIDIRECTIONAL COMPOSITES S Pillai, OS A, S Charca, OT Thomsson(Aalborg Univ.), D Prabhakaran R.L., TL Andersen, H Lilholt(Technical Univ. of Denmark), H Knudsen(Comfil A/S) Results obtained from a study concerning the effect of matrix-fiber interfacial bonding on the tensile bending properties of glass fiber reinforced polybutylene terephthalate (G/PBT) unidirectional (UD) composites are presented in this paper. Both OM and SEM were used to analyze the composite quality.</p> <p>M23-4 PREFERENTIAL ENERGY ABSORBING INTERFACES FOR BALLISTIC AND STRUCTURAL APPLICATIONS DT Fishpool, A Rezai, D Baker(BAE Systems), S Ogini, P Smith(Univ. of Surrey) Ballistic performance of rate dependent "smart-sized" B2-glass fibre reinforced epoxy was evaluated compared with matrix compatible, semi-compatible and incompatible sized materials. The smart-sized material exhibited rate dependent changes in interlaminar shear strength and mode II interlaminar fracture toughness; the ballistic performance of the material was improved over compatible sized materials...</p> <p>M23-5 DISSIPATED ENERGY BASED DAMAGE MODELING IN CFRP NOTCHED COUPONS WITH MULTI-AXIAL FAILURE DATA AU Litchfield, S Feih, AC Orifici(Royal Melbourne Inst. of Technology), RS Thomsson(Cooperative Research Centre for Advanced Composite Structures Limited) A methodology that uses multi-axial testing and dissipated energy (DE) to characterise the mechanical behaviour of laminated composite materials has been implemented into an analysis approach. A constitutive relationship between the DE and material stiffness was formed and was successful in demonstrating that the mechanics of the approach were sound.</p> <p>M23-6 MODE II DELAMINATION OF CFRP-METAL LAMINATES AT BOLTED JOINTS B Balci, D Barbu, H Baier(Instit. of Light Weight Structures) In order to improve the bearing strength of carbon fiber reinforced plastics (CFRP) at bolted joints thin metal sheets are laminated into the load application area. Mode II delaminations start at the butt joints between CFRP and metal layers, which are investigated in this paper.</p>
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Break

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16:15	<p>M24 NANOCOMPOSITES Chairs: JY Park/ T Chou</p> <p>M24-1 DEVELOPMENT OF CARBON NANOTUBE/ EPOXY NANOCOMPOSITES FOR LIGHTNING STRIKE PROTECTION MJ Russ, S Rahatekar, HX Peng (Univ. of Bristol), K Koziol(Univ. of Cambridge) This concept focuses on improving CFRP lightning strike behaviour, by improving the mechanical strength, electrical and thermal conductivity by using carbon nanotubes. The aim is to examine the scalability of such physical and mechanical properties of carbon nanotube reinforced epoxy focusing on effects of nanotube weight fraction and aspect ratio.</p>	<p>M25 SYMPOSIUM ON MULTIFUNCTIONAL COMPOSITE MATERIALS FOR ENERGY APPLICATIONS Chairs: J Baur/ R Baughman</p> <p>M25-1 DEVELOPMENT OF A BIO-INSPIRED STRETCH-ALE NETWORK FOR INTELLIGENT COMPOSITES NP Salowitz, ZQ Guo, YH Li, KL Kim, G Lanzara, FK Chang(Stanford Univ.), K Kim, Y Chen(Univ. of California, Los Angeles) The human skin hosts sensors arrays detecting numerous traits important to how we function. To mimic this capability in composites a bio-inspired, expandable network is under development which can be embedded within a composite. This network consists of sensors, electrical interconnects, and computational components providing skin-type sensing to composite structures.</p>	<p>M26 GREEN COMPOSITES Chairs: AV Vuure/M Kessler</p> <p>M26-1 MECHANICAL PROPERTIES OF "GREEN" COMPOSITES BASED ON POLY-LACTIC ACID RESIN AND SHORT SINGLE BAMBOO FIBERS S Suiito(Univ. of Jember), JK Pandey, H Takagi(The Univ. of Tokushima) This paper deals with the fabrication and mechanical properties characterization of short single bamboo fiber reinforced "green" composites and . The composites were prepared by hot-press a mixture of bamboo fibers with poly-lactic acid. The measurement finding showed that the tensile and flexural properties were affected by fiber content.</p>	<p>M27 APPLICATIONS OF COMPOSITES Chairs: S Lin/V Carvelli</p> <p>M27-1 NUMERICAL MODELING OF DELAMINATION DURING MACHINING OF LFRP COMPOSITES X Soldani, C Santuste, MH Miguez(Univ. Carlos III of Madrid) In this paper, a 3D numerical model of composite machining is presented with special outlook to the development of delamination damage in the workpiece. The numerical model of orthogonal cutting of LFRP was developed with the Finite Element code ABAQUS.</p>	<p>M28 HIGH PERFORMANCE COMPOSITES/SENSING AND INTERFACIAL PROPERTIES OF NANOCOMPOSITES Chairs: BG Yoon/ YB Park</p> <p>M28-1 FABRICATION OF NOVEL POLYURETHANE ELASTOMER COMPOSITES CONTAINING HOLLOW GLASS MICROSPHERES AND THEIR UNDERWATER APPLICATIONS HG Im, CK Kim(Chung-Ang Univ.), OC Kwon(Agency for Defense Development) Hollow glass microspheres (HGMs) consist of outer stiff glass and inner inert gas, which results in some unique properties, such as light weight, high specific compressive strength, low moisture absorption. Based on these properties, HGMs have been used in the fabrication of polymer composite materials for different applications. In the...</p>	<p>M29 METAL MATRIX COMPOSITES Chairs: YP Jiang/ S Sajjadi</p> <p>M29-1 EFFECT OF CR ADDITION AND PROCESSING CONDITIONS ON INTERFACE MICROSTRUCTURE AND THERMAL CONDUCTIVITY OF DIAMOND/CU COMPOSITE H Chen, CC Jia(Univ. of Science and Technology Beijing), SJ Li(Shenzhen HAIMINGRUN Industrial Co.Ltd.) In this study, we investigate the effect of Cr addition on the interface microstructure and thermal conductivity of Cu/ diamond composite with respect to PHPT process conditions. Improvement of interfacial bonding and diamond skeleton has been achieved by CuCr_{0.08}/diamond composite with excellent thermal conductivity as high as 831.4 W/mK.</p>
16:35	<p>M24-2 CARBON NANOTUBE FIBERS: CHALLENGES AND OPPORTUNITIES TW Chou, WB Liu, M Zu(Univ. of Delaware), JH Byun, BS Kim(Korea Inst. of Materials Science) This paper accesses the recent advancements in the science and technology of carbon nanotube (CNT) fibers, in terms of their fabrication methods as well as characterization and modeling of mechanical and physical properties. The challenges and opportunities in CNT fiber research are also evaluated.</p>	<p>M25-2 CARBON NANOMATERIALS - THE ROUTE TOWARD APPLICATIONS IN ENERGY WB Chou, I Lahiri, S Das(Florida International Univ.), M Choi, P Sudhagar, Y Sun, Y Kang(Hanyang Univ.) This talk will focus on engineering carbon nanomaterials, graphene and carbon nanotubes (CNTs) for high efficiency flexible battery and dye sensitized solar cells. Particularly, engineering the interfaces of graphene-polymer, graphene-substrate and graphene-CNTs...</p>	<p>M26-2 THE INFLUENCE OF THERMAL AGEING ON MECHANICAL PROPERTIES OF GREEN RUBBER COMPOSITE W Ariyawirawan, T Mekeaw, R Rungreansi, P Wachirawech (Rajamangala Univ. of Technology), A Nakai, H Hamada(Kyoto Inst. of Technology) Green composites can be prepared to suit applications with desired properties by incorporating lute roving fiber into a rubber matrix. The reinforcement of NR/lute green composite is acquired due to the naturally improved strength and modulus with different fiber content before and after thermal ageing.</p>	<p>M27-2 CONCEPTION AND MANUFACTURING OF A LIGHTWEIGHT LEAF SPRING WITH ADJUSTABLE SPRING RATE WA Hufenbach, F Adam, S Spitzer, D Weck(TU Dresden), M Pohl(Leichtbau-Zentrum Sachsen GmbH) This paper presents a new concept to adjust the spring rate of a lightweight spring system containing glass fiber-reinforced polypropylene leaf spring elements. A dimensioning strategy is developed and validated. Proof-of-concept experiments show a good agreement between the analytical calculation and the measured behaviour under bending load.</p>	<p>M28-2 MECHANICAL AND DIELECTRIC PROPERTIES OF E-GLASS FIBER / MWNTS DISPERSED EPOXY COMPOSITES JH Choi, JS Seo(Agency for Defense Development) Glass fiber/multi-walled carbon nanotubes(MWNTs) dispersed epoxy composites were prepared for the study on mechanical and dielectric characteristics. Tensile and flexural strength of glass fiber/MWNTs-epoxy composite specimens was measured in the ratio of MWNT concentrations. The dielectric properties were characterized by measuring complex permittivity and absorptivity through a free space measurement.</p>	<p>M29-2 INCREMENTAL DAMAGE THEORY OF PARTICULATE-REINFORCED COMPOSITES WITH A DUCTILE INTERPHASE YP Jiang, K Tohgo(Hohai Univ.) This paper deals with a new micromechanics model of particulate-reinforced composites (PRCs) which can describe the evolution of debonding damage, matrix plasticity and particle size effect on the deformation.</p>
16:55	<p>M24-3 ARTIFICIAL LOTUS LEAF STRUCTURES MADE BY BLASTING WITH SODIUM BICARBONATE SM Lee, HD Cho, DS Kim, WB Hwang (POSTECH) Superhydrophobic surfaces have superior hydrophobicity and micro-nano hierarchical structures like those on the lotus leaf. The conventional methods used for the fabrication of microstructures involve delicate and time-consuming processes. We report here a simple and cost-effective method for fabricating artificial lotus-leaf-like structures with uniform superhydrophobicity...</p>	<p>M25-3 NANOPARTICLE-ENHANCED POLYMERS FOR ELECTROMECHANICAL ACTUATION AND ENERGY STORAGE Z Ounajis, P Khodaparast(Pennsylvania State Univ.), S Deshmukh, A Meddeb(Texas A&M University) Our efforts in EAP-based nanocomposites provide new avenues to improve their electromechanical and dielectric response. We find that, due to polarization enhancement, resulting nanocomposites exhibit electrostriction. Despite promising results, dispersion and high dielectric loss issues remain. We address those by exploring use of high dielectric, high aspect ratio metal-oxide inclusions.</p>	<p>M26-3 EFFECTS OF DIFFERENT THERMO-MECHANICAL REFINING PRESSURE ON THE PERFORMANCE OF MEDIUM DENSITY FIBREBOARD (MDF) MADE FROM KENAF (HIBISCUS CANNABINUS L.) CORE AH Alias, MT Paridah(Univ. Putra Malaysia) The study is to evaluate the performance of medium density fibreboard (MDF) made from kenaf (Hibiscus cannabinus L) core. The main objective of this study is to find the optimum refining process to get better board properties, since the kenaf consist of two distinct parts, core and bast.</p>	<p>M27-3 DESIGN, DEVELOPMENT AND CERTIFICATION OF COMPOSITE REAR PRESSURE BULKHEAD FOR A LIGHT TRANSPORT AIRCRAFT S Venkatesh, R Sundaram(National Aerospace Laboratories) Advanced Composites Division of NAL is involved in the design and development of composite structures for civil and military aircraft. One of the challenges was design, develop and certify a composite rear pressure bulkhead for a civil transport aircraft. This paper brings out the constructional details and realization of product.</p>	<p>M28-3 AN EXHAUSTIVE CHARACTERIZATION OF QUANTUM TUNNELLING CONDUCTIVE COMPOSITE G Canassi, M Lombardi, A Guerriero(Italian Inst. of Technology), S Stavisi, F Pirri(Politecnico di Torino) The giant piezoresistive response of a metal-polymer composite based on nanostructured conductive nickel filler dispersed in PDMS has been described. DMTA, TGA, gel content and morphological characterization have been reported. The piezoresistive behavior has been evaluated on samples with different physical parameters like nickel content, applied load velocity and thickness.</p>	<p>M29-3 TUNGSTEN-FIBER REINFORCED TUNGSTEN COMPOSITES: A NOVEL CONCEPT FOR IMPROVING THE TOUGHNESS OF TUNGSTEN J RIESCH, T Hoschen, JH You(Max-Planck-Institute for Plasma Physics, EURATOM Association) The inherent brittleness of tungsten is a severe drawback for its use as plasma facing material in fusion reactors. Authors developed a new concept of tungsten-fiber reinforced tungsten composites showing a so called 'pseudo toughness'. The fabrication process for these composites as well as the proof of principle is presented.</p>
17:15	<p>M24-4 EFFECT OF HALLOYSITE NANOTUBES ON TENSILE PROPERTIES AND INTERFACIAL PROPERTY BETWEEN CARBON FIBER AND EPOXY RESIN R Nakamura(Nihon Univ.), AN Netravili(Cornell Univ.), MV Hosur(Tuskegee Univ.) In the present work, we have characterized the effect of halloysite nanotubes (HNT) on the mechanical properties of nanocomposites and fiber/resin interfacial property using the single fiber composite (SFC) method. These properties were compared to SiO₂ and clay modified epoxy nanocomposites which have been reported earlier.</p>	<p>M25-4 DESIGN CONSIDERATIONS FOR SHAPE MEMORY POLYMER COMPOSITES WITH MAGNETO-SENSITIVE PARTICLES PH Kao, KK Westbrook, F Castro, HJ Qi(Univ. of Colorado) SMPs are adaptive polymers that can recover the permanent shape from a temporary shape by external stimuli. Recently, efforts have been made to improve SMP recovery rate by inductive heating of magnetic particles dispersed in SMP. This paper investigates design considerations for magneto-sensitive particle reinforced SMPs using finite element simulations.</p>	<p>M26-4 GREEN COMPOSITES: SUSTAINABILITY AND MECHANICAL PERFORMANCE JM Chard, G Creech(Scott Bader Company Ltd.), D Jesson, P Smith(Univ. of Surrey) This study examines a range of NF composites, utilising matrices of thermosetting resins with improved sustainability (reformulated with natural oils whilst maintaining performance), in order to develop a range of sustainable composites with useful mechanical properties that could compete with standard E-glass composites.</p>	<p>M27-4 BASIC STUDY ON JOINT STRENGTH OF WELDING FOR CARBON FIBER REINFORCED THERMOPLASTIC Q Yuta, U Kiyoshi, M Hideaki(The Univ. of Tokyo) Recently, the research on fiber reinforced thermoplastic(FRTP) as a light material of the automobile is advanced. In this study, we focus on welding joint which is one of the problems for practical use of FRTP. With hot plate, we welded specimens and evaluated the joint strength by tensile test.</p>	<p>M28-4 FUNCTIONAL EPOXY COMPOSITES WITH MWNTS-GLASS FIBRES J Zhang, SL Gao, E Maeder, JW Liu, RC Zhuang(Leibniz-Institut für Polymerforschung Dresden) We deposited multi-walled carbon nanotubes (MWNTs) onto insulative glass fibre surfaces for the first time, leading to the formation of semiconductive MWNT-glass fibres and in turn multifunctional fibre/polymer interphases. We manufactured the single fibre not only as an in-situ sensor tracking the microcrack, but also as an switch utilizing the microcrack.</p>	<p>M29-4 MICROSTRUCTURE AND MECHANICAL PROPERTIES OF AL-AL₂O₃ MICRO AND NANO COMPOSITES FABRICATED BY STR CASTING ROUTE S Sajjadi, H Ezatpour, H Beygji, S Zebarjad (Ferdowsi Univ. of Mashhad) A modified str casting method is applied to fabricate Al-Al₂O₃ micro and nano composites. The method consisted of heat treatment of reinforcement particles, addition of 1wt.% magnesium as the wetting agent, injection of heat treated particles within the melt by inert argon gas and finally stirring the melt.</p>
17:35	<p>M24-5 FABRICATION AND CHARACTERIZATION OF α-AL₂O₃ NANOPARTICLES REINFORCED POLYAMIDE 6 COMPOSITE FILAMENTS P Saengkwamswang, S Pimanpaeng, V Amornkittbamrung(Khon Kaen Univ.), S Rugmai, S Maensri(Suraneau Univ. of Technology) α-Al₂O₃/PA 6 filaments have been fabricated by a single screw extrusion method. It is found that the α-Al₂O₃ nanoparticles can enhance the mechanical and thermal properties of PA 6 polymer; the bond strength and size(Rg, Lp) of PA 6 matrix play an important role in the properties of α-Al₂O₃/PA 6 filaments.</p>	<p>M25-5 MICROSTRUCTURE AND MATERIAL CHARACTERIZATION OF BAT WING TISSUE FOR ACTIVE SKIN COMPOSITES N Gonjoubour, Y Wang, A Skulborstad(Univ. of Michigan), S Son(Virginia Tech) Bat skins have an inherent microstructure yielding specific macroproperties that enable unique flight style and aerodynamic footprint. It is based on this key observation that we have undertaken the first systematic study of bat skins to investigate its material properties commensurate with specific behaviors and functionality.</p>	<p>M26-5 COMPOSITE HOLLOW CORE HIGH-END BIO-PANELS S Rao, D Bhattacharya(Univ. of Auckland), Y Yadama(Washington State Univ.) This paper presents a relatively new concept of Bio-Panels. The cores for the panels were fabricated from wood fibre/ sisal fibre-polypropylene composites or laminated strand veneer (LSV). With growing environmental concerns and increasing competition, these panels are an attempt to develop products that are structurally strong and are conducive to sustainability.</p>	<p>M27-5 DEFORMATION EVALUATION OF ELASTIC COMPOSITE BLADE MODELS FOR A TIDAL POWER GENERATION BY FLUID-STRUCTURE INTERACTION ANALYSIS H Wada, H Murayama, K Uzawa, K Kageyama(The Univ. of Tokyo), Y Minami(National Maritime Research Inst.) Tidal current power generation system converts kinetic energy of water flow into electric energy by rotating turbine blade. We proposed the passive pitch control system with a composite structure for a tidal current power generation in order to reduce initial and maintenance costs.</p>	<p>M28-5 DISPERSION EVALUATION AND INTERFACIAL SENSING OF CARBON FIBER/CNT-PHENOLIC COMPOSITES USING ELECTRO-MICROMECHANICAL TECHNIQUE ZJ Wang, DJ Kwon, GY Gu, JM Park (Gyeongsang National Univ.) WI Lee(Seoul National Univ.), JG Park(Agency for Defense Development), LK Davies(The Univ. of Utah) Optimum dispersion conditions of CNT in phenolic matrix for self-sensing were investigated by electric resistance measurements. Compressive strength increased significantly of CNT-phenolic composites. Electric contact resistivity between carbon fiber and CNT-phenolic composites exhibited good sensing to stress. Carbon fiber reinforced CNT-phenolic composites showed higher interfacial adhesion than pure phenolic resin.</p>	
17:55	<p>M25-6 LOAD-BEARING MULTI-FUNCTIONAL STRUCTURE WITH DIRECT THERMAL HARVESTING FOR THERMALLY ACTIVATED RECONFIGURABLE WING DESIGN JJ Joo, B Smyers, G Reich(Air Force Research Laboratory), R Behl(Aerospace Mechanics, UDRI) This paper demonstrates the system level design of a novel reconfigurable system that integrates multi-functional structures and materials including energy harvesting. Direct utilization of thermal energy decrease the losses associated with energy conversion, and passive activation using thermal energy reduces the weight penalty by eliminating control systems and separate actuators.</p>	<p>M26-6 PHYSICAL PROPERTIES OF FURNITURE PANELS FROM MACADAMIA SHELLS A Wechsler, M Ramirez, A Crosby, M Zaharia, V Sahajwalla(Univ. of New South Wales), Haley Jones(Australian National Univ.), AA Ballerini, MA Nunez(Univ. of Bio-Bio) This paper examines the development of sustainable composite materials using macadamia shells as fillers with a non-toxic, natural and renewable adhesive: castor oil. The results show that the new filler and adhesive provide panels with improved performance compared with commercially available panel materials.</p>	<p>M27-6 PERFORMANCE EVALUATION OF COMPOSITE MARINE PROPELLER FOR A FISHING BOAT BY FLUID-STRUCTURE INTERACTION ANALYSIS Y Hara, H Murayama, K Uzawa, K Kageyama(The Univ. of Tokyo), T Yamatogi(Nakashima propeller Co., Ltd.) A method for optimizing CFRP propeller by fluid structure interaction was investigated. For the first method, lifting surface theory and finite element analysis was applied. Consequently, computational fluid dynamics was substituted for lifting surface theory and this combination showed the advantage that it can consider real fluid.</p>	<p>M28-6 STRAIN SENSORS USING CARBON NANOMATERIAL BASED POLYMER COMPOSITES YB Park, SW Kim, SH Hwang, JS Choi, MK Um, JH Byun(Ulsan National Inst. of Science and Technology) This study investigates multi-walled carbon nanotube (MW-CNT)- and exfoliated graphite nanoplatelet(xGNP)-polymer composites as sensing materials by monitoring the electrical resistance of the sensors under flexural loading. This work focuses on MW-CNT- and xGNP-polymer composite sensors as stand-alone devices that can be affixed, embedded or otherwise integrated into existing structures.</p>		
18:15	Break					
18:30	WELCOME RECEPTION					

	202B	203	301	302	401	402A
16:15	<p>M30 TSAI AWARD Chairs: O Ochoa</p> <p>M30-1 HIGH MECHANICAL PERFORMANCE OF GRAPHENE OXIDE-POLY(VINYL ALCOHOL) LAYERED NANOCOMPOSITES Y.Gao, LQ Liu, D Zhou, BH Han, Z Zhang(National Center for Nanoscience and Technology) Graphene oxide-poly(vinyl alcohol) layered nanocomposites were fabricated by vacuum-assisted self-assembly technique, in which the nanosheets component takes up over 50wt% and acts as the principal framework. The nacre-like structure favored the composites high mechanical performances. Furthermore, the structural factors affecting mechanical behaviors of the layered nanocomposite papers were deeply investigated.</p>	<p>M31 FIBRES, MATRICES AND INTERFACES Chairs: XW Yuan/ YB Li</p> <p>M31-1 ATMOSPHERIC PLASMA POLYMERISATION OF CARBON FIBRES: IMPACT ON ADHESION TO POLYURETHANE ELASTOMER S.Bai, KK Chee Ho, A Bismarck(Imperial College London), G Knox(Gates Corporation) An atmospheric plasma polymerisation (APP) rout to enhance the adhesion properties of carbon fibres to elastomeric matrix was successfully developed. The surface hydrophilicity of the carbon fibres and fibre matrix compatibility were increased as result of the introduction of chemical functionalities to the carbon fibre surface.</p>	<p>M32 STRUCTURAL RESPONSE AND DESIGN Chairs: C York/ F Paris</p> <p>M32-1 WRINKLING CHARACTERISTIC OF MEMBRANE INFLATED TRUNCATED CONE ZY Du, HF Tan, CG Wang(Harbin Inst. of Technology) A new factor called wrinkle factor is introduced to define the wrinkling location and collapse load of a membrane inflated truncated cone under bending. A wrinkling prediction and analysis model are developed to describe wrinkled region emergence and extension. Comparisons with experimental results agree well.</p>	<p>M33 SMART ACTUATIONS AND ITS APPLICATIONS/SMART STRUCTURE AND MATERIALS Chairs: KS Kim/ S Du</p> <p>M33-1 DESIGN OF SMART COMPOSITE FOR VIBRATION SUPPRESSION USING LAMINATION PARAMETERS S.Honda, K Kosaka, Y Narita, I Kajiwra(Hokkaido Univ.) A multidisciplinary design optimization method for smart laminated composites consisting of graphite-epoxy laminated plates and piezoelectric actuators is presented to maximize the performance of vibration control. Design variables are lamination-parameters, actuator placements, and weight parameters in the H₁ control system, and a genetic algorithm method is used as an optimizer.</p>	<p>M34 PROCESSING AND MANUFACTURING TECHNOLOGIES Chairs: A George/ J Kovacs</p> <p>M34-1 MODELLING OF HEAT TRANSFER AND CONSOLIDATION FOR THERMOPLASTIC COMPOSITES RESISTANCE WELDING HJ Shi, IF Villegas, HEN Bersee(Delft Univ. of Technology) A processing model was developed for the resistance welding of GF/PEI. The thermal, consolidation and degradation aspects of the welding processing were modelled and validated. Based on the processing model, a processing window was determined by using the consolidation and degradation degree as constraints, and a parameters optimization was performed.</p>	<p>M35 DAMAGE AND FRACTURE Chairs: M Kempf/ M Ueda</p> <p>M35-1 HIGH RESOLUTION DAMAGE DETECTION OF LOADED CARBON/EPOXY LAMINATES USING SYNCHROTRON RADIATION COMPUTED TOMOGRAPHY AE Scott, P Wright, M Mavrogordato, I Sinclair, SM Spearing(Univ. of Southampton), W Hepples, N Kalantzis(Luxfer Gas Cylinders) In the present work, high-resolution synchrotron radiation CT results have been obtained for two loaded carbon/epoxy composite laminate systems that are widely used in engineering applications. The imaging techniques enable all major damage mechanisms to be identified and quantified, with the present work particularly focused on individual fibres breaks.</p>
16:35	<p>M30-2 IMPEDANCE CHARACTERIZATION OF TRANS-PARENT AND FLEXIBLE CARBON NANOTUBES THIN FILM NETWORKS MZ Iqbal, J Perez-puigdemont, N Ferrer-anglada(Universitat Politcnica de Catalunya), JH Eom(Sejong University) We prepared SWCNTs networks on transparent flexible substrates with different densities by spray. The Z at low frequency decreases when increasing SWCNTs density, estimated by optical transmittance as expected. The sheet resistance is as low as 2.51x0.05 KΩ/sq for T=65% and 7.97x0.05 KΩ/sq for T=85%.</p>	<p>M31-2 THERMAL AND MECHANICAL PROPERTIES OF SEVERAL PHTHALONITRILE RESIN SYSTEM Z.Tong, Z Heng(Chinese Academy of Sciences) Two kinds of self-catalyst cyano resin with NH₂ group and imide structure in the main chain were synthesized. DSC was used to investigate the curing behavior of the cyano resin comparing with other self-catalyst monomer. The structure and thermal properties of cured resin were studied by FTIR and TGA.</p>	<p>M32-2 DESIGN OF CFRP WITH FIBERS PLACED BY USING AN EMBROIDERY MACHINE K.Oka, A Senba, T Ueda(Nagoya Univ.) In this research, the embroidery-based tailored fiber placement (TFP) is considered and the design method is discussed to optimize a stiffness property of a plate.</p>	<p>M33-2 SMART COMPOSITE MATERIALS AND THEIR APPLICATIONS S.Du, JS Leng(Harbin Inst. of Technology) This presented work summarizes the recent advances in synthesis of a novel epoxy-based SMP, design as well as characterization of SMP composites (SMPs) driven by electrical approach as well as constitutive modeling, and their potential applications.</p>	<p>M34-2 STUDY ON THERMAL EXPANSION PRESSURE AND RESIN PRESSURE VARIATION DURING THERMAL EXPANSION MOLDING PROCESS CB Xin, YZ Gu, M Li, YX Li, ZG Zhang(Ministry of Education) The effects of temperature cycle and process gap on the thermal expansion pressure and resin pressure were investigated. It indicates that the process gap influences magnitude of expansion pressure and the moment of generating pressure. The temperature cycle with lower temperature plateau can effectively reduce the gradient inside the mold.</p>	<p>M35-2 EFFECT OF IMPACT DAMAGE ON THE COMPRESSION FATIGUE PERFORMANCE OF GLASS AND CARBON FIBRE REINFORCED COMPOSITES M.Kempf, S.Schwägele, V.Altstadt(Univ. of Bayreuth), A Ferencz (Henkel AG & Co. KGaA) This study focuses on the post-impact compression performance of glass and carbon fibre reinforced composites under static and dynamic loading. The investigation of different fibre and matrix materials allows to reveal some basic structure-properties-relationships which have to be considered when comparing the Compression After Impact behaviour of different composite materials.</p>
16:55	<p>M30-3 MICROMECHANICS OF RECYCLED COMPOSITES FOR MATERIAL OPTIMISATION AND ECO-DESIGN S.Pimenta, ST Pinho, P Robinson(Imperial College London) With prospects for introducing recycled composites in non-safety-critical structural applications being realistic, understanding the response and developing design methods for these materials is topical. This paper presents original experimental observations of failure mechanisms in several multiscale recycled composites, and the development and validation of analytical models for fracture toughness prediction.</p>	<p>M31-3 COATINGS FOR IMPROVED ADHESION STRENGTH AND RESISTANCE OF GLASS CORD M.Malalan, R Plonka, E Maeder(Leibniz Inst. of Polymer Research) Glass cord/polymer composites based on resorcinol-formaldehyde resin were investigated according to their adhesion strength to hydrogenated nitrile-butadiene rubber and environmental durability. An appropriate coating with improved barrier properties and an enhanced adhesion strength has been developed. A comparison of obtained and industrial specimens has been performed as well.</p>	<p>M32-3 HYGRO-THERMALLY CURVAURE-STABLE LAMINATES WITH NON-STANDARD PLY ORIENTATIONS CB York(Univ. of Glasgow) Stacking sequence configurations for hygro-thermally curvature-stable (HTCS) laminates non-standard ply angle orientations (+60, -60, 0 and 90°) are presented, which lead to solutions in all ply number groupings for 10 plies and above, thus offering a possibility for tapered warp-free laminate designs.</p>	<p>M33-3 ELECTROMECHANICAL RESPONSE OF PIEZO-ELECTRIC FOAMS KS Challagulla(Laurentian Univ.), TA Venkatesh(Stony Brook Univ.) Porous piezoelectric materials with their enhanced hydrostatic figures of merit and reduced acoustic impedances have been targeted for applications such as hydrophones. Present study examines the role of three-dimensional porosity present in foam type structures. Utility of piezoelectric foams for specific applications are assessed by quantifying select figures of merits.</p>	<p>M34-3 FIBER REINFORCEMENT INDUCED WARPAGE ON INJECTION MOLDED THERMOPLASTICS JG Kovacs, B Siklo(Budapest Univ. of Technology and Economics) This paper presents a novel examination method of the deformation of injection molded plastic parts especially for fiber reinforced materials. A special, but simple part was introduced for the description of the effect of different technological parameters and different fiber reinforcements on warpage.</p>	<p>M35-3 COMPRESSIVE STRENGTH OF A CARBON FIBER IN MATRIX M.Ueda, A Hiraga, T Nishimura (Nihon Univ.) Compressive strength of a fiber in matrix was calculated based on a model of column buckling on elastic foundation. Compression test of a carbon fiber in epoxy was performed to measure apparent compressive strength of the fiber. Actual compressive strength of the fiber was predicted from the apparent compressive strength</p>
17:15	<p>M30-4 WIRELESS STRAIN GAGE FOR TESTING AND HEALTH MONITORING OF CARBON FIBER COMPOSITES F.Gasco, P Feraboli, J Braun(Univ. of Washington), J Smith(Intel Research Labs) Based on the WISP platform patented by Intel, a novel wireless, passive, digital strain sensor is developed for structural testing and health monitoring of carbon fiber composites. The device is battery-free and it is powered and read by an RFID reader. The technology readiness is demonstrated through structural testing.</p>	<p>M31-4 RELATIONSHIP OF INTERFACE FRACTURE ENERGY AND INTERLAMINAR SHEAR STRENGTH OF CARBON FIBER REINFORCED COMPOSITE UNDER HYDROTHERMAL TREATMENT HX Liu, YZ Gu, M Li, YX Li, ZG Zhang(Beihang Univ.) Carbon fiber/epoxy resin interface properties, quantified by means of interface fracture energy, are tested in various hydrothermal conditions, comparing to interlaminar shear strength(ILSS). The results show that interface fracture energy degrades obviously after hygroscopic treatments rather than under high temperature. ILSS largely depends on the mechanics property of matrix than interface property.</p>	<p>M32-4 EXPERIMENTAL VALIDATION OF CROSS-SECTIONAL ANALYSIS FOR COMPOSITE ROTOR BLADES U Park, MK Dhadwal, SN Jung(Konkuk Univ.), DH Kim(Korea Aerospace Research Inst.) In this paper, the development and validation of a cross-section analysis program, KSec2D for composite rotor blades is discussed. The cross-sectional properties such as tension center, shear center and section stiffnesses are calculated. A good correlation is achieved in comparison with the experimental results and those of commercial software results.</p>	<p>M33-4 FIBER OPTIC SMART MONITORING OF KOREA EXPRESS RAILWAY TUNNEL STRUCTURES KS Kim(Hongik Univ.) For monitoring of railway structures, optical fiber sensors are very convenient. The fiber sensors are very small and do not disturb the structural properties. They also have several merits such as electro-magnetic immunity, long signal transmission, good accuracy and multiplicity of one sensor line. Strain measurement technologies with fiber optic...</p>	<p>M34-4 MOLDING COMPOUNDS BASED ON PARTIALLY WATER-SOLUBLE ORGANIC BINDER FOR PRODUCTION OF COMPLEX SHAPED CERAMIC MICRO PARTS Q.Weber, T Hanemann(Karlsruhe Inst. of Technology) This work presents a new binder system based on a water-soluble polyethylene-glycol and polyvinyl-butylal. Compared with conventional binders it has the important advantage that liquid pre-debidding takes place in water and not in toxic organic solvents. In addition, these compounds allow further process simplifications by its economic and time-saving benefits.</p>	<p>M35-4 CONCEPTION OF CRASH TESTS FOR COMPOSITE TUBULAR STRUCTURES H.Zabala, J Aurrekoetxea, M Mateos, L Aretabaleta(Mondragon Unibertsitatea) The tests proposed in this communication allow measuring the crashworthiness of tubular structures for the automotive industry subjected to different contour conditions. Three different initiator plugs have been proposed to carry out the compression tests: flat, conical and radial ones and tests at different strain rates have been performed.</p>
17:35	<p>M30-5 PLASMA POLYMERIZATION OF BASALT FIBER/POLYLACTIC ACID COMPOSITES: EFFECTS ON MECHANICAL PROPERTIES D.Kurmiawan, HY Lee, JY Lim(Dongguk Univ.), BS Kim(Korea Institute of Materials Science) Plasma polymerization on basalt fiber was conducted using atmospheric glow plasma discharge plasma. Acrylic acid was used as precursor and helium as carrier gas, with plasma time as the investigated variable. Plasma polymerized basalt fiber/poly(lactic acid) composite was fabricated and characterized.</p>	<p>M31-5 EFFECT OF PAMAM LAYER ON THE INTERFACE PROPERTIES OF CARBON FIBER REINFORCED EPOXY MATRIX COMPOSITES YB Li, QY Peng, XD He, RG Wang, L Mei, C Wang(Harbin Inst. of Technology) In Carbon fiber reinforced resin matrix composite, the interface between matrix and CF plays the role of load transfer. In order to improve this interface strength, we propose to introduce one dendrimer layer- poly(amido amine) (PAMAM) into the epoxy/CF interface. The surface functional groups were examined by XPS and FTIR.</p>	<p>M32-5 OPTIMAL DESIGN OF COMPOSITE INSERTS FOR A HYBRID ULTRACENTRIFUGE ROTOR HG Lee, JS Park, JH Kim(Korea Inst. of Materials Science) Ultracentrifuges that can generate the G-force higher than 600,000 x g are broadly used in biotechnology in order to separate tiny biogenic substances. In this study, we optimized the dimensions of the composite inserts, one of the components of a hybrid composite rotor, to enhance a centrifuge's performance.</p>	<p>M33-5 EFFECT OF DISTRIBUTION MEDIUM ON RESIN FLOW BEHAVIOR IN VACUUM INFUSION MOLDING PROCESS LP Bian, JS Yang, JY Xiao(National Univ. of Defense Technology) The permeability of the distribution medium (DM), the fiber preform and the assembly were measured to study their relations. And the effects of DM on resin flow behavior were studied through a series of visualization flow experiments.</p>	<p>M35-5 TENSILE TESTING CHARACTERIZATION OF ASYMMETRICALLY TAPERED COMPOSITE LAMINATES D Carrella-payan, LF Kawashita, G Allegrì (Bristol Univ.) Tapering composite laminate requires terminating, i.e. dropping-off plies. Ply terminations generates through-the-thickness stress discontinuities within laminates and this promotes delamination. This paper address the experimental characterization of quasi-isotropic asymmetrically tapered laminate loaded in tension. High-speed camera has been used to capture the location of the delamination.</p>	
17:55	<p>M31-6 VOIDS CHARACTERISATION IN CARBON FIBRE/EPOXY COMPOSITE LAMINATES JE Little, XW Yuan, ML Jones(The Univ. of Auckland) Three void characterisation techniques were compared by applying them to carbon fibre/epoxy composite laminates. The conventional Archimedes and microscopy techniques, and the novel micro-CT technique, were used. Micro-CT analysis performed best as it does not feature critical inherent errors and offers comprehensive information on individual void size, shape and distribution.</p>	<p>M32-6 STRUCTURAL INTEGRITY DESIGN OF A COMPOSITE WING IN A TILTROTOR AIRCRAFT JH Lim, SJ Shin(Seoul National Univ.), TS Kim(Risoe DTU), DH Kim(Korea Aerospace Research Inst.) A structural optimization framework was developed for a composite wing design to enhance whirl flutter speed. By this framework, two wing configurations are suggested. The suggested wing should be structurally safe for a given flight condition. Thus a MATLAB-based strain recovery module is developed to conduct the structural integrity analysis.</p>	<p>M34-6 FEASIBILITY STUDY OF SHEARING THICKENING FLUID (STF) DAMPERS KC Chang, FY Yen, T.Chen(National Taiwan Univ.) This study has indicated that the STF material, which is composed of nanosize fumed silica particles suspended in a solvent, can be used as damping elements to fill in the viscous damper device.</p>			
18:15	Break					
18:30	WELCOME RECEPTION					

	Halla A	Halla B	Samda A	Samda B	201A	202A
08:30	<p>P5: A PARADIGM SHIFT: COMPOSITE/SMART SYSTEMS INNOVATION THROUGH NANOSCIENCE, LIFE SCIENCES AND IT TECHNOLOGIES Jim C.I. Chang(Army Research Laboratory) (Chair: L Lee)</p>		<p>P6: CHALLENGES IN COMPOSITES FOR WIND POWER APPLICATIONS Paul Hibbard(Vestas Technology R&D Singapore) (Chair: OT Thomsen)</p>			
09:00	Break					
09:15	<p>T1 NANOCOMPOSITES Chairs: E Thostenson/ I Guz</p> <p>T1-1 CARBON NANOTUBE NETWORK COMPOSITES FOR DAMAGE DETECTION USING TIME DOMAIN REFLECTOMETRY G Pandey, ET Thostenson, Dirk Heider(Univ. of Delaware) In composite materials, there are several damage mechanisms at varying length scales. The present work investigates electric Time Domain Reflectometry (TDR) for non-invasive damage detection. External TDR sensors have been developed and tested. Carbon nanotubes have been selectively introduced forming localized conductive networks that result in higher TDR sensitivity.</p>	<p>T2 SYMPOSIUM ON 'MULTIFUNCTIONAL COMPOSITE MATERIALS FOR ENERGY APPLICATIONS' Chairs: M Durstock/ F Ko</p> <p>T2-1 COMPOSITES WITH SIMULTANEOUS VIBRATION CAPABILITIES Y Wang, DJ Inman(Virginia Tech) Multifunctional structures hold promise for new efficiencies in vehicles and other structural systems. Here we examine the possibility of integrating three functions into a structural system by combining the functions of energy harvesting, energy storage and active control into a composite structure. The composite considered here is a sandwiched material.</p>	<p>T3 COMPOSITE MATERIALS FROM BIO-RENEWABLE RESOURCES Chairs: M Kessler/ J Pandey</p> <p>T3-1 LONG BAMBOO FIBRE COMPOSITES AW Van Vuure, L Osorio, E Trujillo, C Fuentes(Katholieke Universiteit Leuven), J Verpoest(KU Leuven) Several aspects of long bamboo fibre composites are discussed: Extraction and cleaning of the fibres, Study of fibre morphology and fibre properties, Preparation of preforms or preregs, Study of fibre surface (physical) chemistry and compatibilisation (wetting/adhesion) with useful matrices, Composite preparation and properties, Specific (in-use) characteristics like moisture resistance...</p>	<p>T4 APPLICATIONS OF COMPOSITES Chairs: JS Kim/ JH Kweon</p> <p>T4-1 DURABILITY EVALUATION OF THE COMPOSITE BOGIE FRAME UNDER DIFFERENT SHAPES AND LOADING CONDITIONS JS Kim, HJ Yoon, SH Lee, WG Lee(Korea Railroad Research Inst.), KB Shin(Hanbat National Univ.) This study, the glass/epoxy composite bogie frames with two different shapes have been designed to be applied to the bogie of urban subway trains. The durability of the composite bogie frames was evaluated using a Goodman diagram...</p>	<p>T5 ENERGY TECHNOLOGY APPLICATIONS Chairs: HS Kim/ SW Jeon</p> <p>T5-1 CIGS SOLAR CELL MANUFACTURED BY USING NEW SELENIZATION METHOD JU Seo, WN Kim, SW Park, WJ Jung, JS Park, CW Jeon(Yeungnam Univ.) By adjusting the amount of Se, a chalcopyrite CIGS has been successfully obtained. The characteristics of the absorber were analyzed using X-ray diffraction, Raman spectroscopy, and scanning electron microscopy. The solar cell consisted of Ag/Al-doped ZnO/i-ZnO/CdS/CIGS/Mo/Glass revealed the conversion efficiency of 2.93%.</p>	<p>T6 METAL MATRIX COMPOSITES Chairs: D Zhang/ A Kawasaki</p> <p>T6-1 EVALUATION OF THERMAL CONDUCTIVITY OF CF/AL COMPOSITES FABRICATED BY LOW PRESSURE INFILTRATION METHOD MH Lee, YB Choi, K Matsugi, K Sugio, G Sasaki(Hiroshima Univ.) The thermal conductivity of unidirectional coal-tar pitch based CF/Al composites fabricated by low pressure infiltration method was investigated in the viewpoint of the effect of the addition of the alloying element in matrix and the interfacial reactant such as Al₂C₃ between fiber/matrix interface.</p>
09:35	<p>T1-2 DEFORMATION MECHANISM OF POLYETHYLENE/CALCIUM CARBONATE NANOCOMPOSITES M Mohebbi, SM Zabarad, M Mazini(Ferdowsi Univ. of Mashhad) The fracture behavior of medium density polyethylene/calcium carbonate (MDPE/CaCO₃) nanocomposites has been evaluated using the essential work of fracture (EWF) method. The fracture surfaces and the deformation zone in front of the pre-crack of polyethylene and its nanocomposites have been studied by SEM and TEM.</p>	<p>T2-2 ASSESSMENT OF MANUFACTURING LIMITS AND PROCESS-ABILITY FOR COMPOSITE STRUCTURES WITH EMBEDDED ENERGY DEVICES C Thomas, P Farabollini(Virginia Tech) The integration of battery and structure can lead to weight saving by eliminating redundancies. This study assesses the compatibility of the solid state thin film lithium batteries materials with carbon/epoxy composites manufacturing. Successful embedding tests, without deterioration of battery performance, have been performed. Failure types are identified and analyzed.</p>	<p>T3-2 INVESTIGATION OF PROTEIN BASED PLASTICS AND COMPOSITES FOR INDUSTRIAL APPLICATIONS D Grewell, M Baboi, G Srinivasan(Iowa State Univ.) The feasibility of plant-based protein and oil plastics was investigated by extrusion, injection molding, casting and compression molding. The goal of this work was to develop formulations that could meet industrial specifications. Applications included: lubrication sticks, plant pots, chew toys and chemical delivery applications.</p>	<p>T4-2 DAMAGES IN THERMOPLASTIC COMPOSITE STRUCTURES: APPLICATION TO HIGH PRESSURE HYDROGEN STORAGE VESSELS C Thomas, F Nony, S Ylitalo, J Renard (CEA Le Ripault, DAM) This study focuses on the different damages occurring in carbon fibres / polyamide matrix composite structures with the objective to understand their influence on mechanical properties and then on the conception and manufacturing processes of composite structures.</p>	<p>T5-2 CHALLENGES IN THE DESIGN OF HIGH ENERGY STORAGE FLYWHEELS MADE OF COMPOSITE MATERIAL V Antorelli, P He, B Baier(Technische Universität Muenchen) The present paper describes the parameters that must be taken into account when designing a composite flywheel. The parameters include material properties, assembly considerations that involve operational issues. An optimization method is presented which takes into account these parameters and allows finding the best solution in terms of available energy.</p>	<p>T6-2 BIO-MIMETIC METAL MATRIX NANOCOMPOSITES FABRICATED BY FLAKE POWDER METALLURGY ZJ Li, J Liang, GL Fan, D Zhang(Shanghai Jiao Tong Univ.) A simple and scalable methodology called "flake Powder Metallurgy" for biomimetic Al-Al₂O₃ composites has been developed. Nanoflake Al powder with native Al₂O₃ skins are used as building blocks to self-assemble into nanolaminated composites, giving rise to strong and ductile composite with tensile strength of 262 MPa and plasticity of 22.9%.</p>
09:55	<p>T1-3 SYNTHESIS AND SWELLING BEHAVIOR OF POLY(N-TERT-AMYLACRYLAMIDE-CO-ACRYLAMIDE / AMPS NA) NANOCOMPOSITE HYDROGELS Pazhansamy, BA Brundha(Sri Thegaya College) A series of ionic poly(N-tert-amylic)amide-co-acrylamide / AMPS (Na) nanocomposite hydrogels were synthesized by free-radical copolymerization in Water/Methanol medium using Ammonium persulfate (APS) as the initiator and N,N-methylenebisacrylamide (MBA) as a crosslinker at 60°C. The Nanocomposites Hydrogels were prepared via in situ polymerization using Organo modified PMPT(O-MMT) Nano clay.</p>	<p>T2-3 ENERGY HARVESTING AND STORAGE SYSTEM FOR AERO VEHICLES M Tavaj, J Wang, HS Kim, E Black, E Baldwin, E Amasawa(Univ. of Washington), Morio Nagata(Univ. of Tokyo) This talk is aimed at reviewing our AFOSR MURI summary in designing a set of new airborne energy-harvesting/storage system(EHSS) which may be applied to future UAV and MAW.</p>	<p>T3-3 GREEN COMPOSITES FROM CO-PRODUCTS OF BIOFUEL INDUSTRIES: A NEW PARADIGM TOWARDS VALUE-ADDED INDUSTRIAL USES AK Mohanty, N Zannabakhsh, M Misra(Univ. of Guelph) The distillers' dried grains with soluble (DDGS), the co-products from corn ethanol industries and lignin the co-products from cellulosic ethanol industries show immense opportunities in engineering new green composites when integrated with renewable resource-based bioplastics. The material chemistry and process engineering are vital in creating green composites of superior performance.</p>	<p>T4-3 ANALYSIS OF BRAIDED TUBES SUBJECTED TO INTERNAL PRESSURE RJ Paul, P Potluri(Univ. of Manchester), A Scott(Univ. of Southampton) Braided structures subjected to internal pressure have been examined using Computed Tomography. A finite element geometry has been constructed from representative volume element measurements made using Computed Tomography. The model has been used to predict the composite modulus and strength. Strength predictions have been compared with experimental results.</p>	<p>T5-3 STUDY ON THE DURABILITY COMPARISON OF ST5316 WITH NON COATED AND TIN COATED FOR METALLIC BIPOLAR PLATE MS Moon, KD Woo, MH Seo, SK Kang(Chonbuk National Univ.), JH Song(Jeju Univ. of Machinery and Carbon Composites) Nowadays, many economist and scientist worried for sharply increased to fuel consumption. Developed and developing countries investigate new energy system. The purpose of this study is to improve the durability of the metallic bipolar plate for PEMFC by surface treatment instead of the traditional graphite material.</p>	<p>T6-3 IN-SITU SYNTHESIS OF SPINEL WHISKERS REINFORCED ALUMINUM COMPOSITE ZY Yu, MG Zhao, EZ Liu, CS Shi, XW Du, J Wang(Tianjin Univ.) Mg/Al₂O₃ whisker reinforced Al matrix composite was prepared by in-situ synthesis method. The results indicate that the Mg/Al₂O₃ whiskers were in-situ generated in the matrix. The whiskers exhibit excellent distribution and interfacial bonding with the matrix, so the hardness and compressive strength of the composite were improved effectively.</p>
10:15	<p>T1-4 ANALYTICAL MODELLING OF ELASTIC PROPERTIES OF NANOCOMPOSITES WITH A NEW TYPE OF REINFORCEMENT IA Guz(Univ. of Aberdeen), JJ Rushchitsky, AN Guz(Timoshenko Inst. of Mechanics) A new four-component model for predicting the mechanical properties of nanocomposites reinforced with bristled nanowires is presented. The mathematical formulation of the model is based on using the Muskhelishvili complex potentials for each domain occupied by a separate component. The effective elastic constants are computed for different densities of bristles.</p>	<p>T2-4 NOVEL DEVICE ARCHITECTURES FOR ENABLING ENERGY HARVESTING, LIGHTING, AND COMMUNICATIONS FUNCTIONALITIES IN COMPOSITES M Sitein, B O'Connor, A Yadav, K Pipe, S Morris, J Volakis, S Biswas, K Luck, M Hendryx(Univ. of Michigan), Y Bayram(Ohio State Univ.) Novel fiber-based solar cells, thermoelectric generators, and woven antennas are introduced. The talk discusses methods for their fabrication, device structures and their performance, and their potential for integration into multi-functional (e.g. energy harvesting & load-bearing) composites.</p>	<p>T3-4 BIORENEWABLE POLYMERS AND COMPOSITES WITH SELF-HEALING FUNCTIONALITY MR Kessler, TC Mauldin, PR Hondred, R Ding(Iowa State Univ.) This paper outlines recent progress to developing self-healing polymer matrix composites derived from renewable resources. Previous work in the field of self-healing materials is presented, and the potential for applying previously-developed, novel biorenewable polymers and composites into self-healing mechanisms is discussed.</p>	<p>T4-4 ENGINEERED CEMENT COMPOSITES PROPERTIES FOR CIVIL ENGINEERING APPLICATIONS S Boughanem, DA Jesson, PA Smith, MJ Mulheron(Univ. of Surrey) C Eddie, S Pomas, M Rimes(Morgan Sindall Underground Professional Services Ltd) Engineered Cement Composites (ECC) materials containing a low volume fraction of polymeric fibres are of potential interest for civil engineering applications where a level of ductility is required. The present paper considers a range of issues relating to these materials including mechanical performance in tension and flexure, shrinkage and durability.</p>	<p>T5-4 A SINGLE-TYPE COMPOSITE HYBRID BIPOLEAR PLATE WITH GAS DIFFUSION LAYER FOR HIGH EFFICIENCY PEMFC JW Lim, HN Yu, BG Kim, DG Lee(KAIST) In this study, carbon composite-metal-GDL single type hybrid bipolar plate with a low electrical resistance was developed. The developed single type hybrid bipolar plate with continuous GDL connection and graphite coating has 2% of the total electrical resistance compared to the conventional composite bipolar plate.</p>	<p>T6-4 CURRENT RESEARCH STATUS IN THE STATE KEY LABORATORY OF METAL MATRIX COMPOSITES D Zhang, WJ Lu, TX Fan, QB Ouyang, DG Zhang(Shanghai Jiao Tong Univ.) Metal matrix composites (MMCs) based on light metals and alloys with high specific strength and specific stiffness, have been widely used in various areas. In situ processes developed in the State Key Laboratory of Metal Matrix Composites, China, to synthesize magnesium and titanium based MMCs are reviewed.</p>
10:35	<p>T1-5 CARBON NANOFIBER HYBRID LAMINATES FABRICATION AND CHARACTERIZATION MS Kasar, B Narayan(Amirkabir Univ. of Technology) Nanofibers are here synthesized via electrospinning process and used to reinforce the epoxy resin. This composite layer is combined with some other layers reinforced by woven carbon and Kevlar fabrics to obtain hybrid laminates. Characterization tests show that the thin nanofiber layer has low positive effect to the laminate properties.</p>	<p>T2-5 MULTI-SCALE MODLING AND OPTIMIZATION OF STRUCTURALLY INTEGRATED LITHIUM-ION BATTERIES S Golmon, C Deluca, ML Dunn, K Maute(Univ. of Colorado) In this paper we present a multi-scale modeling and analysis approach for predicting the behavior of structurally integrated batteries. We embed this model into a design optimization framework to study the optimal layout of electrodes. Our approach will allow assessing the trade-off between mechanical and electrochemical performance.</p>	<p>T3-5 SUSTAINABLE BIO-COMPOSITES FOR AUTOMOTIVE INTERIOR PARTS HJ Kim, BH Lee, SW Choi(Seoul National Univ.) Here we report on a prototype automotive interior part utilizing the formulated biocomposites. The prototype automotive interior parts are made of PLA/kenaf 50 wt.%. Clearly these study are encouraging enough to warrant further development of these bio composite materials and the manufacturing process based on carding.</p>	<p>T4-5 OVERWRAP COMPOSITE REPAIRS OF OFFSHORE RISERS AT TOPSIDE AND SPLASH ZONE AFL Leong, JH Leong, YC Tan, PFM Lew, CD Wood(PETRONAS Research), Y Tan, KA Kozelski(CSIRO) This paper describes work carried out to develop, test and field-demonstrate a polymer resin composite overwrap system designed for repair and/or corrosion protection of pipelines and risers in the oil and gas industry. The system has been successfully field tested on three risers at two areas of an offshore platform.</p>	<p>T5-5 TEMPERATURE DEPENDENT ELECTRICAL PROPERTIES OF MOLYBDENUM-DOPED VANADIUM COMPOSITE THIN FILMS ON METALLIC PLATES FOR FUEL CELL APPLICATIONS HM Jung, JH Noh, HS Kim, SK Um(Hanyang Univ.) An experimental feasibility study of undoped and Mo-doped vanadium oxide composite thin films on metallic bipolar plates as an efficient self-heating source for fuel cell vehicles at sub-zero ambient temperatures was conducted by carefully modulating the electrical resistance of the negative temperature coefficient material.</p>	<p>T6-5 NOVEL PROCESSING FOR DEPOSITION OF CU NANOPARTICLES ONTO CARBON - APPLICATION TO ADAPTATIVE CU-C COMPOSITES C Vincent, J Sivain(LCMC) A new process, simple and low cost, for deposition of metallic particles onto various substrates is described. Here, the example of copper nanoparticles coating a substrate is illustrated. An increase of thermal properties of Cu-diamond composites compared to powder metallurgy processed composites is shown.</p>
10:55	<p>T1-6 FABRICATION AND CHARACTERIZATION OF EXFOLIATED GRAPHITE NANOPLATELET-MULTIWALLED CARBON NANOTUBE HYBRID FREESTANDING SHEETS SH Huang, YB Park(Ulsan National Inst. of Science and Technology) In this work, xGNPs and MWNTs stabilized by SLS and Triton X-100 were successfully prepared to paper-like structure, and their mechanical and electrical properties were studied. Complex interactive mechanism of MWNT's length and aspect ratio of xGNPs affect the electro-mechanical properties of hybrid sheets, hence they show unique properties.</p>	<p>T2-6 STRUCTURAL POWER COMPOSITES AS ENERGY STORAGE DEVICES A Javid, A Bismarck, ES Greenhalgh, KCC Ho, A Kucernak, MSP Shaffer, N Shirshoval(Imperial College London) A novel concept of structural supercapacitors based on CF reinforced composites has been introduced that can simultaneously act as a structural component and an electrical energy storing device. Supercapacitors consisting of woven carbon fibre mat based electrodes; filter paper insulator and PEDGGE/DGEBA based polymer electrolyte were fabricated.</p>	<p>T3-6 BIOPLASTICS AND GREEN COMPOSITES FROM RENEWABLE RESOURCES: WHERE WE ARE AND FUTURE DIRECTIONS! M Misra, V Nagarajan, J Reddy, AK Mohanty(Univ. of Guelph) This study highlights the current status, opportunities and challenges of bioplastics, natural fibre composites and all green composites in structural and semi-structural applications.</p>	<p>T4-6 IMPROVED STRESS PREDICTION OF LAMINATED COMPOSITE PLATES USING LW THEORY Jun-sik Kim(Kumoh National Inst. of Technology), JW Han, MH Cho(Seoul National Univ.) A simple yet accurate higher order CD plate theory is developed to predict the thermo-elastic behavior of laminated composite plates. The theory is built upon the foundation of partial mixed variational theorem, where the stress comes from the fifth-order zigzag model, while the displacement does from the classical LW model.</p>	<p>T5-6 CHARACTERIZATION OF MULTISTACK CIGS, (CuGA/IN/SE...) ON MO COATED SLG BY USING THE IN-LINE SPUTTERING SYSTEM JS Park, SW Park, WJ Jung, JU Seo, WN Kim, CW Jeon(Yeongnam Univ.) The Cu(In,Ga)Se₂ polycrystalline thin films were prepared by using a novel precursor. The Se inserted precursors were annealed in a furnace system without supplying Se source. In order to overcome the several problems found in a selenized Cu(In,Ga)Se₂ layer such as voids formation, rough surface and uncontrollability of MoSe₂ thickness.</p>	<p>T6-6 IN SITU TiBw/Ti COMPOSITES WITH A NOVEL CUBIC CONTINUOUS NETWORK REINFORCEMENT ARCHITECTURE LJ Huang, L Geng(Harbin Inst. of Technology), HX Peng(Bristol Univ.) TiB whiskers are in situ synthesized around the as-received Ti particles (powders) and subsequently formed into a TiBw network microstructure. The experimental results show that the as-sintered TiBw/Ti composites with a network microstructure exhibit a superior combination of strength and ductility (71% increment of strength allied with 11.5% of elongation).</p>
11:15	Break					

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08:30						
09:00	Break					
09:15	<p>T7 STRUCTURAL HEALTH MONITORING AND MANAGEMENT Chairs: N Takeda/ H Murayama</p> <p>T7-1 DEBONDING DETECTION FOR CFRP STRUCTURES USING FIBER OPTIC DOPPLER SENSORS FC Li, G Meng, JP Jing(Shanghai Jiao Tong University), K Kageyama, H Murayama(The Univ. of Tokyo) Specimens with lap splice joint are prepared for the purpose of guided-wave-based debonding detection. Fiber optic Doppler (FOD) sensors are used to acquire guided ultrasonic waves propagating in bonded CFRP assemblies.</p>	<p>T8 FIBRES, MATRICES AND INTERFACES Chairs: JJ Sha/ G Holmes</p> <p>T8-1 MECHANICAL CHARACTERISATION OF GLASS FIBRES RECYCLED FROM THERMOSETTING COMPOSITES USING WATER-BASED SOLVOLYSIS PROCESS C. Xu, Q. Ghisla, K. Evaristo, J. of Exeter), G. Olivoux(Institut Catholique d'Arts et de Métiers) This study reports on the recyclability and reuse of reinforcements recovered from glass fibres reinforced polyester composites through solvolysis process only using subcritical water (hydrolysis). The relationship between the hydrolysis conditions (processing temperatures and times) and the mechanical performance of the fibres recovered was investigated.</p>	<p>T9 IMPACT AND DYNAMIC RESPONSE Chairs: IG Kim/ K Ogi</p> <p>T9-1 THE EFFECT OF NUMBER OF FABRIC ON CFRP-FABRIC HYBRID COMPOSITE IMPACT SHIELD PERFORMANCE JB Moon, GS Son, YR Park, CG Kim(KAIST) Hybrid sandwich composite shield with unrestrained boundary fabric was studied to improve the energy absorbing rate by using new additional energy absorbing mechanism namely the fabric pull-out. By using the PMMA as the rear plate, the fabric pull-out mechanism was realized and the energy absorbing was increased due to this...</p>	<p>T10 INTELLIGENT TEXTILES AND COMPOSITES (ICIT 2011) Chairs: TJ Kang/ YS Seo</p> <p>T10-1 DEVELOPMENT OF A HYBRID ELECTROMAGNETIC SHIELDING FABRIC V. Salarova, M.Jiri(Technical Univ. of Liberec) Wet fabrics with the same structure, different portion of conductive phase in hybrid yarn and different placement of the hybrid yarn were studied. Percolation threshold, dependence of resistivity and total shielding effectiveness on the conductive component amount and dependence of total shielding effectiveness on volume resistivity was examined.</p>	<p>T11 PROCESSING AND MANUFACTURING TECHNOLOGIES Chairs: M Kwak/ A George</p> <p>T11-1 EFFECT OF POLYAMIDE VEIL LAYER ON STRENGTH PROPERTY OF VARTM CFRP Y Yoshida, Y Kogo(Tokyo Univ. of Science) Y Hirano, Y Iwahori(Japan Aerospace Exploration Agency) In this study, an effect of manufacturing process is examined to improve CAI strength of Vartm CFRP laminate. An effect of adding polyamide veil in between CNF's and other processing factors on CAI strength are examined by performing F statistical test.</p>	<p>T12 DAMAGE AND FRACTURE Chairs: S Tsampas/ WS Ji</p> <p>T12-1 DAMAGE RESISTANCE OF GRAPHITE/EPOXY LAMINATES WITH A FASTENER SUBJECTED TO ARTIFICIAL LIGHTNING Y Hirano, Y Iwahori(Japan Aerospace Exploration Agency), C Kourings(Delft Univ. of Technology) The investigation presented here focuses on understanding the effect of the fit of the fastener on the damage caused by an artificial lightning strike. The artificial lightning test is performed to brined fastener installed specimen, the damaged specimens have been examined by visual, non-destructive and micrographic inspection.</p>
09:35	<p>T7-2 STRAIN-INSENSITIVE FIBER BRAGG GRATING ULTRASONIC SENSING SYSTEM USING FIBER RING LASER H Tsuda(AIST) A vibration sensing system incorporating an FBG sensor and a fiber ring laser was constructed. The fiber ring laser based at the Bragg wavelength of the FBG sensor and the system proved to be capable of detecting vibration regardless of strain applied to the FBG sensor.</p>	<p>T8-2 DEPENDENCE OF AMINO-FUNCTIONALIZATION ON INTERFACIAL ADHESION STRENGTH IN EPOXY/AL LAMINATED COMPOSITES QY Peng, XD He, YB Li, RG Wang, L Mei, C Wang(Harbin Inst. of Technology) The interfacial bonding between epoxy and aluminum tends to be weak in laminated composites. The PAMAM layer was used to amino-functionalize the interface to improve the interfacial strength. The results show the adhesion strength of epoxy/Al interface is increased by 50 % after PAMAM layer introduced into the NaOH-treated interface.</p>	<p>T9-2 HIGH-VELOCITY IMPACT DAMAGE BEHAVIOR OF GRAPHITE-EPOXY COMPOSITE LAMINATES YS Woo(Chungbuk National Univ.), SC Ha, HJ Shin, IG Kim(Chungnam National Univ.) In this study, tests and analysis were performed to investigate the high-velocity impact damage behavior of laminated composites. The experimentally measured ballistic and residual velocity was compared to LS-DYNA analysis results. The variation of impact velocity and impact force and the damage behavior were discussed.</p>	<p>T10-2 DEVELOPING BASE TECHNOLOGIES FOR TORBORROW'S SMART TEXTILES R Hufnagel, S Lukas, H Dirk, R Felix, G Sabayaschi(Empa) To provide textile modules for smart clothes, we developed low-pressure plasma metallization processes to produce electrically conductive filaments. An insulating coating based on polymeric materials has been applied using either dip coating or overjacketing extrusion. In addition, we melt-spun bicomponent polymer optical fibers that can be applied as near-to-body sensors.</p>	<p>T11-2 CURING OF COMPOSITE MATERIALS USING THE RECENTLY DEVELOPED HEPAISTOS MICROWAVE MS Kwak(TWI Ltd Advanced Materials and Processes Group), P Robinson, A Bismarck(Imperial College London), R Wise(TWI Ltd) Carbon-fibre reinforced epoxy laminates were cured using fixed frequency microwave technology. It has been demonstrated that by following the correct procedure, microwave processed samples can be at least equal in terms of mechanical performance, with a reduction of more than 50% in processing time.</p>	<p>T12-2 3D SIMULATION OF FACE/CORE DEBOND PROPAGATION IN SANDWICH COMPOSITES EXPOSED TO CYCLIC LOADING R Moslemian, C Berggreen(Technical Univ. of Denmark), A Karlsson(Univ. of Delaware) In this study a numerical routine to simulate fatigue debond propagation in sandwich panels is developed and implemented in the commercial finite element program ANSYS. To accelerate the crack growth simulation, a cycle jump technique is utilized and implemented in the finite element routine.</p>
09:55	<p>T7-3 MONITORING CRACK GROWTH IN A DCB TEST USING A SURFACE-BONDED CHIRPED FBG SENSOR AJ Anderson, SJ Ogin, AD Crocombe(Univ. of Surrey), MRL Gower(National Physical Lab.) Delamination growth within GFRP DCB specimens was monitored using a surface-mounted chirped fibre Bragg grating (CFBG) sensor. A distinct perturbation in the reflected spectra identified the location of the delamination front. The delamination length was measured using the CFBG technique to within 4 mm over the 60 mm sensor length.</p>	<p>T8-3 TENSILE FRACTURE CHARACTERISTICS OF HYBRID FIBER COMPOSITE USING SINGLE FIBER FRAGMENTATION TEST JJ Jia, YZ Gu, M Li, H An, ZG Zhang(Beihang Univ.) The hybrid effect of carbon and glass monofiber hybrid composite systems with six kinds of hybrid ratios was demonstrated by the single fiber fragmentation test. The fiber fragment numbers show obvious differences between hybrid fiber and mono-one.</p>	<p>T9-3 MESO-SCALE MODELLING OF SHOCK WAVE PROPAGATION IN A CELLULAR GLASS PARTICLE REINFORCED THERMOPLASTIC COMPOSITE KA Brown, R Brooks, O Awoyemi(Univ. of Nottingham) The aim of this study is to develop a multi-scale modeling approach that accurately simulates the real microstructure, and behaviour of a novel cellular particle reinforced thermoplastic composite under shock loading. Numerical simulations of a two-dimensional (2D) meso-scale statistical volume element (SVE) model are investigated.</p>	<p>T10-3 GRAPHENE-COATED PYROLYTIC CARBON FROM TEXTILES J Harlin, M Zhang(The Univ. of Georgia) Pyrolytic carbon structures with a graphene coating are formed from textile fabrics as the starting materials. The starting material, textile fabrics, are immersed into a dispersion of graphene sheets and PYTSA in water.</p>	<p>T11-3 LIMITATIONS OF FIBRE PLACEMENT TECHNIQUES FOR VARIABLE ANGLE TOW COMPOSITES AND THEIR PROCESS-INDUCED DEFECTS BC Kim, K Harza, P Weaver, K Potter(Univ. of Bristol) In this paper, various limitations of the current fibre placement techniques were broadly investigated as well as their process-induced defects. In light of these defects, potential future development of the fibre placement techniques was discussed.</p>	<p>T12-3 PROBABILITY-BASED ANALYSIS FOR MODELING FAILURE MODE INTERACTION PROGRESSIVE DAMAGE IN LAMINATED COMPOSITE STRUCTURES WITH AN INITIAL DELAMINATION WS Ji, AM Waas(Univ. of Michigan), R Raveendra(Comet Technology Corporation) The present progressive failure analysis (PFA) is targeted at the development of a numerical model for predicting an initial failure mode and consequent damage growth interacting with other failure mechanisms at multiple length scales in the composite structure.</p>
10:15	<p>T7-4 DEBONDING DETECTION IN CF/EP SANDWICH STRUCTURES USING ACTIVE SENSOR NETWORK S Mustapha, D Wang, LYe(The Univ. of Sydney) The aim of this study is to evaluate debonding in sandwich CF/EP composite structures using guided waves and detect debonding using an inverse algorithm based guided wave signals activated and captured by surface-mounted PZT elements. Studies were conducted where debonding of different sizes were introduced at different locations.</p>	<p>T8-4 CHARACTERIZATION OF FIBER/MATRIX BONDING STRENGTH DURING THE PYROLYSIS OF CFRP TO C/C COMPOSITES JJ Sha(Dalian Univ. of Technology), J Hausher, W Krenkel(Univ. of Bayreuth), A Kanschak(Fraunhofer Inst.) The fiber/matrix bonding strength during the pyrolysis of CFRP to C/C composite was measured by single fiber push-out test. The evolution of fiber/matrix bonding strength during the pyrolysis was caused by the change of matrix state and interaction of matrix and interface between fiber and matrix.</p>	<p>T9-4 HIGH-VELOCITY IMPACT DAMAGE PROGRESS IN FRP LAMINATES E Ojig, K Ogi(Ehime Univ.), A Yoshimura(Japan Aerospace Exploration Agency), T Okabe(Tohoku Univ.) The primary purpose of the present study is to characterize the high-velocity impact damage progress in FRP laminates. The secondary aim is to investigate the effect of mechanical properties on high-velocity impact damage progress. First, the surface and internal damages of CFRP plates impacted at a velocity of 430 m/s.</p>	<p>T10-4 FAST TESTING OF HYDROSTATIC RESISTANCE OF SEMI-PERMEABLE LAMINATED FABRICS L Heg, MB Baczek, J Lectychoval(Technical Univ. of Liberec) Resistance against water leakage under increasing pressure is an important parameter of protective outdoor semi-permeable textile laminates. Standard testing under slowly increasing pressure given by ISO 811 is costly due to long testing time.</p>	<p>T11-4 VOID FORMATION IN AN ANISOTROPIC WOVEN FIBRE DURING RESIN TRANSFER MOLDING D Seto, R Matsuzaki, A Todoroki, Y Mizutani(Tokyo Inst. of Technology) Void formation is one of significant defect during process of Resin transfer molding (RTM) and it is well known that the amount of void formed depends on impregnation velocity. In this work, influence of direction of impregnation of anisotropic fiber is determined by an analysis model and experiments.</p>	<p>T12-4 2D NUMERICAL INVESTIGATION OF PRE-TENSION ON LOW VELOCITY IMPACT DAMAGE OF SANDWICH STRUCTURES AD Zammis, S Feli, A Onifri(RMIT Univ.) A 2D numerical investigation was conducted into the effects of a pre-tension load on the impact response of carbon-epoxy laminates and sandwich laminates with a PMI foam core. Damage was found to be more extensive in the top skin for the 5000 micro-strain pre-load case, but core indentation depth dropped.</p>
10:35	<p>T7-5 ESTIMATION OF PEEL STRESS AT THE OVERLAP END OF SINGLE-LAP JOINT BY USING EMBEDDED FBG H Murayama, K Kageyama, K Uzawa, I Ohsawa, K Ohara(The Univ. of Tokyo), H Igawa(Aerospace Exploration Agency) We embedded the long-length FBG into the adhesion layer of a single-lap joint. We found the reflected spectrums around the overlap end were split, because there were large peel stresses which could cause the birefringence effect. We propose the method to identify the peel stress by analyzing the reflected spectrums.</p>	<p>T8-5 WETTING BEHAVIORS IN RESIN-FIBER SYSTEM T Setoguchi, Y Fukuhara, I Ueno, S Ogihara(Tokyo Univ. of Science), K Watanabe(Mitsubishi Rayon company limited) We focus on the wetting process in the glass fiber-resin system. We evaluate the effects of the gap distance between fibers on the resin spreading along two fibers. We illustrate the change in wetting behaviors by comparing the flow rate at the resin tip and in the resin bulk.</p>	<p>T9-5 DAMAGE SIMULATION OF CFRP LAMINATES UNDER HIGH VELOCITY PROJECTILE IMPACT A Yoshimura, T Ogasawara(Japan Aerospace Exploration Agency), T Okabe(Tohoku Univ.), M Yamada, Y Tanabe(Nagoya Univ.) An analytical model which simulates the damage process of CFRP under high velocity impact is proposed. The model is based on FEM, in which three types of damages are introduced: fiber failures, ply cracks and delaminations. Simulation results demonstrate that the model well predicts the damage process in the CFRP.</p>	<p>T10-5 ENGINEERING TRANSPORT PROPERTIES OF FIBROUS MATERIALS J Fan(Hong Kong Polytechnic Univ.) Fibrous materials have wide applications in many different fields. In most of these applications, it is essential to optimize the transport properties. This paper presents the mechanisms and their interactions of different transport phenomena in fibrous media. On this basis, paper discusses the optimization of transport properties for different applications.</p>	<p>T11-5 COMPRESSIBILITY MODELING AND VALIDATION FOR COUPLED FLOW SIMULATION AR George(Swerea SICOMP), A Hahlbom, M Elghareeb, K Drechsler(Univ. of Stuttgart), D Heider(Univ. of Delaware) A variety of reinforcement materials are characterized for their wet compressibility for the purpose of enhanced flow simulation. This data is then correlated to the thickness changes during vacuum infusion. The difference from wetting fluid choice is investigated, as well as the mechanisms behind the observed non-Darçin pressure gradients.</p>	<p>T12-5 TRIAXIAL FAILURE CRITERIA FOR POLYMER COMPOSITES-PART (A) OF WWFE-II: COMPARISON BETWEEN THEORIES A Kaddour, M Hinton(QinetQ) This paper is concerned with providing a preliminary indication of the outcome of Part A of the 2nd World-Wide Failure Exercise (WWFE-II). The WWFE-II is an international activity aimed at assessing the maturity of established failure criteria capable of predicting the strength and deformation of materials under three dimensional (3D)...</p>
10:55	<p>T7-6 EMBEDDING TECHNIQUES OF FBG SENSORS IN ADDITIVE LAYERS OF COMPOSITE STRUCTURES AND APPLICATIONS SW Kim, SJ Yoo, EH Kim, J Lee(KAIST), JB Kwon, DJ Yoon(KRISIS) In this study, three embedding techniques were suggested to prevent split problems when FBG sensors were embedded into adhesive layers. The signal characteristics of the reflected spectra of FBG sensors for each technique were quantitatively investigated. Among the suggested methods, PAC technique showed significant capacity for the embedding of sensors.</p>	<p>T8-6 INTERFACE DESIGN OF CORD-RUBBER COMPOSITES ZM Xie, HW Du, YY Weng, XL Li(Harbin Inst. of Technology) Based upon the imperfect interface and the concept of a neutral inclusion, the interfacial parameters for cord-rubber composites are studied in the anti-plane shear and plane deformations. It is found that the interface design for two-strand cord is available under an assumption of the neutral inclusion.</p>	<p>T9-6 FACESHEET EFFECTS ON THE LOW VELOCITY IMPACT DAMAGES IN TITANIUM/GFRP HYBRID LAMINATES H Nakatani(Tokyo Univ. of Science), T Kosaka(Kochi Univ. of Technology), K Osaka, Y Sawada(Osaka City Univ.) Effect of titanium facesheets on low-velocity impact damages in T/GFRP laminates has been evaluated by experimental and numerical ways. Bottom titanium layer has been found to dominate impact behaviour, and to play a major role in preventing damages in the GFRP core by its stiffness and energy absorption capability.</p>	<p>T10-6 NON-ISOTHERMAL CRYSTALLIZATION BEHAVIORS OF HDPE/MWCNT NANOCOMPOSITES JH Kim, YP Sep, YS Seo(Seoul National Univ.), Soon Man Ghong(KIST) Thermal properties and nonisothermal crystallization kinetics of polyolefin nanocomposites (high density polyethylene/multiwalled carbon nanotubes) were characterized by differential scanning calorimetry and thermogravimetric analyzer. In situ metalocence polymerization was used to prepare nanocomposites of multiwalled carbon nanotubes (MWCNT) and high density polyethylene (HDPE). This polymerization method consists of attaching a metalocence.</p>	<p>T11-6 CONTINUOUS GROWTH OF VERTICALLY ALIGNED CARBON NANOTUBES R Guzman De Villoria, SA Steiner, BL Wardle (Massachusetts Inst. of Technology), AJ Hart (Univ. of Michigan) A controlled process to synthesize aligned carbon nanotubes by Chemical Vapour Deposition in a continuous manner is presented. Uniform growth is achieved using different substrates including alumina fibers in bundle form and silicon wafers.</p>	<p>T12-6 STUDY OF COMPRESSIVE FAILURE IN MULTIDIRECTIONAL FIBRE-REINFORCED COMPOSITES SA Tsampas, ES Greenhalgh, J Ankersen(Imperial College London), PT Curtis(DSTL) Compressive failure of multidirectional fibre-reinforced composites was investigated. Cross-ply and multidirectional compact compression (CC) specimens were tested to deduce the failure mechanisms that occur during compressive loading. Experimental results and subsequent Fractographic analysis revealed that the layup significantly influenced the performance of MD fibre-reinforced composites under compression.</p>
11:15	Break					

	Halla A	Halla B	Samda A	Samda B	201A	202A
11:30	<p>T13 NANOCOMPOSITES Chairs: JY Kim</p> <p>T13-1 EFFECT OF SENSITIZING AND ACTIVATING PRE-TREATMENT ON THE ELECTROLESS PLATED MWCNTS Xa.Li, YX Duan, Yi Xue, LL Sun, YF Luo(Beihang Univ.) SnCl₄ was used as sensitizer in pretreatment process, and the effect of content of SnCl₄ on the properties of the electroless plated MWCNTs was discussed. The results show that the optimal SnCl₂/PdCl₂ composition is 0.22mol/L of SnCl₄ when the concentration of PdCl₂ is determined as 0.006mol/L.</p>	<p>T14 SYMPOSIUM ON 'MULTIFUNCTIONAL COMPOSITE MATERIALS FOR ENERGY APPLICATIONS' Chairs: K Maute/ M Shtein</p> <p>T14-1 IMPACT OF MECHANICAL LOADING ON THE ELECTROCHEMICAL BEHAVIOR OF CARBON FIBERS FOR USE IN ENERGY STORAGE COMPOSITE MATERIAL E Jacques, MH Kjel, D Zenkert, G Lindbergh, M Behm(KTH Royal Inst. of Technology) This paper focuses on the impact of mechanical loading on the electrochemical behavior of carbon fibers used as structural electrodes. The strains applied to the fibers did not affect their specific capacity. Swelling of the fiber length of 0.33% for lithiations and shrinkage of about 0.30% for delithiations were measured.</p>	<p>T15 GREEN COMPOSITES Chairs: JA Garcia-Manrique/ J Pandey</p> <p>T15-1 POLYANILINE/CELLULOSE CONDUCTIVE COMPOSITE BY SELF-ASSEMBLY OF SILANE COUPLING AGENT HJ Lee, BH Lee, TJ Chung, HJ Kwon, HJ Kim(Seoul National Univ.) Nanocomposite of polyaniline and bacterial cellulose was synthesized by self-assembly of silane coupling agent. The synthesized PANI/SA-BC composite had a good electrical conductivity around 1.52 S/cm achieved by a dense packing of PANI on an arrayed layer of a silane coupling agent on BC surface.</p>	<p>T16 NANO-PARTICLE REINFORCED POLYMER COMPOSITES FOR ENGINEERING APPLICATIONS Chairs: K Friedrich/ L Chang</p> <p>T16-1 FATIGUE BEHAVIOR OF POLYMER NANOCOMPOSITES V.Altstaedt, C Goetz, FW Fabris(Univ. of Bayreuth) In this study we investigate the influence of nanoclays on a polyamide matrix in terms of fatigue properties. The results of the fatigue crack growth testing are correlated to the nanocomposites morphology, which was investigated using transmission electron microscopy.</p>	<p>T17 DURABILITY AND AGING Chairs: J Cinquin/ B Sun</p> <p>T17-1 ATOMIC OXYGEN EROSION RESISTANCE OF PHOSPHORUS-CONTAINING POLYIMIDES DERIVED FROM BIS-(4-AMINOPHENOXYL)PHENOXYL PHOSPHINE OXIDE AND AROMATIC DIAMHYDRIDES E Xia, K Wang, M Zhan(Key Laboratory of Aerospace Advanced Materials and Performance) All films showed 5% decomposition temperature range from 482 to 508 °C, and the char yields range from 49 to 66 wt%. The mass loss of polyimide films 3a or 3e reduced to approximately 20% that of Kapton HN film after AO exposure 20 h.</p>	<p>T18 METAL MATRIX COMPOSITES Chairs: D Zhang</p> <p>T18-1 CARBON NANOTUBE REINFORCED ALUMINUM MATRIX COMPOSITES BY NOVEL POWDER METALLURGICAL PROCESS A Kawasaki, H Kurita(Tohoku Univ.), HS Kwon(KITECH) Aluminum/carbon nanotube (CNT) composites with nanoscale dispersion and regular orientation of CNTs have been fabricated by a combination of spark plasma sintering and hot-extrusion processes. The CNTs were well dispersed onto Al particles by a nanoscale dispersion method. The highly densified CNT composites were prepared by spark plasma sintering...</p>
11:50	<p>T13-2 IMPROVEMENT IN MECHANICAL PROPERTIES OF MODIFIED GRAPHENE/EPOXY NANOCOMPOSITES Y Wang, Y Zhao, H Zheng(Beijing Univ. of Aeronautics and Astronautics), WP Liu(Shanghai aircraft manufacturing co.,Ltd.) In our recent work, we prepared a toluene-2,4-diisocyanate (TDI) functionalized graphene by covalent chemical modification of graphene oxide (GO) and tested impact strength of TDI modified graphene (TMG)/epoxy and GO/epoxy nanocomposites. The results illustrate that adding either GO or TMG can toughen epoxy in impact strength at low content.</p>	<p>T14-2 MULTIFUNCTIONAL STRUCTURAL CAPACITORS CONSISTING OF BARIUM TITANATE AND BARIUM STRONTIUM TITANATE COATED CARBON FIBERS Y Lin, Z Zhi, HA Sodano(Univ. of Florida), J Romero(Arizona State Univ.) This paper introduces a new method to significantly increase the energy storage capacity of the active structural fiber using barium strontium titanate (BaSr-xTiO₃). The results demonstrate a novel process which can reduce the fiber size while maintaining the same energy density as that obtained with the 28 times larger fiber.</p>	<p>T15-2 OPTIMIZATION OF MECHANICAL PROPERTIES OF BASALT WOVEN/APA-6 COMPOSITE PARTS BY MEANS OF VELOCITY CONTROL R Hoto, J Andres, L Gascon, JA Garcia-manrique(Universitat Politcnica de Valencia), B Cabillic(Ecole Centrale Nantes) This work has shown the latest tendencies on the manufacturing of composites, namely GreenComposites. In this study, they are made of more sustainable basalt fabrics and thermoplastic matrices. Numerical approach by FEM methods also demonstrate its validity to determine the effective injection strategy including the position of vents and gates.</p>	<p>T16-2 DEVELOP WEAR-RESISTANT POLYMERIC COMPOSITES BY USING NANOPARTICLES L Chang(The Univ. of Sydney), K. Friedrich(Technical University of Kaiserslautern) The wear mechanisms of the hybrid polymer nanocomposites filled with both nanoparticles and conventional micro-sized tribo-fillers were investigated. It was found that the load carrying capacity of the SFRPs is mainly determined by the properties of fibers. However, the tribological performance of SFRPs can be significantly improved.</p>	<p>T17-2 EFFECTS OF CHEMICAL ENVIRONMENT ON DURABILITY OF GLASS FIBER/EPOXY COMPOSITES B Sun, Yan Li(Tongji Univ.) In this paper, effects of chemical environment on the durability of glass fiber reinforced epoxy composites were investigated. Microstructures of glass fiber reinforced epoxy composites and moisture absorption were studied. Interlaminar shear test and bending test were employed to study the effects.</p>	<p>T18-2 EFFECTS OF HOT EXTRUSION AND HEAT TREATMENT ON THE MICROSTRUCTURE AND TENSILE PROPERTIES OF TiBw/Ti6Al4V COMPOSITES WITH A NOVEL NETWORK MICROSTRUCTURE B Wang, LJ Huang, HL Wang, L Geng(Harbin Inst. of Technology) The equiaxed network microstructure has been deformed to a column network due to the extrusion deformation. The tensile test results show that not only the strength but also the ductility is remarkably improved by extrusion deformation. Moreover, the tensile properties can be further improved by the subsequent heat treatment.</p>
12:10	<p>T13-3 PREPARATION AND THERMOELECTRIC PROPERTY OF LAYERED NANO-COMPOSITE OXIDE JY Kim, YS Lim, SM Choi, WS Seo(KICET) Thermoelectric oxide, Na_{0.7}CoO₂, was exfoliated into submicron-sized nano-plate of Na_{0.7}CoO₂ by soft chemical method. Thermoelectric property of nano-composite of sodium cobalt oxide by restacking of the exfoliated nano-layer with calcium were evaluated.</p>	<p>T14-3 METAL-CARBON AND CARBON-CARBON NANOCOMPOSITES FOR LITHIUM-ION BATTERIES AND STRUCTURAL APPLICATIONS M Benson, W Gu, B Hertzberg, K Evanoff, I Kovalenko, A Magasin-ski, G Yushin(Georgia Tech) Carbon-Metal and Carbon-Carbon Nanocomposites for Li-ion Batteries and Structural Applications.</p>	<p>T15-3 MECHANICAL PROPERTIES OF PAPERCRETE CONTAINING WASTE PAPER HJ Yun, HS Jung, CS Choi(Hanyang Univ.) Papercrete is a new composite material using waste paper as a partial replacement of portland cement. This study aimed to evaluate the mechanical properties such as compressive and splitting tensile strength of papercrete containing waste papers as a partial replacement of portland cement.</p>	<p>T16-3 EFFECT OF INCORPORATING NANOPARTICLES IN THERMOPLASTIC FIBER-REINFORCED COMPOSITES ON THE ELECTRICAL CONDUCTIVITY K Hildebrandt, P Mitschang(Institut für Verbundwerkstoffe GmbH) The paper evaluates the influence of different nanofillers on the electrical conductivity of thermoplastic endless fiber-reinforced composites (FRPC). The incorporation of carbon black and carbon nanotubes lead to a significant increase in electrical conductivity of the polymer films and the FRPCs. The conductivity is dependent on various factors.</p>	<p>T17-3 DURABILITY EVALUATION OF CARBON/BMI COMPOSITES AFTER THERMAL AGING D Leveque(ONERA), H Katoh(JAXA), J Cinquin(EADS IW), K Hasegawa(Mitsubishi Heavy Industries) This article concerns the durability evaluation of two carbon/BMI composites after thermal aging (up to 200°C and 10,000 hours). The work program includes mechanical characterization, physicochemical degradation assessment and damage observations on different laminate lay-ups. Some relationships between damage due to aging and respective residual mechanical properties have been established.</p>	<p>T18-3 FABRICATION BY TAPE-CASTING AND HOT-PRESSING OF COPPER DIAMOND COMPOSITE THIN FILMS T Guillemet, J Silvain, J Heintz(Inst. of Condensed Matter Chemistry of Bordeaux), N Chandra, YF Lu(Univ. of Nebraska-Lincoln) Diamond dispersed copper matrix composite films were fabricated by associating tape casting and hot pressing. An innovative process of Cu particles deposition onto diamonds was used to get dense Cu₂D composite materials. Very interesting thermal conductivity and thermal expansion coefficient are obtained compared to pure copper.</p>
12:30	Lunch					
13:30	<p>P7: MULTIFUNCTIONAL COMPOSITES FOR AUTONOMIC AND ADAPTIVE STRUCTURES: CRITICAL ISSUES AND OPPORTUNITIES Les Lee(Air Force Office of Scientific Research)</p>	<p>(Chair: H. T. Hahn)</p>	<p>P8: MAIN DYNAMICS OF THE COMPOSITES INDUSTRY Frederique Mutel(JEC Group)</p>	<p>(Chair: T Massard)</p>		
14:00	Break					

	202B	203	301	302	401	402A
11:30	<p>T19 STRUCTURAL HEALTH MONITORING AND MANAGEMENT Chairs: J Epaarachchi</p> <p>T19-1 IDENTIFICATION OF DISTORTIONS OF FBG SPECTRUM USING FIXED FBG FILTERS G Kahandawa, JA Epaarachchi, H Wang(Univ. of Southern Queensland) This paper details the research work performed to identify distortions of spectra of an embedded FBG sensors using a fixed FBG sensor. The developed method can be used to measure FBG spectra in time domain and to transfer directly to a post processing algorithms.</p>	<p>T20 FIBRES, MATRICES AND INTERFACES Chairs: L Ling/ HJ Jeon</p> <p>T20-1 PREPARATION AND CHARACTERIZATION OF CARBON NANOTUBE/CARBON FIBER MULTI-SCALE REINFORCEMENT C Wang, XD He, YB Li, QY Peng, L Mei, RG Wang(Harbin Inst. of Technology), LY Tong(The Univ. of Sydney) In this study, a chemical preparation method was introduced to graft the carbon nanotubes onto the carbon fibers, and then the interfacial enhancing mechanisms between carbon fiber and matrix were discussed. Lastly, a simple pullout model of this multi-scale reinforcement from matrix based on the discussed mechanisms was presented to...</p>	<p>T21 IMPACT AND DYNAMIC RESPONSE Chairs: E Gonzalez/ HL Li</p> <p>T21-1 DAMPING CAPACITY OF FLY ASH-BASED GEOPOLYMER Z Pan, K Gong, KN Feng, WH Duan, F Collins(Monash Univ.), JG Sanjayan(Swinburne Univ. of Technology) The feasibility of geopolymer in the manufacturing of concrete railway sleepers was investigated with respects to its vibration damping. Geopolymer showed a damping capacity comparable to Portland cement counterpart. The damping mechanisms are further discussed based on the thermogravimetric analysis and mercury intrusion porosimetry results.</p>	<p>T22 INTELLIGENT TEXTILES AND COMPOSITES (ICIT 2011) Chairs: TJ Kang/ V Safarova</p> <p>T22-1 ANALYSIS OF THE MECHANICAL BEHAVIOUR OF MAGNETO SHAPE MEMORY POLYMERS UNDER MAGNETIC FIELD HD Park, WR Yu, CH Ahn(Seoul National Univ.), P Harrison(Univ. of Glasgow), ZI Guo(Newcastle Univ.) This study was aimed to model the mechanical behavior of a new SMPU composite (magneto SMPU, ma-SMPU), which were prepared by introducing aligned carbonyl iron particles (CIP) under magnetic field. With ma-SMPU, thermomechanical cyclic test and creep test under magnetic field were simulated and the results were analysed.</p>	<p>T23 PROCESSING AND MANUFACTURING TECHNOLOGIES Chairs: T Lili</p> <p>T23-1 A 1D COUPLED CURING AND VISCO-MECHANICAL VOID GROWTH MODEL OF THICK THERMOSETTING COMPOSITE LAMINATES MW Nielsen, JH Hattel, TL Andersen, K Branner, PH Nielsen(Technical Univ. of Denmark) It is generally known that voids have a detrimental effect on the strength and fatigue life of composite laminate structures. A 1D coupled curing and visco-mechanical void growth model for thick thermosetting composite laminates is presented in a finite volume formulation.</p>	<p>T24 DAMAGE AND FRACTURE Chairs: SW Jeon</p> <p>T24-1 FIBER COMPRESSIVE FAILURE CRITERION AS SHEAR BAND MODE BIFURCATION CONDITION T Nadabe, N Takeda(The Univ. of Tokyo) This study investigates fiber compressive failure criterion as shear band mode bifurcation condition. From the shear band mode bifurcation condition, the characteristics of compressive strength are well reproduced. The present failure criterion is implemented in progressive failure analysis and bearing failure in CFRP bolted joints is analyzed.</p>
11:50	<p>T19-2 TEST OF SINGLE REFLECTIVE GRATING BASED FIBER OPTIC SENSOR DESIGN FOR MEASUREMENT OF TILT ANGLE YG Lee, BW Jang, YY Kim, DH Kim, CG Kim(KAIST) This paper describes the prototype design of the fiber optic tiltmeter which is developed to obtain a stable reflected signal when the tilt angle dependent sine function load is applied. Variations of the reflected signals from tilt angle of 0 to -90 was continuously measured and recorded.</p>	<p>T20-2 MECHANICAL PROPERTIES AND STRAIN INDUCED CRYSTALLIZATION OF NBR COMPOSITES WITH DIFFERENT SURFACE TREATMENTS AND CONTENT OF CARBON NANO-TUBE JH Sung, SR Ryu, DJ Lee(Yeungnam Univ.) The mechanical properties and strain induced crystallization (SIC) of elastomeric composites are investigated as functions of CNT content, atmospheric-pressure flame plasma (APFP) treatment, acid treatment, and refluxing time. It is found that mechanical properties have a linear relationship with the SIC depending on the CNT content and treatment.</p>	<p>T21-2 EFFECTS OF PLY CLUSTERING IN LAMINATED COMPOSITE PLATES UNDER LOW-VELOCITY IMPACT LOADING EV Gonzalez, P Maimi, A Turon, J Costa(Univ. of Girona), PP Camanho(Univ. of Porto) This work presents a complete study of the effects of ply clustering on monolithic, flat and rectangular polymer-based laminated composite plates with conventional stacking sequences, subjected to a drop-weight impact loading.</p>	<p>T22-2 FABRICATION AND PERFORMANCE OF HYPERBRANCHED SHAPE MEMORY POLYMER COMPOSITES RESPONSIVE TO DIFFERENT STIMULI JW Cho, SK Yadao(Konkuk Univ.) This paper investigates shape memory performance of carbon nanotube composites with the hyperbranched polymers which can be responsive to different stimulus of temperature, electric field and water. Various fabrication methods are also discussed for conventional, functionalized carbon nanotubes, and in-situ polymerized composites.</p>	<p>T23-2 THE EFFECT OF PROCESSING PARAMETERS ON STRUCTURAL PROPERTY FOR FILAMENT-WOUND COMPOSITE PRESSURE VESSELS T Lili, W Zhengqing(Harbin Engineering Univ.), Z Limin(Hongkong Polytechnic Univ.) Two methods for calculating mandrel revolutionary angle, plane-hypothesis method and geodesic path, are discussed. fiber path according to semi-geodesic path is more stable than the path according to plane-hypothesis method. With the increase of open hole diameter, the fiber path calculated by plane-hypothesis method is far from the geodesic trajectories.</p>	<p>T24-2 CYCLIC CRACK PROPAGATION AND -ARREST IN A UNIDIRECTIONAL POLYMER MATRIX COMPOSITE EXHIBITING LARGE SCALE BRIDGING S Wahlgren(Risø DTU/LM Wind Power), B Sørensen(Risø DTU), C Lundsgaard-larsen(LM Wind Power) A novel test configuration for characterization of cyclic crack propagation in composite DCB specimens has been proposed. The configuration allows for steady state crack growth in fracture mode I and II and any mixity in between. Crack development hypotheses as well as supporting sample results of tests are presented.</p>
12:10	<p>T19-3 INTEGRATION OF HEALTH MONITORING SYSTEM FOR COMPOSITE ROTORS P Kostka, K Holeczek, A Filippatos, W Hufenbach(Technische Universitaet Dresden) A concept of a combined material-integrated structural health monitoring and active vibration damping system is proposed. Using a common set of integrated sensor and actuator components, the system allows the control of the structural dynamic behavior under relevant operating conditions as well as a detection of a progressing damage.</p>	<p>T20-3 PREPARING CONTINUOUS SIBN CERAMIC FIBER FROM PRECURSOR POLYMER OF N-METHYL-POLYBOROSILAZANES YQ Peng, QJ Han, MH Yu(Donghua Univ.) SIBN fiber is a new type of ceramic fibers, and expected to possess such comprehensive performances with high mechanical properties, good dielectric behaviors, and excellent thermal resistance. Therefore it is considered as the best candidate for reinforcement in high-temperature, radar-wave-transparent ceramic composites. we have developed a new route to prepare...</p>	<p>T21-3 SCATTERING OF ANTI-PLANE SH-WAVE BY MULTIPLE CYLINDRICAL CAVITIES AND A LINEAR CRACK HL Li(Harbin engineering Univ.) In this paper, the method of Green's function is used to investigate the problem of dynamic stress concentration of multiple cylindrical cavities and a linear crack. Multi-polar coordinate system is used too. An example is studied to show the effect of crack on the dynamic stress concentration around cylindrical cavities.</p>	<p>T23-3 MANUFACTURING TECHNOLOGY OF CERAMIC MATRIX COMPOSITES USING UNDERWATER SHOCK COMPACTION YK Kim(Kumamoto Univ.), YW Lee(Pukyong National Univ.) As a fabrication method for ceramics, we introduce an underwater shock compaction technique using a high performance explosive. This technique uses an underwater shock wave generated by detonation of the explosive with a peak shock pressure of about 6 GPa. The underwater shock compaction is very effective to obtain denser...</p>		
12:30	Lunch					
13:30						
14:00	Break					

	Halla A	Halla B	Samda A	Samda B	201A	202A
14 : 15	<p>T25 NANOCOMPOSITES Chairs: J Pandey/ JH Kweon</p> <p>T25-1 MECHANICAL AND THERMAL PROPERTIES OF FUNCTIONALIZED GRAPHENE/ETHYLENE VINYL ACETATE NANOCOMPOSITES T.Kuila, P Khanra, NH Kim, SH Bae, KM Kim, JH Lee(Chonbuk National Univ.) The nanocomposites of ethylene vinyl acetate (EVA)/octadecyl amine modified graphene (ODA-G) have been prepared by solution mixing techniques. The nano level dispersion of ODA-G in EVA has been confirmed by transmission electron microscopy. The dynamic mechanical and thermal properties of the nanocomposites are better as compared to neat EVA.</p>	<p>T26 SYMPOSIUM ON 'MULTIFUNCTIONAL COMPOSITE MATERIALS FOR ENERGY APPLICATIONS' - DISCUSSION Chairs: J Thomas /D Inman</p> <p>KEYNOTE I. ENERGY HARVESTING AND STORAGE SYSTEM FOR AERO VEHICLES M.Taya (Univ. of Washington)</p> <p>KEYNOTE II. NANO-SCALE MULTIFUNCTIONAL COMPOSITES FOR ENERGY APPLICATIONS RH Baughman (Univ. of Texas-Dallas)</p>	<p>T27 DURABILITY OF POLYMER MATRIX COMPOSITES Chairs: SK Woo/ AR Bunsell</p> <p>T27-1 SIMPLIFIED DETERMINATION METHOD OF LONG-TERM VISCOELASTIC BEHAVIOR OF AMORPHOUS RESIN HN Cai(Xi'an Jiaotong Univ.), M Nakada, Y Miyano(Kanazawa Inst. of Technology) This paper deals with the long-term viscoelastic behavior of amorphous resin at a temperature below T_g from measuring the short-term viscoelastic behavior at elevated temperatures. The accelerated testing methodology (ATM) based on the time-temperature superposition principle (TTSP) for polymeric materials was proposed by Miyano et al. Elevated temperature states are...</p> <p>T27-2 DETERMINATION OF INTRINSIC SCATTER IN LIFETIMES OF CARBON FIBRE EPOXY PRESSURE VESSELS IN VIEW OF DEFINING FUNDAMENTAL SAFETY FACTORS AR Bunsell, HY Chou(Mines ParisTech), A Thionnet(Université de Bourgogne) Multiscale modelling and experimental data, shows how damage is accumulated at the fibre level in carbon fibre composite pressure vessels. The viscoelastic behaviour of the matrix allows deferred failure of the fibres under sustained loading. The paper shows how the probability of failure can be determined.</p>	<p>T28 APPLICATION OF COMPOSITES Chairs: YH Kim/ JH Jeon</p> <p>T28-1 THE DESIGN OF A CFRP CHOPPER DISC FOR A TIME OF FLIGHT SPECTROMETER V Antonelli, M Wedekind, L Kramer, H Baier(Technische Universität München) CFRP chopper discs are used for neutron time of flight spectrometers at the research reactor (FRM II) at the Technische Universität München. In this paper the design process as well as the manufacturing and the final test results, carried out on several prototypes, are presented.</p> <p>T28-2 A COMPARISON OF MECHANICAL PROPERTY OF JUTE/STYRENE BY VARTM AND HAND-RAY UP METHOD HB An(Korea Maritime Univ., The Univ. of Tokushima), H Takagi(The Univ. of Tokushima), YH Kim(Korea Maritime Univ.) We made jute composites with styrene resins by VARTM (Vacuum Assisted Resin Transfer Molding) instead of the hand lay-up. The VARTM can make jute composites in vacuum. In this study, we compare the VARTM system with original hand lay-up method for tensile and flexure strength from jute fibers.</p>	<p>POSTER SESSION (3F LOBBY)</p>	<p>T29 METAL MATRIX COMPOSITES Chairs: T Suzuki/ SW Jeon</p> <p>T29-1 INFLUENCE OF MILLING ATMOSPHERE ON THE HIGH-ENERGY BALL-MILLING PROCESS OF PRODUCING PARTICLE-REINFORCED ALUMINUM MATRIX COMPOSITES S.Siebeck, D Nestler, H Podlesak, B Wielage(Chemnitz Univ. of Technology) The influence of the atmosphere and the amount of PCA on the high-energy milling of aluminum with SiC particles was studied. The milling behavior shows a significant difference between inert gases and rinsing air. For air, because of the separating effect of the in-situ-formed alumina no PCA is necessary.</p> <p>T29-2 IMPROVEMENTS OF YOUNG'S MODULUS ON NI-BASED CNT COMPOSITE COATING T.Suzuki, M Kato, K Yokoyama, J Murakami(Yamagata Research Inst. of Technology), Hiroshi Iizuka(Yamagata Univ.) 1. Young's modulus of Ni electroplated coating is increased by containing CNTs. 2. Ni-based CNT composite coatings with high CNT concentration layer at surface have a higher Young's modulus. 3. The measured Young's moduli agree well with the predictions of Halpin-Tsai equations at high CNT concentration.</p>
14 : 35	<p>T25-2 UNIFORM SURFACE DECORATION AND INTERFACIAL BONDING OF ALUMINA PARTICLES ON CARBON NANOTUBES BY MICROWAVE TREATMENT ES Kim, KP So, HY Jeong, YH Lee(Sungkyunkwan Univ.) In this study aluminum oxide particles were uniformly covered on carbon nanotubes surface by sol-gel process followed by microwave treatment. The decoration of particles was confirmed by SEM, TEM and EDX mapping. Al-O-C covalent bonds were generated by microwave treatment. The bonding structure was indicated by XRD and XPS.</p>		<p>T27-3 EXPERIMENTAL EVALUATION OF INTERFACIAL FAILURE CRITERION IN A GLASS FIBER/EPOXY COMPOSITE S.Ogihara, H Nakatani, I Ueno(Tokyo Univ. of Science), J Koyanagi(JAXA), K Watanabe(Mitsubishi Rayon), S Kobayashi(Tokyo Metropolitan Univ.) The interfacial debonding criterion under combined normal and shear stress states is experimentally evaluated by using the cruciform specimen method for a glass fiber/epoxy composite. The effects of the curing temperature on the interfacial debonding criterion is also considered.</p>	<p>T28-3 INFLUENCE OF HYDROTHERMAL ENVIRONMENT ON MECHANICAL BEHAVIOR OF FIBER REINFORCED POLYMERS: CHARACTERIZATION AND MODELING S.Cao, B Wang, GQ Jiao(Northwest Polytechnical Univ.) Moisture absorption and diffusion of carbon fiber reinforced polymer matrix composites (CFRP) was investigated. Water absorption experiments, mechanical property tests and finite element analysis were performed in this article.</p>		<p>T29-3 MICROSTRUCTURE AND MECHANICAL PROPERTIES OF AN AL-CUO IN SITU COMPOSITE PRODUCED BY FRICTION STIR PROCESSING G You, PW Kuo, NI Ho(National Sun Yat-Sen Univ.) In this study, FSP was applied to produce aluminum based nanocomposites from powder mixtures of Al and CuO. The major contributions to high strength of the composite are the ultrafine-grained structure of aluminum matrix and the Orowan strengthening caused by the fine dispersion of nano-size Al₂O₃ particles inside aluminum grains.</p>
14 : 55	<p>T25-3 ELECTRICAL CONDUCTIVITY OF STYCAST 1266 EPOXY/ GRAPHENE COMPOSITES DH Teo, K Shin, YH Seo(Sejong Univ.) Composites of graphene flakes and Stycast 1266 epoxy with different graphene mass fraction from 0% to 15% were produced. DC conductivity of the composite agrees well with percolation law. The percolation threshold from DC conductivity measurement was 8 wt.% and the critical exponent t= 1.85±0.23.</p>					<p>T29-4 NUMERICAL ANALYSIS OF THE EFFECT OF PARTICLE ARRANGEMENT ON MECHANICAL BEHAVIOR AND PARTICLE DAMAGE IN METAL MATRIX NANOCOMPOSITES E Law, SD Pang, ST Quek(National Univ. of Singapore) The effect of particle arrangement on the mechanical response and particle damage in metal matrix nanocomposites is investigated using discrete dislocation simulations. Uniform random and mildly clustered particle arrangements produce the greatest flow stress if particles are intact, but cause earlier onset and greater degree of damage for damageable particles.</p>
15 : 15	<p>T25-4 BARRIER FILMS BASED ON EVOH AND GRAPHENE OXIDE HM Kim, HS Lee(Dong-A Univ.) GO is exfoliated in EVOH/GO composite. The O₂ TR and WVTR of EVOH/GO (0.3wt.%) composite coated PET film is lower than that of pure PET film. The barrier property of EVOH film is improved when it is contained GO. EVOH/GO films are promising for the transparent high gas barrier film.</p>	<p>OPEN PANEL DISCUSSION</p> <p>Panelists: Ray Baughman (Univ. of Texas in Dallas) Jeffery Baur (Air Force Research Lab, AFRL/RXB) Martin Dunn (Univ. of Colorado) Michael Durstock (Air Force Research Lab) Tom Hahn (Univ. of California, Los Angeles) Dan Inman (Univ. of Michigan) Frank Ko (Univ. of British Columbia) Max Shtein (Univ. of Michigan) Minoru Taya (Univ. of Washington) James Thomas (Naval Research Lab)</p>	<p>T27-4 TIME-DEPENDENT PROGRESSIVE DAMAGE AND RESIDUAL STRENGTH OF NOTCHED COMPOSITE LAMINATES J.Koyanagi(Japan Aerospace Exploration Agency), Satoru Yoneyama(Aoyama Gakuin Univ.) This paper presents time-dependent progressive internal damage and effect on the residual strength of notched composite laminates. Under constant tensile load condition for the notched specimen, the full field strain measurement is implemented by digital image correlation method. The constant load test is interrupted and the residual strength is examined.</p>	<p>T28-4 DESIGN, PREPARATION AND CHARACTERIZATION OF BIOLOGICAL AUXETIC HYDROGELS WITH SHELL-CORE STRUCTURE YX Ma, YD Zheng, HY Meng, J Tan(Univ. of science and technology Beijing), WH Song(Brunel Univ.), XF Yao(Tsinghua Univ.) Shell-core PVA hydrogels were design and fabricated. Unique biconcave-shape deformation occurred under axial compression with a lateral contraction in the middle zone of the samples. The core diameter had an important influence on the Poisson's ratio of the samples. The larger the core diameter, the smaller their Poisson's ratio is.</p>		<p>T29-5 MEASUREMENT OF RESIDUAL STRESS IN A356/SICP METAL MATRIX COMPOSITE BY NANOINDENTATION SG Jeong, JH Park, JH Jang, KS Han(Postech) The residual stress of A356/20vol.%-SiC metal matrix composites (MMCs) was measured by nanoindentation method. The experimental results of the residual stress obtained by nanoindentation were compared with those by conventional X-ray diffraction (XRD) methods. Results are very different, and there need much considerations on preciseness of tests.</p>
15 : 35	<p>T25-5 IMPROVING THE WETTABILITY OF ALUMINUM ON CARBON NANOTUBES KP So, IH Lee, DL Duong, TH Kim, SC Lim, YH Lee(Sungkyunkwan Univ.), KH An(Chonju Machinery Research Center) Wetting of a metal on CNTs is difficult due to their high surface tensions difference. Here, we report a simple method to enhance the wettability of CNT. This method involves two steps: i) decoration of Al on MWNT by electroplating and ii) wetting of Al powder on Al-electroplated CNTs...</p>		<p>T27-5 EFFECT OF FABRIC ARCHITECTURE (NCF) ON BENDING AND CREEP TEST OF TEXTILE COMPOSITES T.Sakai(Tokyo Metropolitan Univ.), S Wakayama, CR Rios Sobranis, J Rodriguez-laviada(CICYT), E Perez-pacheco(Instituto Tecnológico Superior de Calnali en el Estado de Campeche) The creep compliance of 0 and 90 ° are almost the same and lower than that observed at 45°. It is suggested that creep compliance will be constricted by 0° layer. Therefore, it is suggested that the position of 0° layer dominate the creep behavior of whole of composites.</p>	<p>T28-5 PHOTOCATALYTIC DEGRADATION OF PHENOLIC COMPOUNDS BY TIO₂ POWDERS P.Liwsirsang, S Jiemsirilers, DP Kashima, S Jinawath(Chulalongkorn Univ.), C Kalambaheti(PTT RTI) Phenolic compounds are found in wastewater. All of them are durable in the environment which become toxic. Phenolic compounds employed in this experiment were phenol, acetophenone and cumene hydroperoxide. Photocatalysis of titanium were determined by UV-VIS spectrophotometer. The results from the photocatalysis showed that acetophenone was effectively degraded by TiO₂.</p>		
15 : 55			<p>T27-6 DURABILITY KINETIC MODELING OF CLAY NANOENFORCED POLYPROPYLENE AT LOW TEMPERATURE OXIDATION G Gutierrez, B Fayolle, G Regnier, L Audouin(Arts et Metiers Paris Tech.) Oxidation kinetics of polypropylene and montmorillonite filled films was followed at low temperatures. The filler slightly reduces slightly the oxygen permeability but does not considerably modify the polypropylene kinetic behaviour under studied conditions. Closed Loop Model is valid for PP based nanocomposite and can be used to estimate NC durability.</p>	<p>T28-6 PREPARATION AND PERFORMANCE ANALYSIS OF A NATURE-INSPIRED ANTI-CUT MATERIAL Z.Yang, Z Zhang, M Li, Y Gu, Z Li(Beihang Univ.) A novel anti-cut material, simulating the structure of Namagadite was prepared. The influence of shape group, size and thickness on the anti-cut performance and flexibility were discussed with orthogonal test. Considering its high strength, high flexibility and low-cost, it has a prospect application in industry and daily life.</p>		<p>T29-6 THERMAL SHOCK CRACKING BEHAVIORS OF 2D WOVEN CARBON FIBER REINFORCED MAGNESIUM MATRIX COMPOSITE WJ Lee, IM Park, YH Park (Pusan National University), JM Lee, SK Lee(KIMS) This study focuses on the effect of temperature fluctuations on the microstructure and in-plane compressive strength of 2D woven C/Mg composite laminate. Plain woven carbon fabric reinforced magnesium matrix composite laminates were fabricated by pressure infiltration method, and their thermal shock behaviors were investigated.</p>
16 : 15						

Break

	202B	203	301	302	401	402A
1 4 : 15	<p>T30 STRUCTURAL HEALTH MONITORING AND MANAGEMENT Chairs: TJ Swait/ A Muc</p> <p>T30-1 DAMAGE DETECTION AND AMELIORATION BY ELECTRICAL RESISTANCE FOR SMART COMPOSITES TJ Swait, FR Jones, SA Hayes(Univ. of Sheffield) A practical method is presented which enables damage to be reliably detected and located in a carbon fibre reinforced polymer composite (CFRP) structure. The carbon fibres themselves are used as sensing elements since their resistance changes with damage to the structure. These changes in resistance are recorded by a network.</p>	<p>T31 FIBRES, MATRICES AND INTERFACES Chairs: H Kanazawa / WR Yu</p> <p>T31-1 PREPARATION AND CHARACTERIZATION OF CORE-SHELL TYPE P3HT@PEO COMPOSITE NANOFIBERS USING SINGLE NOZZLE SYSTEM TH Kim, CR Park(Seoul National Univ.) Poly(3-hexylthiophene) and polyethylene oxide composite nanofibers were prepared using an electrospinning apparatus equipped with a single nozzle and its structure was characterized. It is found that P3HT locates in the core while PEO in the shell of the composite fiber.</p>	<p>T32 IMPACT AND DYNAMIC RESPONSE Chairs: S Atobe/ Y Aoki</p> <p>T32-1 DYNAMIC RESPONSE AND DAMAGE MECHANISM OF TWO-CORE COMPOSITE SANDWICH PANELS UNDER LOW-VELOCITY IMPACT CL Li, DZ Jiang, G Du, CQ Wang(National Univ. of Defense Technology) The emphasis is focused on the contact force response and crash mechanism of two-core sandwich panels. Effects of configurations, impact energy levels and types of the cores on the response are investigated.</p>	<p>T33 MECHANICAL AND PHYSICAL PROPERTIES Chairs: A Arunitt/ N Kreua-Ongarjnukool</p> <p>T33-1 INFLUENCE OF THE PITCH FIBER REINFORCEMENT OF CFRP ON THE MECHANICAL AND THERMAL CONDUCTIVITY PROPERTIES M Glowania, D Lindner, M Linke, T Gries(TA of RWTH Aachen Univ.), D Heider(Univ. of Delaware) Collaborative effort, between the Institut für Textiltechnik (ITA) of RWTH Aachen Univ. and the Center for Composite Materials (CCM), Univ. of Delaware, opens new ways for Fiber Reinforced Plastics to conduct heat in three directions. This effect is achieved using pitch-based carbon fibers and matrix modifications.</p>	<p>T34 PROCESSING OF OUT-OF-AUTOCCLAVE PREPREGS Chairs: RA Witik/ P Hubert</p> <p>T34-1 MODELLING AND CHARACTERIZATION OF THICKNESS VARIATIONS IN L-SHAPE OUT-OF-AUTOCCLAVE LAMINATES M Brillant, P Hubert(McGill Univ.) This paper presents the details of an analytical model of the compaction of L-shape laminates, developed to predict the thickness variation at the corner. The analytical model predictions showed good agreement with the plain weave concave laminate experimental results.</p>	<p>T35 DAMAGE AND FRACTURE PREPREGS Chairs: DW Jensen/ C Marotzke</p> <p>T35-1 PREDICTING DAMAGE ACCUMULATION IN GLASS FIBER REINFORCED PLASTICS THROUGH CUMULATIVE DAMAGE MODELS R Fragoudakis, A Saigal(Tufts Univ.) The Palmgren-Miner, Broutman-Sahu and Hashin-Rotem models are compared to determine which of the three gives a more accurate estimation of the fatigue life of S₂ and E glass fibre/epoxy composites. It is also shown that the fatigue life of S₂ glass fibre/epoxy is better than that of E glass fibre/epoxy.</p>
1 4 : 35	<p>T30-2 DETECTION OF DISBONDING IN BONDED JOINTS WITH A SPATIALLY DISPLACED CFBG SENSOR TC Capell, S Ogin(Univ. of Surrey) This paper describes a study using computer modelling of the sensitivity of chirped fibre Bragg grating sensors to disbands in a generic bonded joint when the sensor is located in an undamaged part of the bonded joint.</p>	<p>T31-2 EFFECT OF FLEXIBLE INTERPHASE ON MECHANICAL PROPERTY OF CFRP N Yoshikawa, N Asami, O Satoshi(Kyoto Inst. of Technology), O Akiyo(Japan aerospace exploration agency), M Misao(Daicel Chemical Industries Ltd) CFRP with flexible interphase was fabricated by using flexible resin which is low modulus and the effects of flexible interphase on mechanical property of CFRP were evaluated. Consequently, the improvement of static strength and the inhibition of progressing brittle fracture were observed and availability of flexible interphase was confirmed.</p>	<p>T32-2 INVESTIGATION OF BALLISTIC RESPONSE OF CFRP COMPOSITES OF VARIOUS NON-CONVENTIONAL REINFORCEMENT ARCHITECTURES TK Cwili, LANuncu, P Curtis, P Robinson(Imperial College London), D Pope(DSTL) In this paper the authors present results of ballistic tests done on carbon fiber reinforced panels of various architectures. Novel, non-conventional layouts were introduced, aiming at mimicking low interlaminar shear strength characteristic for armor grade Ultra High Molecular Weight Polyethylene (UHMWPE) panels.</p>	<p>T33-2 DESIGN AND TESTING OF LIGHT-WEIGHT PARTICLE FILLED POLYMER COMPOSITES A Arunitt, J Kers, J Majak, A Krumme, K Tall(Tallinn Univ. of Technology) A new composite is modelled on basis of testing the material. Numerical procedure has been developed for design the new composite. Artificial neural networks and real-coded genetic algorithm (GA) were used for modelling response between objectives and design variables and solving optimization problem, respectively.</p> <p>T33-3 THERMAL CONDUCTIVITY OF COMPOSITE MATERIALS REINFORCED WITH GLASS MICRO BALLOONS Y Ozawa, S Sato(Fukushima Univ.), M Watanabe(Technical Academy Koriyama) The mechanical and thermal properties of polymer composite materials system reinforced with micro glass balloons are investigated. A homogenization theory with multi-scale analytical method has been applied for micro porous materials. Numerical calculations were performed by using a unit model of the composites in order to evaluate their thermal conductivity.</p>	<p>T34-2 ASSESSING THE ECONOMIC AND ENVIRONMENTAL POTENTIAL OF OUT OF AUTOCLAVE PROCESSING RA Witik, R Teuscher, V Michaud, J Manson(EFPL), F Gaille, H Ringwald(EADS Deutschland) The economic and environmental differences between autoclave curing and other selected out of autoclave (OOA) processes are quantified and key parameters affecting costs and environmental performance are identified. OOA processing led to energy savings and improved environmental performance; however costs remained relatively unaffected by the efficiency improvements.</p>	<p>T35-2 INFLUENCE OF BRAIDED SLEEVES ON THE IMPACT DAMAGE OF CYLINDRICAL UNIDIRECTIONAL ELEMENTS DN Allen, DW Jensen, MD Embley(Brigham Young Univ.), MJ Jensen(Altus Poles) The compression-strength-after-impact of 8-mm diameter, basalt/epoxy composite rods with co-cured aramid sleeves, representing elements of continuously-fabricated three-dimensional IsoTruss® or isogrid structures was quantified. Cylindrical specimens with half-to-full coverage and bi-directional braids or uni-directional spiral wraps were impacted at 5 or 10 J. Results indicate that consolidating sleeves simultaneously increase CSAI.</p>
1 4 : 55	<p>T30-3 CURE MONITORING OF CARBON/EPOXY COMPOSITE BY OPTICAL-FIBER-BASED DISTRIBUTED STRAIN/TEMPERATURE SENSING Y Ito, Y Fujimoto, S Minakuchi, T Mizutani, N Takeda(Univ. of Tokyo), H Koinuma, T Shimizu(Mitsubishi Heavy Industries Ltd) In recent years, advanced composite structures have been used extensively in many industrial fields. Quality and reliability are keys of advanced composite structures that are often used under harsh environments. Measurement and comprehension about curing process are quite important since quality of composite products are very dependent on their curing...</p>	<p>T31-3 RESIDUAL STRENGTH OF ORGANIC MONO-FILAMENTS AFTER COMPRESSIVE LOADING H Saito, S Inaba, M Nakahashi, I Kimpara(Kanazawa Inst. of Technology), T Katayama(Kuraray Co., Ltd.) In this study, the compressive durability of mono-filament of polyarylate fiber was evaluated. Especially, the residual tensile strength was evaluated after static and cyclic compressive loading. The mechanism of degradation of residual strength after compressive loading was discussed with both experimental results and theoretical discussions.</p>	<p>T32-3 REAL-TIME IMPACT FORCE IDENTIFICATION OF CFRP LAMINATED PLATES USING SOUND WAVES S Atobe, H Kobayashi, H Fukunaga(Tohoku Univ.), N Hu(Chiba Univ.) This paper proposes a method for identifying the location and force history of an impact force acting on CFRP laminated plates using measured sound pressures obtained with microphones. In order to verify the validity of the proposed identification method, impact force identification of a CFRP laminated plate is performed experimentally.</p>	<p>T33-4 CENTRAL REFLECTION AND ITS USE IN FORMULATION OF UNIT CELLS FOR MICROMECHANICAL FEASIBILITY S Li(Univ. of Nottingham), ZM Zou(Univ. of Manchester) Central reflection as a type of symmetry has been exploited resulting in new unit cells. Sizes of these unit cells have been halved without any penalty in contrast to plane reflections or rotations. A single set of boundary conditions is obtained for all loading conditions, which have been validated systematically.</p> <p>T33-5 IMPROVED IMPACT STRENGTH OF STYRENE-METHYL METHACRYLATE COPOLYMER SHEET BY GRAFTED DEPROTEINIZED NATURAL RUBBER N Kreua-ongarjnukool, P Pittayavinal, S Tuampoemsab(KMUTNB) This research was studied to improve impact strength of styrene-methyl methacrylate copolymer sheet (S-co-MMA sheet) by using deproteinized natural rubber (DPNR) as an impact modifier. The result was shown DPNR-g-S/MMA could be compatible. Finally, the use of S-co-MMA monomer can reduce raw material cost, and improve impact strength by DPNR-g-S/MMA.</p>	<p>T34-3 ADAPTATION OF SOLID MICROMECHANICS FOR MODELLING CURING RESINS IN PROCESS SIMULATION S MalekMohammadi, R Thorpe, A Poursartip(The Univ. of British Columbia) Next generation composites process models attempt to predict both fluid and solid response during cure. Classical micromechanics is not able to predict resin dominated properties in the fluid state as it ignores the fibre bed response. We show that a simple modification is a promising approach for agreement with experiments.</p>	<p>T35-3 MICROMECHANICS BASED FAILURE ANALYSIS OF LAMINATES UNDER OFF-AXIS LOADING CG Marotzke, R Basan(BAM Federal Inst. for Materials Research and Testing) The debonding of a fiber within a glass fiber / epoxy composite under transverse loading is studied. The stress field in the interface as well as the mode I and mode II energy release rates are analysed for two fiber volume fractions. The stability of the crack is analysed.</p>
1 5 : 15	<p>T30-4 STRAIN SENSING USING SINGLE CARBON FIBRES T Mader, D Nestler, B Wielage(Chemnitz Univ. of Technology) The aim of this work is to develop a strain sensor with a diameter equal to that of the reinforcing fibres. Carbon fibres show piezoresistive properties. This effect can serve as strain- and tension-sensitive microsensor technology capable of supporting health and safety monitoring functions in parts made of composite materials.</p>	<p>T31-4 IMPROVEMENT IN ADHESIVE PROPERTY OF POLYOLEFINS, SILICONE RESIN, AND OTHER STABLE POLYMERIC MATERIALS H Kanazawa, A Inada, Y Sugeno, J Sato(Fukushima Univ.) The surface modification of polyolefin materials such as polyethylene and polypropylene was carried out by a combination method. The obtained materials gave a high hydrophilic property and a good adhesive property. The technique is applicable for other chemically stable polymeric materials such as polycarbonate, silicone resins and fluorine resins.</p>	<p>T32-4 DYNAMIC AND IMPACT BEHAVIORS OF FRP GUARDER BELT FOR SIDE COLLISION OF AUTOMOBILES Y Aoki, G Ben, HS Kim, A Tabata(Nihon Univ.) In this paper, the FRP guarder belt equipped in the automotive door is developed and examined by an experiment and a numerical analysis for replacing the conventional steel door guarder beam. As the measured impact load to displacement for FRP guarder belt agreed well with that of numerical result.</p>	<p>T33-6 EFFECTS OF SLIT ANGLE OF UNIDIRECTIONALLY ARRANGED CHOPPED STRANDS (UACS) ON THE THERMAL RESIDUAL STRESS IN UACS/AL LAMINATE Xue, WX Wang, Y Takao, T Matsubara(Kyushu Univ.) This paper focus on the analysis of thermal residual stress in CFRP/Al (CARALL) fabricated with UACS, which is made by cutting parallel slits on unidirectional carbon fiber prepreg with different slit angle. specimen with certain slit angles are found to have one third reduction of thermal residual stress.</p>	<p>T34-4 EFFECT OF PROCESS CONDITIONS ON POROSITY IN OUT-OF-AUTOCCLAVE PREPREG LAMINATES J Kay, C Fahrang, K Hsiao, G Fernlund(The Univ. of British Columbia) A study was performed that evaluated the effect of vacuum pressure (100%, 80% and 60% vacuum) and relative humidity (100%, 75%, 50% and 0%) on the resulting porosity of MTM 45-1 five-harness prepreg laminates cured under a vacuum bag. The porosity levels increased with decreased vacuum and increased relative humidity.</p>	<p>T35-4 TAPPING TEST AND ANALYSIS FOR DAMAGE DETECTION SJ Kim, SM Ahn, IH Hwang(Korea Aerospace Research Inst.), CH Hong(Chungnam National Univ.) The tapping test has the ability indicating damage in a structural element due to a localized change of stiffness. The change in vibration signature may be detected by ear or more precisely by measurement instrumentation. In this paper, a tapping test method for discriminating between measurements made on undamaged and...</p>
1 5 : 35	<p>T30-5 DAMAGE MONITORING OF SHIP FRP DURING EXPOSURE TO EXPLOSION IMPACTS S Anderson, C Hedberg(Blekinge Inst. of Technology), K Haller(Acoustic Agree), SE Hellbratt(Thyssen Krupp Kockums Fiber Reinforced Plastics (FRP) has been used by Kockums shipyard in the manufacturing of ships over 35 years, during which time it has been proven to be durable and practical. The light weight makes it a more and more attractive material as energy and material expenditure decreases are required.</p>	<p>T31-5 INTERFACIAL ADHESION AND MECHANICAL PROPERTIES OF BAMBOO FIBRE COMPOSITES CA Fuentes Rojas, LQN Tran, AW Van Vuure, I Verpoest, M Van Hellemont(Katholieke Universiteit Leuven), C Dupont-gillain(Universite Catholique de Louvain) Bamboo fibres attract interest as a sustainable reinforcement due to specific mechanical properties. A novel procedure allows stable contact angles to be measured; allowing meaningful information on interfacial interactions to be obtained. Energy components of bamboo fibres and thermoplastic matrices were matched, resulting in the improvement of the physical adhesion.</p>	<p>T32-5 RESPONSE BEHAVIOR OF RECTANGULAR CFRP TUBES DEVELOPED FOR FULL-LAP COLLISION OF AUTOMOBILES UNDER IMPACT LOAD HS Kim, Y Aoki, G Ben(Nihon Univ.) In this study, we developed rectangular CFRP tubes equipped with two ribs to serve as impact energy absorption members under full-lap collision conditions. Drop weight impact tests were carried out to investigate the impact response behavior and impact energy absorption characteristics of the rectangular CFRP tubes.</p>	<p>T33-7 THE EFFECTS OF HYGROTHERMAL AGEING ON THE MECHANICAL PROPERTIES OF SUSTAINABLE COMPOSITES M.Malmeister, J Blake, A Chalmers(Univ. of Southampton) A materials test programme has been undertaken which encompasses the issues of environmental degradation and durability of composite materials in a humid environment. The effect of water diffusion on the flexural properties and flexural failure modes of glass reinforced Insead oil resin in comparison with epoxy resin has been investigated.</p>	<p>T34-5 COST ANALYSIS ON L-SHAPE COMPOSITE COMPONENT MANUFACTURING R Tong, SV Hoa, MY Chen(Concordia Univ.) Multiple samples of L-shape products are made by using autoclave and out-of-autoclave manufacturing processes. Cost analysis was conducted on these processes to determine most cost-effective production processes considering parallel production operations.</p>	<p>T35-5 DYNAMIC PROPAGATION OF A WEAK-DISCONTINUOUS INTERFACE CRACK IN FUNCTIONALLY GRADED LAYERS UNDER ANTI-PLANE SHEAR JW Shin, SC Kim, HJ Hwang(Korea Aerospace Research Inst.), YS Lee(Chungnam National Univ.) The dynamic propagation of an interface crack between two functionally graded material (FGM) layers under anti-plane shear is analyzed. Numerical values on the dynamic energy release rate are presented for the FGM to show the effect of the gradient of material properties, crack moving velocity, and thickness of FGM layers.</p>
1 5 : 55	<p>T30-6 MODELING DAMAGE IN CYLINDRICAL SHELLS USING ELASTIC WAVE-BASED TECHNIQUES A Muc, A Stawiariski(Cracow Univ. of Technology) In this study, effective computational and experimental procedures are introduced and used to characterize the dynamic behavior of cylindrical panels with the single delamination between laminate layers. Based on the computed results it is possible to determine the effect of delamination on the overall structural dynamic behavior.</p>	<p>T31-6 FREE-EDGE STRESSES IN COMPOSITE LAMINATES UNDER MECHANICAL LOADING B Rasuo, M Dinulovic(Univ. of Belgrade) Stress-strain state at the free edges of composite laminates is very complex and must be analyzed as a three-dimensional. This paper analyzes the stress-strain conditions at free edges of the laminates [0/±θ], [0/90], and the general case of symmetric laminates subjected to axial loading. In determining the three-dimensional stress state...</p>	<p>T32-6 HIGH RESOLUTION MEASUREMENT FOR FRACTURE BEHAVIOR OBSERVATION OF CFRP H Kusano(Shimadzu Corp.), T Mizuno(Marubun Corp.), A Yamada(Hi Jet Service Co., Ltd), Y Aoki(Japan Aerospace Exploration Agency) The tensile fracture mechanism of unidirectional CFRP has not been experimentally made clear because the fracture speed of unidirectional CFRP is quite high. The objective of this study is to clarify the fracture behavior of unidirectional CFRP under static tensile loading by high-speed video camera and DIC method.</p>	<p>T34-6 CO-INJECTION RESIN TRANSFER MOLDING OF CARBON/EPOXY-FOAM-CARBON/PHENOLIC MULTILAYER INTEGRAL COMPOSITES CP Yin, YJ Xiao, JC Zeng, W Zhang, SL Xing(National Univ. of Defense Technology) The Co-injection Resin Transfer Molding process is described and used to fabricate carbon/epoxy - foam - carbon/phenolic multilayer integral composites. The interface microstructure and the interlaminar shear strength of the specimen fabricated by GRTM are studied compared to those of multilayer composites manufactured by fabricating the layers...</p>	<p>T35-6 NORMAL-/SHEAR-DECOHESIVE DAMAGE OF ADHESIVELY BONDED JOINTS AT ROOM/CRYOGENIC TEMPERATURES CS Lee, JM Lee(Pusan National Univ.) It is well known that an adhesively bonded joints (ABJ) is fabricated using a combination of two or more (non-) metallic materials and adhesives. The ABJ is frequently adopted in various industrial structures, especially cryogenic industrial fields because of its superior material advantages, such as excellent bonding capacity, thermal barring...</p>	
1 6 : 15	Break					

	Halla A	Halla B	Samda A	Samda B	201A	202A
16:30	<p>T36 NANOCOMPOSITES Chairs: HD Wagner/ JK Kim</p> <p>T36-1 DEFORMATION-INDUCED CEMENTITE DECOMPOSITION IN PEARLITIC STEEL WIRES STUDIED BY ATOM PROBE TOMOGRAPHY P.D. Choi (Max-Planck Inst. for Iron Research) Atom Probe Tomography was used to characterize pearlitic steel wires, cold drawn to true strains of up to 5.4. Electron microscopy was employed for complementary microstructural characterization. A refinement of the lamellar structure and cementite decomposition was observed. The latter is discussed in terms of carbon-dislocation interaction.</p>	<p>T37 SYMPOSIUM ON 'MULTIFUNCTIONAL COMPOSITE MATERIALS FOR ENERGY APPLICATIONS'- DISCUSSION Chairs: J Thomas/ D Inman</p> <p>OPEN PANEL DISCUSSION</p> <p>Panelists: Ray Baughman (Univ. of Texas in Dallas) Jeffery Baur (Air Force Research Lab, AFRL/XXBC) Martin Dunn (Univ. of Colorado) Michael Durstock (Air Force Research Lab) Tom Hahn (Univ. of California, Los Angeles) Dan Inman (Univ. of Michigan) Frank Ko (Univ. of British Columbia) Max Shtein (Univ. of Michigan) Minoru Taya (Univ. of Washington) James Thomas (Naval Research Lab)</p>	<p>T38 DURABILITY OF POLYMER MATRIX COMPOSITES Chairs: H Cai/ M Drissi-Habti</p> <p>T38-1 EFFECT OF PLY THICKNESS ON MECHANICAL PROPERTY OF CFRP SYMMETRIC ANGLE-PLY LAMINATES K Takagi, H Nakatani, K Suga, S Ogihara (Tokyo Univ. of Science), A Koike (Suzu Advanced Engineering Center) This paper deals with mechanical property and damage evolution in CFRP symmetric angle-ply laminates with different ply thickness. Monotonic tensile tests and loading-unloading tests are performed on [(±45)₁]₁ [(±67.5)₁]₁ [(±0.05mm prepreg×48plies)₁ [(±45)₁/(±45)₁]₁ [(±67.5)₁/(±67.5)₁]₁ [(±0.15mm prepreg×16plies)₁ T700/2500 carbon/epoxy laminates. We discuss effect of ply thickness on mechanical property of angle-ply laminates.</p>	<p>T39 NANO COMPOSITE IN ENERGY APPLICATIONS Chairs: SH Ahn/ SY Lee</p> <p>T39-1 ULTRA-HIGH SPEED FABRICATION OF TiO₂ PHOTOANODE BY FLASH LIGHT FOR DYE-SENSITIZED SOLAR CELL HJ Hwang, HS Kim (Hanyang Univ.) In this work, a new way to fabricate nanoporous TiO₂ photoanode by flash light is demonstrated. TiO₂ nanoparticles are sintered by flash light irradiation at room temperature in ambient condition, which is dramatically simplified, ultrahigh speed and large area fabrication process compared to a conventional high temperature thermal sintering process.</p>	<p>T40 COMPOSITE MATERIALS FROM BIO-RENEWABLE RESOURCES Chairs: M Kessler/ S Tschegg</p> <p>T40-1 CURE CHARACTERISTIC, MECHANICAL PROPERTIES AND MORPHOLOGY OF IN-SITU SILICA-GEL/NR COMPOSITES C Thongpin, C Sriperthee (Silpakorn Univ.) Rice husk ash (RHA) contains over 60% silica and can be an economically valuable raw material for the production of silicates and silica. The amorphous nature of RHA silica makes it extractable at lower temperature, and hence provides a low energy method as an alternative to the current high energy.</p>	<p>T41 METAL MATRIX COMPOSITES Chairs: WJ Kim/ JH Han</p> <p>T41-1 IMPROVEMENT OF PLASTICITY BY TAILORING SECONDARY PHASES IN Ti-3CH Ti-2Zr-Be-Cu-Ni BMG MATRIX COMPOSITES WH Ryu, ES Park (Seoul National Univ.) In the present study, the nanoscale l-phase particle developed by tailoring combination of constituent elements can enhance the plasticity in Ti-based BMGs, which explain the beneficial effects of MA of elements having positive enthalpy of mixing.</p>
16:50	<p>T36-2 MAGNETITE IN GLASSY MATRIX V Sandu, MS Nicolescu, V Kuncser, I Ivan (National Inst. of Materials Physics), E Sandu (Horia Hulubei National Inst. of Nuclear Physics and Engineering) We present the structural and magnetic properties of nanostructured magnetite in a glassy matrix obtained by controlled crystallization of borosilicate glass with two nucleators: Cr₂O₃ or P₂O₅. We correlate the structural properties as revealed by X-ray diffraction and Mossbauer spectroscopy, morphology, and the temperature dependence of the...</p>	<p>T38-2 EFFECT OF FLAKE ORIENTATION ANISOTROPY ON AGING AND DURABILITY OF GLASS/EPOXY COMPOSITES B Pagotto, M Kubouchi, S Aoki (Tokyo Inst. of Technology), T Sakai (Nihon Univ.) This paper presents the results of a study evaluating the effects of flake orientation anisotropy on the aging process and flexural durability of glass/epoxy composites. Flake orientation strongly influences the aging process of composites, while its effect on wet retention of flexural properties and durability is somewhat limited.</p>	<p>T39-2 HYBRIDIZED Si-CNF NANOCOMPOSITE AND GRAPHITE AS A HIGH PERFORMANCE ANODE FOR LITHIUM BATTERY TH Park, JS Yeo, MH Seo, SH Yoon, J Miyawaki, I Mochida (Kyushu Univ.) This paper presents silicon particles were coated with Py/C and CNFs were grown on their surface by the chemical vapor deposition. When Si/Py/C/CNF composites were hybridized with commercial graphite, the cycling performance of these mixtures was improved due to flexibility and electric conductivity of CNFs.</p>	<p>T40-2 ANALYSIS OF COMPOSITE MATERIALS WITH HIGH RESOLUTION COMPUTED TOMOGRAPHY O Brunke, T Paul (phoenix v-ray), L Chugh (Hocht Solution) During the last decade, Computed Tomography (CT) has progressed to higher resolution and faster reconstruction of the 3D-volume. Most recently it even allows a three-dimensional look into the inside of materials with submicron resolution.</p>	<p>T41-2 LOW TEMPERATURE SYNTHESIS OF AL-B-C MULTI-PHASE COMPOSITES VIA REACTIVE SINTERING OF B₂C AND AL MC Kim, YM Sun, JH Han, KH Han (Yeungnam Univ.) Utilizing the mechanically milled B₂C-AL powders with and without the addition of AlSi brazing powders, low-temperature synthesis of multi-phase Al-B-C composites has been attempted. It has been demonstrated that for the composite with high Al content, say 60%, and addition of AlSi brazing powders fairly dense sinter can be produced.</p>	
17:10	<p>T36-3 HIGH THERMAL CONDUCTIVITY OF CARBON NANOTUBE SHEET/EPOXY COMPOSITE JG Park, QF Cheng, J Lu, JW Bao, Y Tian, R Liang, B Wang, C Zhang, JS Brooks (Florida State Univ.) The thermal conductivity of various MWCNT/epoxy composites at different concentrations was measured. The long-MWCNT composite showed a higher thermal conductivity than short-MWCNT. A higher concentration (60 wt. %) of long-MWCNT B7/epoxy composites showed a room temperature thermal conductivity ~55 W/mK and the mechanical stretch-induced alignment improved this further to 100...</p>	<p>T38-3 EFFECT OF FIBER DISCONTINUITY ON THE MECHANICAL PROPERTIES IN FIBER REINFORCED COMPOSITE LAMINATES K Takagi, H Nakatani, S Ogihara (Tokyo Univ. of Science), A Matsuba (Hiroshima Prefectural Technology Research Inst.) In the present study, the effect of fiber discontinuity size on the mechanical properties in CFRP laminate is investigated experimentally. The damage initiation and growth near the fiber discontinuity are also discussed.</p>	<p>T39-3 PT-BASED/CNT ALLOY NANOPARTICLES COMPOSITE FOR HIGH PERFORMANCE DIRECT METHANOL FUEL CELL SH Park, HM Jung, SK Um, YW Song, HS Kim (Hanyang Univ.) DMFC still has the problem, slow reaction and short life time due to CO poisoning of the catalyst and high cost of the platinum catalyst. Therefore, to overcome these problems, we demonstrated novel method for the formation of alloy nanoparticles on carbon nanotube (CNT) by flash light irradiation.</p>	<p>T40-3 RESIDUAL CHARACTERISTIC OF BENDING MOMENT ON REPEATED FOLDING MOTION OF COATED PAPERBOARD CREASED BY ROUND-EDGE KNIFE S Nagasawa, M Nasrudin, Y Shiga, Y Fukuzawa (Nagaoka Univ. of Technology) This work deals the creasing characteristics of coated paperboard. Repeated folding motion was experimentally investigated using the developed new measurement system. The permanent (residual) deformation, the variance of residual stiffness and the hysteresis characteristics of bending moment were analyzed by varying the nominal shear strain (the scoring depth).</p>	<p>T41-3 MG-RICH MG-CU-Zn-GD BULK METALLIC GLASS COMPOSITES WITH ENHANCED PLASTICITY JL Lee, ES Park (Seoul National Univ.) We have prepared in-situ Mg-based BMG composites in newly developed Mg-Cu-Gd-Zn alloy system by the appropriate composition design and well controlled solidification. It is believed that the finding of a novel BMG matrix composites reinforced by in situ precipitates provides a possibility of using Mg-based BMGs as an engineering materials.</p>	
17:30	<p>T36-4 ELECTRICAL AND MECHANICAL PROPERTIES OF POLYURETHANE NANOCOMPOSITES CONTAINING SELF-ALIGNED GRAPHENE SHEETS MM Gudarzi, SH Aboutalebi, QB Zheng, JK Kim (The Hong Kong Univ. of Science & Technology) Highly-oriented graphene sheet reinforced polyurethane (PU) composites are successfully produced based on chemical reduction of aqueous dispersion of graphene oxide in polyurethane. The electrical and mechanical properties of the resulting composites are measured.</p>	<p>T38-4 3D MICROCRACKING NETWORKS OF STITCHED MULTIAXIAL LAMINATES UNDER THERMAL LOADINGS Q Nguyen Thi Thuu, FV Valdivieso, AV Vautrin (Laboratoire Claude Goux) Until recently, structural composites used in the aeronautical industry were still manufactured by the traditional process based on prepregs autoclaving. But occurrence of stitched multiaxial laminates NCF (Non Crimp Fabric) conducing to a new type of high performance preforms for manufacturing complex composite structures by RTM (Resin Transfer Moulding) process.</p>	<p>T39-4 EFFECT OF SURFACE POLARITY OF CELLULOSE NANOFIBERS ON THE MECHANICAL PERFORMANCE OF STARCH BASED COMPOSITE JK Pandey, H Takagi (The Univ. of Tokushima) Two different cellulose nano-fibers were employed to reinforce the matrix of biodegradable polycaprolactone-starch composites and their comparative performance was evaluated in terms of mechanical properties. Initial results indicate that mechanically extracted fiber may be beneficial for the future composite development.</p>	<p>T40-4 DESIGN OF EXPERIMENT: WOOD COMPOSITES BASED ON CROSSLINKED POLYPROPYLENE A Khongrit, U. Meekum (Suranaree Univ. of Technology) Investigation of wood composite based on crosslinked polypropylene was studied. The design of experiment was used to optimizing and quantifying the amount of the composite constituents. The 2k factorial design was conducted to evaluating the statistical effects of material compositions.</p>	<p>T41-4 CONSOLIDATION OF MECHANICALLY MILLED AL-MWCNT NANO-COMPOSITE POWDERS BY THE CONVENTIONAL POWDER METALLURGY PROCESSING H Hendrik, KH Han (Yeungnam Univ.) The consolidation of Al-2%MWCNT-1%Mg nano-composite powders, prepared by the sonication and mechanical milling was investigated by the conventional PM process. The results showed that on sintering milled powder compacts in vacuum or in argon at 650°C, undesired Al₂C₃ formed while in N₂ sinter without Al₂C₃ was produced.</p>	
17:50	<p>T36-5 TOUGHENING OF EPOXY COMPOSITES WITH REDUCED SINGLE-WALLED CARBON NANOTUBES YM Rubi, B Ashraf, J Guan, Y Zhang, C Li, O Bourne, C Kingston, P Hubert, A Johnston, B Simard (National Research Council), V Mirjalil (McGill Univ.) We will show that the fracture toughness of epoxy resins and carbon fiber laminates can be greatly improved using reduced SWCNT. Dynamic mechanical analyses, Raman spectroscopy and imaging, stress-strain curve analyses and fracture toughness tests (mode I and II) are used to support the conclusions.</p>	<p>T38-5 THE USE OF XPS TO INVESTIGATE THE AGEING MECHANISM OF THE PHENOL-UREA-FORMALDEHYDE (PUF) BINDER COATED MINERAL FIBERS A Zafar, J Schjotth-Thomsen, R Sodhi (Aalborg Univ.), D Kubber (Rockwood International) XPS has been used to investigate the ageing mechanism of the phenol-urea-formaldehyde (PUF) binder coated mineral fibres. The results show that the chemical composition of the mineral wool products change significantly after ageing due to hydrolytic degradation of the urea-formaldehyde groups present in the binder.</p>	<p>T39-5 DYE-SENSITIZED SOLAR CELLS WITH A TiO₂ MULTILAYER STRUCTURE FABRICATED USING THE NANO-PARTICLE DEPOSITION SYSTEM JD Choi, MS Kim, DM Chun, SH Ahn, GY Lee, CS Kim, DH Kim (Seoul National Univ.) Semiconductor oxide powders with different diameters were deposited on ITO PET substrate using NPDS. In this paper fabricated multi-layer structure using 15 and 250 nm particles. The TiO₂ powders were deposited with a subsonic nozzle at room temperature. Without sintering process enables to fabricate TiO₂ layer on the flexible substrate.</p>	<p>T40-5 FRACTURE MECHANICS OF CONCRETE REINFORCED WITH HEMP, STRAW AND ELEPHANT GRASS FIBRES I Mienta (Univ. of Technology Vienna), EK Tschegg, SE Standl-Tschegg, A Kollitsch (Univ. of Natural Resources and Life Sciences) This paper reports on an experimental study of the fracture energy of concrete reinforced with natural fibres of hemp, elephant grass, and straw. The uniaxial fracture energy of specimens containing 0,19% of fibres by weight and of 40mm of length has been tested with the wedge splitting test method.</p>	<p>T41-5 FABRICATION OF CARBON NANOTUBE ALUMINUM COMPOSITE BY HIGH RATIO DIFFERENTIAL SPEED ROLLING SJ Cho, WJ Kim (Hongik Univ.), SH Han (Korea Inst. of Materials Science) A possibility of producing the 3vol.% CNTs reinforced aluminum CNTs composites by using sheath rolling and high-ratio differential speed rolling (HRDSR) in sequence has been explored. It was found that HRDSR was effective in powder compaction, uniform dispersion of CNTs, and formation of a good bond between CNT and matrix.</p>	
18:10	<p>T36-6 A FACILE APPROACH TO EPOXY/GRAPHENE PLATELETS NANOCOMPOSITES I Zaman, TM Lip, QH Le, L Luong, Jun Ma (Univ. of South Australia) We in this study developed a facile method to fabricating epoxy/graphene nanocomposites, and investigated their mechanical properties and electrical conductivity. The fracture toughness of epoxy increased significantly upon compounding with graphene, and the electrical conductivity of neat epoxy was improved by a power of 7.</p>	<p>T38-6 BENDING FATIGUE BEHAVIOR OF SMART GLASS-FIBER REINFORCED VINYLESTER COMPOSITE MATERIALS M Drissi-Habti, X Chapeleau (IFSTTAR) In this contribution, some of the research work carried out on deced National Project is presented. The mechanical behavior of smart composite specimens under quasi-static and dynamic fatigue in 3-points bending is investigated experimentally. Acoustic emission technique is used to detect damage development and its propagation as a function of...</p>	<p>T39-6 PHOTOVOLTAIC CHARACTERISTICS OF DYE SENSITIZED SOLAR CELL (DSSC) FABRICATED BY NANO-PARTICLE DEPOSITION SYSTEM (NPDS) CS Lee, YH Kim, KS Kim (Hanyang Univ.) TiO₂ powders for dye-sensitized solar cell (DSSC) were sprayed on indium tin oxide (ITO) glass using nano-particle deposition system (NPDS). The cell fabricated by NPDS shows 3.29% of cell efficiency. That indicated that NPDS is a proper way to improve density of TiO₂ layers which improves the electron diffusion rate.</p>	<p>T40-6 THE EFFECT OF CHEMICAL TREATMENTS ON HEMP REINFORCED COMPOSITES H Wang, MM Kabir, KT Lau (Univ. of Southern Queensland) Glass or carbon fibres are traditionally used as reinforcement in engineering composites. The increasing ecological and environmental concerns have led to an alternative of natural fibres. Among them, hemp fibre offers the best mechanical properties. The main problem with the hemp fibres, as well as other natural fibres, is their...</p>	<p>T41-6 HIGH-PERFORMANCE METAL MATRIX COMPOSITES REINFORCED BY CARBON NANOTUBES J Stein, B Lenczowski (European Aeronautic Defence and Space Company Deutschland GmbH), N Frey, E Angeliere (Universite Montpellier II) Multi-walled carbon nanotubes-reinforced metal matrix composites have been successfully produced by optimized powder metallurgy process. The tensile strength, yield strength and Young's modulus of the carbon nanotubes-reinforced material were considerably increased. The produced material is perfectly homogeneous and dense, and has got high potential for aerospace and space applications.</p>	
	<p>T36-7 NANO-BIO-COMPOSITE MECHANICS: RECENT EXPERIMENTS HD Wagner (Weizmann Inst. of Science) This lecture will focus on techniques for the testing of very small objects belonging to various areas, for example carbon and tungsten sulfide nanotubes in the composites area, and dentin pillars in biology. Some of our recent experimental and theoretical results regarding materials mechanics at the nanoscale will be reviewed.</p>					

	202B	203	301	302	401	402A
16:30	<p>T42 BIO-INSPIRED COMPOSITES Chairs: HC Park/ JH Jeon</p> <p>T42-1 IMPACT AND FLEXURAL STRENGTH OF RAYON BASED ALL-CELLULOSE COMPOSITE LAMINATES T Huber, M Staiger(Univ. of Canterbury), S Bickerton(Univ. of Auckland), J Müssig(Univ. of Applied Sciences Bremen) All-cellulose composite made from rayon textile will be presented. The composites were made by partially dissolving the fibre surface using the ionic liquid- butyl-3-methylimidazolium acetate as solvent. The dissolved cellulose was regenerated in situ to create a strong fibre-matrix-interface. The composite showed high flexural and impact properties.</p>	<p>T43 CARBON NANOCOMPOSITES AND HYBRID ADVANCED COMPOSITES Chairs: BL Wardle/ JM Park</p> <p>T43-1 EFFECT OF CARBON NANOTUBES ON FATIGUE LIFE OF CARBON FIBER/EPOXY COMPOSITES L Gorbatikh, T Li, N De Greef, SV Lomov, I Verpoest(Katholieke Universiteit Leuven) In the current work the effect of carbon nanotubes (CNTs) on the tension-tension fatigue life of a woven carbon fiber/ epoxy composite is investigated. The addition of 0.25wt% of CNTs in the matrix is shown to improve the high cycle fatigue properties in the fiber and bias directions.</p>	<p>T44 IMPACT AND DYNAMIC RESPONSE Chairs: HN Kim/ P Hogg</p> <p>T44-1 AN EXPERIMENTAL COMPARISON OF DIFFERENT CARBON AND GLASS LAMINATES FOR BALLISTIC PROTECTION FY Zhu, C Zhang, XG Chen, P Hogg(Univ. of Manchester), CY Zhu(Zhejiang Sci-Tech Univ.) This programme evaluated both 2D and 3D laminates experimentally and compared their ballistic protection. The results shows that the ballistic performance of a given fibre system is independent of fibre architecture, and is dependent only on the amount of fibres that need to be broken in order to penetrate sample.</p>	<p>T45 MECHANICAL AND PHYSICAL PROPERTIES Chairs: J Xu/ W Chan</p> <p>T45-1 STRAIN BEHAVIOUR OF CFRP HIGH PRESSURE VESSEL DURING MANUFACTURING PROCESS T Kosaka(Kochi Univ. of Technology), O Kosaka, Y Sawada(Osaka City Univ.), J Suzuki(SAMTECH Co., Ltd) During manufacturing a CFRP high pressure vessel, delamination may initiate between a liner and FRP. In this study, strains of the liner and FRP were measured during manufacturing processes. Experimental and analytical results showed that the mechanical characteristics of the pressure vessel are affected by the initial delamination after manufacturing.</p>	<p>T46 PROCESSING AND MANUFACTURING TECHNOLOGIES Chairs: FY Yeh/ A Shojaei</p> <p>T46-1 STUDIES ON TORSIONAL STRENGTH OF CARBON FIBER COMPOSITES SHAFT BY INNOVATIVE SHEET WINDING N Kimoto, M Okochi, N Matsumoto, T Nakamura(FUIKURA RUBBER LIMEI)ED The composites cylindrical tube having spiral structure of prepreg sheets fabricated by simultaneous multi-ply winding reveal more than twenty percent higher ultimate static strength compared with conventionally designed sheet wound tube. During this study, we also developed innovative fabrication machine that can produce this lay-up structure consistently.</p>	<p>T47 DAMAGE IN COMPOSITES OR MECHANICAL PROPERTIES Chairs: LV Smith/ L Smith</p> <p>T47-1 PREDICTION FOR THE TRANSVERSE TENSILE STRENGTH OF UNIDIRECTIONAL COMPOSITES CONSIDERING INTERPHASE BM Zhang(Beijing Univ. of Aeronautics & Astronautics), Z Yang(Harbin Inst. of Technology), CX Liu, XH Wang(Heliongiang Inst. of Technology) The transverse tensile strength of unidirectional composites considering interphase is forecasted by means of finite element method based on the general software Abaqus/Explicit. Two damage models such as interphase debonding and matrix damage are considered during the process of simulation. The interphase debonding is modeled using the "cohesive element".</p>
16:50	<p>T42-2 SYNTHESIS OF CU-DOPED WO₃ MATERIALS WITH PHOTONIC STRUCTURES FOR GAS SENSORS SM Zhu, XY Liu, YD Li, D Zhang(Bio-inspired Composites) Copper doped WO₃ with photonic crystal structures has been fabricated by using Morph butterfly wings as hard-template, which presents high response sensitivity as well as a high selectivity to trimethylamine.</p>	<p>T43-2 ALIGNED CARBON NANOTUBE/NAFION NANOCOMPOSITE IONIC ELECTROACTIVE POLYMER ACTUATORS Y Liu, S Liu(The Pennsylvania State Univ.), RG de Villoria, H Cebe(Massachusetts Inst. of Technology) Recent advances in fabricating controlled-morphology aligned carbon nanotube (VA-CNTs) create unique opportunities for markedly improving the electromechanical performance of ionic polymer conductor network composite actuators (IPNCs). The experimental results show that CNTs allow fast ion transport and low electrical resistance that lead to large actuation and fast actuation speed.</p>	<p>T44-2 BLUNT IMPACT DAMAGE FORMATION IN FRAME AND STRINGER STIFFENED COMPOSITE PANELS GK DeFrancisci, ZM Chen, HN Kim(Univ. of California San Diego) Ground service equipment (GSE) and maintenance vehicles are the largest source of major damage to commercial aircraft. Resulting damage can be extensive and yet difficult to visually detect especially for composite airframe structures. Two specimens have been experimentally evaluated to characterize the damage progression caused by this type of impact.</p>	<p>T45-2 ANALYTICAL MODEL FOR COMPUTING THERMAL EXPANSION COEFFICIENTS AND THERMAL STRESS IN UNIDIRECTIONAL LAMINA WVS Chan, N Srisuk(University of Texas at Arlington) A unit cell model with an elliptical fiber cross-section was developed to calculate both the longitudinal and transverse thermal expansion coefficients and the fiber and matrix stresses of lamina. The study shows that the fiber shape has significant effect in the transverse CTE but not in the longitudinal CTE.</p>	<p>T46-2 CHARACTERISTICS AND APPLICATION OF AN EPOXY RESIN HAVING THERMOPLASTIC BEHAVIORS YS Park, JC Kim, TS Park, JM Cho(Hankuk Carbon Co., Ltd.), Y Tsujimura(Nagase Chemtex Corporation), H Suzuki(Nagase & Co., Ltd.) The evaluation on the thermoplastic epoxy was performed in two ways. One was examined as cured resin itself. The other was in forms of fiber reinforced plastics (FRP). Mechanical, physical and thermal properties were measured and also possibility on reusability or recyclability was examined for the thermoplastic epoxy.</p>	<p>T47-2 COMPARISONS OF DAMAGE GROWTH UNDER BIAXIAL LOADING LV Smith, M Salavatan(Washington State Univ.) This study considered composite pressure vessels with a bias fiber orientation. All test coupons produced matrix dominated failure modes (transverse or shear). The first ply failure strain and modulus reduction was relatively constant for the each failure mode. Shear failure modes showed hardening, while transverse failure modes showed softening.</p>
17:10	<p>T42-3 DESIGN OF MULTILAYERED SPRUCE LAMINATES FOR MOISTURE-SENSITIVE ACTUATING COMPONENTS W Hufenbach, M Gude, F Adam, V Lustig, S Spitzer, C Kirvel, C Neimhus(Technische Universität Dresden) The anisotropic elongation of unidirectional singlelayers induced by moisture expansion can lead to a complex residual stress state in unbalanced spruce laminates. These tensions can cause bending deformations. To predict the deformation behavior, an analytical and numerical tool was designed. The results of both calculation models could be experimentally verified.</p>	<p>T43-3 NON-LINEAR THERMAL CONDUCTIVITY ENHANCEMENT IN NANOCOMPOSITES WITH ALIGNED-CNT IMPLEMENTATION N Yamamoto, BL Wardle(Massachusetts Inst. of Technology), AM Marconnet(Stanford Univ.) Carbon nanotubes (CNTs) in composites tend not to achieve the high thermal conductivity values of individual CNTs. Factors behind such scaling effects include CNT morphology and boundary properties. In this work, consistent CNT samples with well-controlled morphology were thoroughly evaluated and compared with both analytical and numerical transport models.</p>	<p>T44-3 IMPACT PROPERTIES OF JUTE AND JUTE HYBRID REINFORCED COMPOSITES Y Yu, YQ Yang, H Hamada(Kyoto Inst. of Technology) At current study, a preliminary investigation on the impact properties and morphologies of unsaturated polyester reinforced by jute woven fabric from the used coffee bags with different moisture contents were carried out. Additionally, the effects of the hybridization with glass woven fabric laminated structures were also investigated.</p>	<p>T45-3 VIBRATION CHARACTERISTICS OF EMBEDDED DOUBLE WALLED CARBON NANOTUBES SUBJECTED TO AN AXIAL PRESSURE XW Lei, T Natsuki, JX Shi, QQ Ni(Shinshu Univ.) The elastic matrix containing embedded carbon nanotubes (CNTs) leads to new nanocomposites. Radial breathing mode (RBM) frequency is used to precisely determine the geometry of CNTs. In this work, the RBM frequency of embedded (double walled CNTs) DWCNTs subjected to axial pressure is studied by using an elastic continuum model.</p>	<p>T46-3 PREPARATION AND ELECTROMAGNETIC PROPERTIES OF MAGNETIC PARTICLES EMBEDDED COMPOSITE FILMS FOR NEAR-FIELD ELECTROMAGNETIC NOISE SUPPRESSION SB Lee, JW Yi, HS Choe, SK Lee(Korea Inst. of Materials Science), KH Kim(Yeungnam Univ.) The near-field EM absorbing composite films containing magnetic Ni/Fe-Co hollow fibers were fabricated through electroless plating. The magnetic hollow fibers are effective fillers for EM absorbing materials and improve the EM noise suppression in high frequency band due to excellent electromagnetic properties such as high permittivity and high permeability.</p>	<p>T47-3 EFFECT OF NANOREINFORCEMENT ON DISCRETE AND CONTINUUM DAMAGE MECHANISMS IN LAMINATED COMPOSITES AR Shaikh, G Lubineau, M Jouiad(King Abdullah Univ. of Science and Technology) In the present work, the transverse matrix cracking behaviors were investigated experimentally for two systems of glass fiber reinforced epoxy composites: with CNTs and without CNTs. An experimental campaign which involves 4 plies and 8 plies cross-ply [90₀]_n laminates were conducted in this study.</p>
17:30	<p>T42-4 THE SKELETON OF EUPLICTELLA ASPERGILLUM AS FOUNDATION FOR THE DEVELOPMENT OF NOVEL COMPOSITE AEROSPACE STRUCTURES D Bacheva, RS Trask(Univ. of Bristol), MSA Elsayed(McGill Univ.) The hierarchical organisation of E. aspergillum is an example of an effective design strategy for improving the performance of an inherently brittle material such as silica. The excellent mechanical stability of the skeleton comes from the elaborate interaction between the various components, formed with an optimum use of material.</p>	<p>T43-4 VACUUM ASSISTED INFUSION OF HYBRID ALIGNED CARBON NANOTUBE-FIBER COMPOSITES FOR MECHANICAL REINFORCEMENT SS Wicks, D Lidston, RG Devilloria, BL Wardle(MIT) Aligned carbon nanotubes are introduced on advanced fiber weaves through in situ chemical vapor deposition. The permeability of fuzzy fiber Reinforced Plastic (FFRP) laminates dropped by less than 10x with the longest CNTs. Results indicate that processing of large FFRP laminates with an aerospace-grade resin can be accomplished by infusion.</p>	<p>T44-4 EVALUATING THE USE OF ELASTOMERS IN IMPROVING BLAST RESISTANCE OF FIBRE-METAL COMPOSITES R Das, D Vershalo(Univ. of Auckland), J Ari-gur(Western Michigan Univ.) This paper investigates the effectiveness of Fibre Metal Laminates (FML) in withstanding blast loading using finite element simulations. Three different types of laminates were investigated. It was found that the addition of an elastomer layer can contribute to an increase in the blast performance of the laminate.</p>	<p>T45-4 NUMERICAL HOMOGENISATION OF PARTICLE-REINFORCED NEO-HOOKEAN COMPOSITE XH Shi, ZU Guo(Newcastle Univ.), XG Peng(Shanghai Jiao Tong Univ.), J Harrison(Univ. of Glasgow) Although the mechanical properties of particle-reinforced composites in infinitesimal strain have been investigated extensively, their mechanical behaviour in the finite deformation regime is still not well-understood due to the intrinsic difficulties related to the geometrical and material nonlinearities. In this paper, the mechanical response of neo-Hookean composite under general finite.</p>	<p>T46-4 EFFECT OF MOLDING CONDITION ON IMPACT PROPERTY OF GLASS FIBER REINFORCED THERMOPLASTICS USING IN-SITU POLYMERIZABLE POLYAMIDE 6 AS THE MATRIX K Nakamura, G Ben, N Hirayama(Nittoboseki Co., Ltd.), H Nisida(Nagase Chemtex Corporation) The effect of molding conditions on the mechanical properties of glass fiber reinforced in situ polymerizable polyamide 6 matrix (I-GRTP) were investigated by the use of differential scanning calorimeter (DSC), three-point bending tests and Izod impact tests for various types of the composites.</p>	<p>T47-4 TRANSLAMINAR PLY FRACTURE TOUGHNESS OF ADVANCED COMPOSITES RF Teixeira, ST Pinho, P Robinson(Imperial College London) This paper aims to relate the translaminar toughness of individual plies to the translaminar toughness of the laminate, by obtaining the resistance curves (R-curves) both for the plies and laminate from the experimental data. The fracture surfaces were examined using SEM to find relationships between the features of these surfaces...</p>
17:50	<p>T42-5 FACILE SYNTHESIS OF SULFONATED POLYIMIDE WITH HIGHLY CONDUCTIVE SILVER ELECTRODE VIA DIRECT ION-EXCHANGE SELF-METALLIZATION FOR ELECTRO-ACTIVE ARTIFICIAL MUSCLE JK Song, JH Jeon, IK Oh(KAIST) We report a novel facile, eco-friendly approach to prepare well-defined silvered sulfonated polyimide (SPI) via direct ion-exchange self-metallization for electro-active artificial muscle. The as-prepared silver electrode is highly conductive and exhibit strong adhesive with sulfonated polyimide matrix, leading to a much higher tip displacement compared with Nafion 117.</p>	<p>T43-5 A NOVEL ROUTE FOR PREPARATION OF NANO-STRUCTURED CARBON GOLD COMPOSITE BALL FROM ARBORESCENT COPOLYMER MICELLES MY Huh, MH Jung, W Ki, SJ Kang, Si Yun(Jeonju Inst. of Machinery and Carbon Composite) Carbonaceous materials have been employed as catalyst support, separation medium, energy storage and conversion system. Pyrolysis of ordered micelles on the substrate leads to stable carbon ball or nano-patterned carbon materials. In contrast to conventional micelles, dendritic micelles retain much more stable morphology due to their covalently bonded structures. In...</p>	<p>T44-5 HYBRID PARTICLE-ELEMENT SIMULATION OF COMPOSITE MATERIAL IMPACT PHYSICS KJ Son(American Univ.), EP Fahrenthold(Univ. of Texas) In this paper, previous and ongoing computational research employing a hybrid particle-element method is summarized and presented for the following advanced composite material systems: reinforced carbon-carbon composites, Kevlar-epoxy composites, multi-layered Kevlar woven fabrics, aluminum-Kevlar orbital debris shields, and porous tile thermal protection systems.</p>	<p>T45-5 DAMAGE PREDICTION IN POLYMERIC COMPOSITES: UP-DATE OF PART(A) OF THE THIRD WORLD-WIDE FAILURE EXERCISE (WWFE-III) AS Kaddour, M Hinton(QinetiQ), SG Li(Univ. of Nottingham), P Smith(Univ. of Surrey) A high profile international activity is currently underway to assess the maturity of well established methodologies for the prediction of damage (matrix cracking and delamination) and ultimate failure in composite laminates. The activity is known as the 3rd World-Wide Failure Exercise (WWFE-III).</p>	<p>T46-5 NEW POLYMER ALLOYS BASED ON IN SITU-POLYMERIZABLE POLYAMIDE 6 APPLICABLE TO HIGH CYCLE RESIN TRANSFER MOLDING (I) H NISIDA, T Imahishi(Nagase Chemtex Corporation) The purpose of this study is to develop a new resin applicable to high cycle resin transfer molding for automotive application. In this study, we tried to form polymer alloy based on the in situ-polymerizable polyamide 6 without reducing the excellent workability of the monomer mixture by using isocyanate prepolymers...</p>	<p>T47-5 A METHODOLOGY FOR G-CONTROLLED FATIGUE CHARACTERIZATION OF SANDWICH FACE/CORE INTERFACES USING THE MMB AND MODIFIED TSD SPECIMENS C Berggreen, M Manca, G Paladini, A Quispitupa(Technical Univ. of Denmark), LA Carlsson(Florida Atlantic Univ.) The current study focuses on the development of a methodology to perform fatigue crack growth characterization of debonded sandwich composites under well controlled cyclic energy release rate amplitude (G-control) and mode-mixity. The methodology is demonstrated using the sandwich MMB and modified TSD specimens.</p>
18:10	<p>T42-6 DEVELOPMENT OF BIRD-MIMETIC SPAN-WISE CAMBERED CARBON/FIBROXY SPAR STRUCTURE FOR FLAPPING WING OF FLYING ROBOT KI Yoon, HJ Hwang, S Widihianni, BS Yoon, DK Chung, JH Kim(Konkuk Univ.) This paper investigate the design and performance of carbon/ epoxy spar structure for the flapping wing of a 50 cm flying robot, mimicking those of birds by applying camber along span-wise direction and different aspect ratio. Experiments include the measurement of wing stiffness and force measurement in wind tunnel.</p>	<p>T43-6 CHARACTERIZATION OF ELECTRICAL CONDUCTIVITY IMPROVEMENT FOR CARBON NANOCOMPOSITES YQ Wang, YR Wang, CO Won, Ji Song(Changwon National Univ.), JH Byun, BS Kim(Korea Inst. of Materials Science) Carbon nanoparticles (CNPs) have attracted a great deal of attention in many research fields, due to their special electronic, mechanical, and chemical properties. The applications of CNPs for many industrial and commercial practices are expected to be increased considerably. As these properties make them ideal, CNPs are expected to be...</p>	<p>T44-6 NUMERICAL EVALUATION OF HOPKINSON BAR TEST FOR CARBON FIBER REINFORCED PLASTICS K Suga, K Okamoto, S Ogihara, M Kikuchi(Tokyo Univ. of Science) The present study evaluates the effectiveness of the split Hopkinson bar (SHPB) test for carbon fiber reinforced plastics (CFRP) by a dynamic finite element method. The effects of the length of specimen, duration time and observation point identified material properties by SHPB are examined through several simulations.</p>	<p>T45-6 COMBINATION SHEAR-COMPRESSION TESTING OF FOAM MATERIALS FOR THEIR APPLICATION IN BICYCLE HELMETS OR OTHER COMPLEXLY LOADED STRUCTURES K Vandenberghe, J Jans, I Verpoest, J Goffin, G Van Der Perre, J Vander Sloten(Katholieke Universiteit Leuven) Rotational accelerations during bicycle accidents cause significant brain injuries. They create a mixed shear-compression loading on the foam structure. This paper presents a new static combined compression-shear test method with variable shear-compression ratios. Comparison with standard test methods proved its validity, and first test results on two foams are presented.</p>	<p>T46-6 RHEOLOGICAL PROPERTIES OF NANOCOMPOSITES BASED ON POLYAMIDE66/POLYAMIDE6/ MULTI-WALLED CARBON NANOTUBE PREPARED BY MELT MIXING AH Hadiadzei, A Shojaei, R Bagheri(Sharif University of Technology) It was found that the effectiveness of MWNT on the rheological performance of PA66 was improved by incorporation of PA6 in the nanocomposite. This could be explained by the improvement of dispersion of MWNT in the matrix by incorporation of PA6.</p>	<p>T47-6 THE EFFECT OF PLY THICKNESS ON THE DAMAGE MECHANISMS IN NOTCHED COMPOSITES ZS Li, ZD Guan, W He, DB Liu(Beihang Univ.) The effect of ply thickness on the damage mechanisms in notched composites in order was investigated using progressive failure analysis (PFA) methodology. For thicker ply laminates, higher thermal residual stresses lead to accelerating matrix cracking, delamination, splitting damage and failure type transits from brittle or pull-out to delamination...</p>
	<p>T42-7 COMPOSITE ARTIFICIAL WING MIMICKING A BEETLE HIND-WING QV Nguyen, NS Ha, HC Park, NS Goo(Konkuk Univ.) In this paper, we have successfully fabricated an artificial wing mimicking the real hind wing of beetle, Allomyrina Dichotoma, by using a simple procedure of composite fabrication. Finite element analyses, stiffness measurements and dynamic vibration tests for the real beetle hind wing and the artificial wing were conducted to compare...</p>		<p>T44-7 BALLISTIC IMPACT PERFORMANCE OF COMPOSITE PLATE WITH AND WITHOUT BONDING H Kasano(Takushoku Univ.) Ballistic impact performance of two layered composite plates consisting of PC and PMMA monolithic plates is studied. Semi-empirical approach for predicting the impact properties is presented and then ballistic impact tests are carried out to verify the predictions ...</p>	<p>T45-7 MICRO-MECHANICS THEORY APPLIED IN AERONAUTICAL PRODUCT DEVELOPMENT FK Arakaki(EMBRAER S.A.) The main purpose of this paper is to describe two applications that were made in the EMBRAER airplanes development program, considering the Micro-Mechanics theory. It should be pointed out that the results of the simulation were used to give directives to the certification campaign.</p>		

	Halla A	Halla B	Samda A	Samda B	201A	202A
08:30	PL9: CARBON NANOTUBE FIBERS: CHALLENGES AND OPPORTUNITIES Tsu-Wei Chou(University of Delaware) (Chair: JH Byun)		PL10: THE IMPACT DAMAGE AND THE LOW COMPRESSION STRENGTH OF THE COMPOSITE LAMINATES Hiroshi Suemasu(Sophia University) (Chair: M Hojo)			
Break						
09:15	W1 NANOCOMPOSITES Chairs: Z Liang/ T Kuila W1-1 THERMAL AND MECHANICAL PROPERTIES OF MICROWAVE CURED SIC/ EPOXY NANOCOMPOSITES VK Rangari, R Rabby, S Jeelan(TUSKEGEE Univ.) Microwave processing is successfully used in producing epoxy based polymer nanocomposites infused with SIC nanoparticles. In this technique, the nanocomposite curing time is drastically reduced from 18 hours to 30 minutes without compromising the thermal and mechanical properties.	W2 TEXTILE COMPOSITES: 3D PREFORMING- AND DAMAGE TOLERANCE Chairs: S Lomov/ P Potluri W2-1 MECHANICAL BEHAVIOUR OF NON-CRIMP 3D WOVEN CARBON/EPOXY COMPOSITE UNDER IN-PLANE TENSILE LOADING SV Lomov, V Verpoest(Katholieke Univ.), AE Bogdanovich, D Mungalov(Vocational School of Technical Sciences), M Karahan(Uludag Univ.) The paper studies internal structure and mechanical properties, damage progression in quasi-static and fatigue tension loading of a non-crimp 3D woven carbon/epoxy composites...	W3 DURABILITY OF POLYMER MATRIX COMPOSITES Chairs: JH Byun/ SS Jeon W3-1 THE MECHANICAL EFFECTS OF DENSE UV-RADIATION ON PULTRUDED POLYMER-MATRIX A Cordelle, M Drissi-habti(IFSTAR) Vinyl ester UV-exposed mechanical properties are studied using nonradiationinduced. Roughness caused by UV-exposure leads to a huge standard deviation. Characterization of the evolution of mechanical properties with exposure time and quantification of the depth affected by UV radiations can be carried out using a new method: analyse the cross section.	W4 AEROSPACE APPLICATIONS Chairs: JH Han/ P Curtis W4-1 ELECTROACTIVE POLYMER AND ITS COMPOSITES: THEORY, EXPERIMENT AND APPLICATIONS Y Liu, L Liu, J Leng(Harbin Inst. of Technology) This paper reviews the theory, experiment and applications of electroactive polymer and its composites.	W5 RESEARCH AND DEVELOPMENT OF GREEN COMPOSITES Chairs: DH Cho/ SH Lee W5-1 CELLULOSE NANOFIBER PREPARATION BY STEAM OR OZONE TREATMENT/MECHANICAL FIBRILLATION AND ITS APPLICATION FOR NANOCOMPOSITE JH Jiang, NH Kim(Kangwon National Univ.), SH Lee(Biomass Technology Research Center) Steam and ozone treatments were conducted to disturb wood cell wall supramolecular structure for enhancing the mechanical fibrillation of Pinus koraiensis. Both treatments were effective to generate porous structure in cell wall by partially extracting or degrading hemicellulose and lignin.	W6 EXPERIMENTAL TECHNIQUES Chairs: E Ruiz/ L Lee W6-1 TRANSIENT AIR PERMEABILITY MEASUREMENT OF FIBROUS REINFORCEMENT Y Hoo, S Comas-cardona, C Binetruy(Ecole des Mines de Douai), S Driapier(Ecole Nationale Supérieure des Mines) A methodology to measure fabric in-plane permeability using a transient air flow has been described. The method is convenient, clean and fast, avoids usage of a gas flow meter. The results match well the permeability measured with liquid compression and injection techniques.
09:35	W1-2 THERMOPHYSICAL AND TENSILE BEHAVIOR OF HYBRID EPOXY COMPOSITES WITH BORON CARBIDE PARTICULATES S Patankar, B Mohan, A Kelkar(NC A&T State Univ.) Thermo-physical and tensile behavior of epoxy-fiberglass composites hybridized with Boron Carbide (B ₄ C) nanoparticles are studied. 5 wt.% B ₄ C shows marginal degradation in the tensile properties. However, strong radiation weathering capability of epoxy and higher thermal neutron cross section of B ₄ C, they offer potential as radiation shielding material for space structures.	W2-2 FATIGUE BEHAVIOR OF A 3D BRAIDED CARBON/EPOXY COMPOSITE V Carvelli, J Pazmino (Politecnico di Milano), S Lomov, I Verpoest(K. U. Leuven), A Bogdanovich, D Mungalov(3TEX Inc.) The topic of the present work is the fatigue behavior of 3D braided carbon fiber composites. The experimental investigation involved: tensile-tensile cyclic tests to obtain a fatigue life curve and to evaluate the effect of FVF on the fatigue life; micro-CT observations to capture the damage imparted during cyclic loading.	W3-2 CHARACTERISATION OF HEXTOOL COMPOSITE FOR RTM MOULDS K Szymanska, M Salvia(Ecole Centrale Lyon) HexTOOL composite is a new mould solution for the manufacture of aerospace components. It needs to be properly characterized in term of its thermomechanical behaviour for which it can be subjected during manufacturing life cycle and to evaluate the effect of FVF on the fatigue material behaviour, thermo-mechanical tests and durability investigation.	W4-2 DIELECTRIC BEHAVIOR AND THERMO-MECHANICAL PERFORMANCE OF BATIO3 REINFORCED AND CARBON REINGORCED EPOXY COMPOSITES AC Patsidis, GC Psarras, K Kalaitzidou(Georgia Inst. of Technology) In this study, ceramic and exfoliated graphite nanoplatelets are used as epoxy reinforcements resulting in composites with enhanced dielectric, electrical, and thermo-mechanical properties. Possible synergy on the composites performance is also investigated by fabricating and characterizing composites containing both ceramic and carbon fillers at various ratios.	W5-2 EFFECT OF SURFACE MODIFICATION ON FLEXURAL PROPERTIES OF JUTE FIBER GREEN COMPOSITES HJ Kim(Kyungpook National Univ.), S Miyamoto, Y Takada, K Takemura(Kanagawa Univ.) Green composites, consisting of an association of a biodegradable polymer matrix and a natural fiber as reinforcement have become popular due to both increasing social and economic pressure to conserve petroleum resource. Green composites offer environmental benefits such as biodegradability, less greenhouse gas emissions, and renewability of the base material.	W6-2 MULTI-SCALE DEFORMATION BEHAVIOR IN HYBRID CFRP OBSERVED BY IN-SITU FE-SEM Y Tanaka, K Naito, S Kishimoto, Y Kagawa(National Inst. for Materials Science) The developed multiscale pattern was applied to measure in-plane multiscale deformation and strain distribution in a hierarchical microstructure carbon fiber-reinforced composite by using in situ FE-SEM observations. The present study provides localized deformation behaviors and fracture initiation site at multiple length scales.
09:55	W1-3 THE INFLUENCE OF SUPRAMOLECULAR MICROSTRUCTURES ON THE LOAD TRANSFER EFFICIENCY FOR SINGLE CARBON NANOTUBE FIBER EMBEDDED POLYPROPYLENE COMPOSITES L Liu, Y Gao, MY Xie, Z Zhang(National Center for Nanoscience and Technology) CNT fibers could act as heterogeneous nucleate agents to form transcrystallinity layer around polypropylene matrix. Micro-Raman tests have revealed that load-bearing capability of CNT fiber was greatly dependent on the microstructure of iPP transcrystals, in which the negative birefringence of TCL is favorable for the load transfer efficiency.	W2-3 IMPACT DAMAGE ANALYSIS OF 3D WOVEN CARBON FIBRE COMPOSITES USING COMPUTED TOMOGRAPHY E Archer, S King, S Buchanan, A McIlhagger, J Quinn(Univ. of Ulster) This paper investigates the damage imparted to 3D orthogonal woven fabric composite by drop weight impact and compression after impact (CAI) testing. Furthermore, specimens are analysed using computed tomography (CT) and through transmission ultrasound inspection to observe how an impact event affects the structural integrity of the 3D woven composite.	W3-3 CREEP OF FULLY OR PARTIALLY FRP-CONFINED SQUARE OR CIRCULAR CONCRETE COLUMNS Y Ma, Y Wang, B Han, M Liu(Beijing Jiaotong Univ.) This paper focuses on the experimental investigation and modeling approach of the creep of fully or partially FRP-confined square or circular concrete columns. A total of four fully FRP-confined square specimens and six partially FRP-confined circular ones with different concrete mixes are tested for shrinkage and creep.	W4-3 MULTI-PHYSICS NANO-ENGINEERED STRUCTURAL DAMAGE DETECTION AND DE-ICING RG De Villoria, S Wicks, BL Wardle, A Miravete(MIT), SS Kessler(Mettis Design Corp.) Catastrophic structural failures are the cause of many physical and personal losses every year, with prevention estimated at billions of dollars each year. Non-destructive evaluation (NDE) techniques have been pursued and employed for damage detection of such structures to detect cracks and other damage at pre-critical levels for remediation.	W5-3 TENSILE PROPERTY IMPROVEMENT BY CYCLIC LOADING TREATMENT FOR RAMIE/PP COMPOSITES J Noda, K Matsushige, K Goda(Yamaguchi Univ.), H Marutani, K Aoki, S Arai(Kayaku Akzo Corp.) The purpose of this study is to develop a green composite with high strength and stiffness through cyclic load application due to the reorientation of cellulose microfibrils. After cyclic loading, while neat resin specimens were lowered in strength and stiffness, the composite specimens increased in strength and stiffness.	W6-3 COMPARISON OF WETTABILITY AND CAPILLARY EFFECT EVALUATED BY DIFFERENT CHARACTERIZING METHODS S Wang, MJ, Y Gu, Y Li, Z Zhang(Beihang Univ.) This paper aims to compare the capillary pressures and contact angles obtained by Wilhelmy plate, droplet spreading, wicking, and infiltration experiments driven by external pressure. The resultant contact angles and capillary pressures are quite different from these measurements, and the capillary pressures in axial impregnation show dynamic features.
10:15	W1-4 MECHANICAL BEHAVIOUR OF WAVINESS-DOMINATED CONTROLLED MORPHOLOGY ALIGNED CARBON NANOTUBE POLYMER COMPOSITES: MODELING STUDY CORRELATED WITH EXPERIMENTS H Cebeci(MIT/TU), HS Turkmen(TU), BL Wardle(MIT) The elastic response of controlled-morphology nanocomposites comprised of aligned, but wavy, carbon nanotubes (CNTs) is studied theoretically and in comparison to prior experimental data. Waviness of the CNT reinforcement in the polymeric composites is shown to dominate the elastic response so its contribution to composite modulus is deduced.	W2-4 A A PROPOSAL OF FE MODELING OF UNIDIRECTIONAL COMPOSITE CONSIDERING UNCERTAIN MICRO STRUCTURE Y Fujita, T Kurashiki, H Yamatsuka, M Zako(Osaka Univ.) The aim of this study is to estimate the dispersion of strength of unidirectional composites. The simplified FE model of UD composite considering random fiber arrangement is proposed to avoid huge computational costs. Strength under share, tensile or compressive and the combinational loads are estimated by the model.	W3-4 DAMAGE ACCUMULATION AND LIFETIME PREDICTION OF WOVEN GFRP UNDER CONSTANT TENSILE LOAD TEST IN HYDROCHLORIC ACID SOLUTION M Kotani, H Kawada, Y Yamamoto, Y Sato, R Sato(Waseda Univ.) The delayed fracture of corrosion resistant GFRP under constant tensile load in deionized water and hydrochloric acid is discussed in this paper. The fracture time was predicted based on the assumption of global load sharing by substituting the degradation of the GFRP constituents.	W4-4 HYGROTHERMALLY STABLE LAMINATES WITH EXTENSION-TWIST AND BEND-TWIST COUPLINGS R Haynes, E Armanios(Univ. of Texas at Arlington) The material-independent hygrothermal-stability conditions are derived from Classical Lamination Theory and used in conjunction with specific coupling coefficients in an optimization routine to identify hygrothermally stable stacking sequences with optimal coupling. Of particular interest is the combined effect of extension-twist and bend-twist couplings.	W5-4 EVALUATING THE CARBON STORAGE POTENTIAL OF FURAN RESIN-BASED GREEN COMPOSITES Terence Palad Tumalon(Univ. of the Philippines), M Kubouchi, S Aoki(Tokyo Inst. of Technology), T Sakai(Nihon Univ.) The carbon storage potential of thermoset-based NFRP's is investigated. The use of furan resin to improve carbon fixation is evaluated in comparison to orthophthalic-type UP. Carbon storage potential is expressed as both net bio-based carbon content and net CO ₂ emission. Mechanical strength test also shows furan's viability as ortho-UP substitute.	W6-4 CHARACTERISATION OF IMPACT BEHAVIOUR OF CARBON FIBRE LAMINATES M Mateos, H Zabala, J Mugica, I Arretxabala, M Sarrionandia(Mondragon Univ.) In this communication a previously developed characterisation method is applied to a carbon epoxy composite subjected to impact. This method is based on the instrumented tensile impact technique and has enabled to obtain stress-strain curves. The results show the material properties dependency on strain rate...
10:35	W1-5 DAMAGE SENSING IN FIBER COMPOSITES USING NON-UNIFORMLY DISPERSED CARBON NANOTUBES L Gao(Beijing Univ.), T Chou, ET Thostenson (Univ. of Delaware), M Li, Z Zhang (Beihang Univ.) This paper reviews our work in damage sensing of composites in which carbon nanotubes were dispersed through a fibering agent. Damage propagation of this composite under static, cyclic and impact loadings have been examined. The electrical response of the specimens enables a quantitative measure of the damage state.	W2-5 CHARACTERISATION AND MODELLING OF THE HIGHLY DYNAMIC DEFORMATION AND FAILURE BEHAVIOR OF PREVIOUSLY FATIGUED 3D TEXTILE COMPOSITES W Hufenbach, M Gude, R Protz(TU Dresden) Material models usually assumed a defect free material. In practice, often occurring defects are mostly considered globally using safety factors which lead to overising. Extensive studies on non-crimp fabric reinforced composites analyze the influence of fatigue predamage under subsequent highly-dynamic loading. For the mathematical description an additive model was introduced.	W3-5 EFFECT OF CYCLIC HYGROTHERMAL AGING AND DRYING TEMPERATURE ON THE INTERFACIAL PROPERTIES OF BMI/CARBON FIBER COMPOSITE P Sun, Y Zhao, Y Luo, Y Duan, L Zhang(Beihang Univ.) This paper presents a proposed method of producing new circular reinforced concrete columns reinforced with various types of reinforcing materials. The experimental program includes casting and testing up to failure sixteen circular columns having the same dimensions of 72 mm in diameter and 1m long were tested under concentric compression ...	W4-5 STRUCTURAL BEHAVIOUR OF REINFORCED CONCRETE COLUMNS REINFORCED WITH VARIOUS MATERIALS YB Shaheen, M Hassanen(Engineering College) This paper presents a proposed method of producing new circular reinforced concrete columns reinforced with various types of reinforcing materials. The experimental program includes casting and testing up to failure sixteen circular columns having the same dimensions of 72 mm in diameter and 1m long were tested under concentric compression ...	W5-5 EFFECT OF NEEDLE PUNCHING ON STRENGTH OF STAMPABLE SANDWICH SHEET FABRICATED WITH BAMBOO FIBER AND RECYCLED CARBON FIBER MAT J Koike, K Okubo, T Fujii(Doshisha Univ.) The effect of needle punching on the recycled carbon fibers for the skin layer was investigated. By applying the needle punching technique to the proposed sandwich mat with the surface layers of carbon fibers, 112% of final improvement ratio was obtained when the punching density was 40/cm ² .	W6-5 CHARACTERISATION OF WAVINESS DEFECTS IN INDUSTRIAL COMPOSITE SAMPLES S Lemaitre, M Sutcliffe(Univ. of Cambridge), A Scott(Univ. of Southampton) The poor compressive strength of unidirectional composite is due to localised fibre misalignment affecting the plastic buckling mechanism. Fibre misalignment in real composites is distributed throughout the material. Characterising the distribution of fibre orientations is necessary to accurately determine compressive strength, and thus the strength reduction due to misalignment defects.
10:55	W1-6 MODELLING COMPACTION EFFECT ON PERMEABILITY OF 3D CARBON REINFORCEMENTS X Zeng, AC Long, F Gommer, A Endrueillet, MJ Clifford(Univ. of Nottingham) An approach to characterise and model the effects of compaction on permeability of 3D carbon reinforcement is presented. X-ray computed tomography is used to achieve high quality images. The deformed geometry is modelled in TexGen and CFD flow simulation is solved in ANSYS CFX to predict permeability under different compaction.	W2-6 MODELLING COMPACTION EFFECT ON PERMEABILITY OF 3D CARBON REINFORCEMENTS X Zeng, AC Long, F Gommer, A Endrueillet, MJ Clifford(Univ. of Nottingham) An approach to characterise and model the effects of compaction on permeability of 3D carbon reinforcement is presented. X-ray computed tomography is used to achieve high quality images. The deformed geometry is modelled in TexGen and CFD flow simulation is solved in ANSYS CFX to predict permeability under different compaction.	W3-6 DYNAMIC BEHAVIOR OF VIRGIN AND RECYCLED PP/PEFR AND PP/EPDM/TALC MATERIALS FOR CAR BUMPERS N Bahlouli, YY Remond, K Wang, R Matadi, S Ahzi(IMFS-Univ. de Strasbourg) The recycling of polymers for the automotive applications will impose recycling of used part as the shielding parts. In order to recycle recycled polymers for structural parts of cars, recycling effects on quasistatic to high strain rates response for different temperatures of composite based polypropylene were studied in this paper.	W4-6 SUPERHYDROPHOBIC AND SUPEROLEOPHOBIC NANOCCELLULOSE AEROGEL AS BIOINSPIRED CARGO CARRIERS ON WATER AND OIL H Jin, M Kettunen, A Laiho, H Pynnönen, J Paltakari, A Mar(Helsinki Univ. of Technology) We demonstrate that superhydrophobic and superoleophobic nanocellulose aerogels, consisting of fibrillar networks and aggregates with structures at different lengths scales, support considerable load on a water surface and also on oils as inspired by floatation of insects on water due to their superhydrophobic legs. The aerogel is capable of supporting ...	W5-6 COMPARISON BETWEEN GLASS AND FLAX NON-CRIMP STITCHED FABRICS L Bizet, G Sebastian, R Christopher(Univ. du Havre), O Pierre(Univ. d'Orleans) Our study compares glass and flax fibers arranged in non-crimp stitched fabrics (NCF). This paper gives results on critical process parameters, i.e. longitudinal and transverse permeability, for both non-crimped fabrics. Tensile mechanical properties from both NCF associated with a classical epoxy resin and partially agro-resourced polyurethane are measured.	W6-6 CHARACTERISATION OF IMPACT BEHAVIOUR OF CARBON FIBRE LAMINATES M Mateos, H Zabala, J Mugica, I Arretxabala, M Sarrionandia(Mondragon Univ.) In this communication a previously developed characterisation method is applied to a carbon epoxy composite subjected to impact. This method is based on the instrumented tensile impact technique and has enabled to obtain stress-strain curves. The results show the material properties dependency on strain rate...
11:15	Break					

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09:15	<p>W7 TEXTILE COMPOSITES Chairs: JH Byun/ T Zeng</p> <p>W7-1 EXPERIMENTAL AND NUMERICAL STUDY OF MECHANICAL PROPERTIES OF THREE DIMENSIONAL FOUR-DIRECTIONAL BRAIDED COMPOSITES G Fang, J Liang, J Han(Harbin Inst. of Technology) The mechanical properties of 3D four-directional braided carbon/ epoxy composites are studied by experimental and numerical method. The failure modes of the braided composites are strongly depended on the braid angles. The stress-strain relationship of the composites under uniaxial tensile or compressive loading is simulated and good agreement of experimental results.</p>	<p>W8 FIBRES, MATRICES AND INTERFACES Chairs: JM Park/ HK Lee</p> <p>W8-1 THE EFFECT OF THE BONDING BETWEEN THE HPPE FIBER AND THE MATRIX ON THE PROPERTIES AND THE FRACTURE MODE OF POLYMERIC COMPOSITE MATERIALS V.V. Kudinov, NV Korneeva(Russian Academy of Sciences), IS Abdullin(Kazan State Technological Univ.) The paper presents the results obtained in the study of the mechanical properties and fracture mode of composites reinforced with plasma-activated High Performance Polyethylene fibers. It was found out that plasma treatment of the fiber increases CM properties. Active centres of the strong joint at the fiber/matrix interface were observed.</p>	<p>W9 STRUCTURAL BEHAVIOUR OF COMPOSITES SUBJECTED TO IMPACT AND BLAST/ IMPACT AND DYNAMIC RESPONSE Chairs: ZW Guan/ ZH Hu</p> <p>W9-1 STRUCTURAL BEHAVIOUR OF RECYCLED CONCRETE FILLED STEEL TUBE COLUMNS STRENGTHENED WITH CFRP SHEETS UNDER AXIAL LOADING J Dong, Q Wang(Sichuan Univ.), Z Guan(Univ. of Liverpool) Currently, recycled aggregate concrete filled steel tube (RCFST) columns have been the interest of structural engineers. There has been extensive experimental research either on the behaviour of RCFST columns or FRP confined CFST columns. However, few attempts have been made to study the structural behaviour of RCFST column strengthened with FRP materials.</p>	<p>W10 MECHANICAL AND PHYSICAL PROPERTIES Chairs: G Fernlund/ J Cinquin</p> <p>W10-1 BEHAVIOR OF SANDWICH BEAMS IN BENDING M. L. Cezayirli, J. Nachazel, M. Skarohlid(Czech Technical Univ.) A test of sandwich beam in bending with skins (bearing layers) of different thicknesses and mechanical properties is proposed, as alternative to ASTM D7250. Sandwich beam is loaded in three-point bending. From the bending test the comparable shear modulus of core can be found out according to proposed calculation.</p>	<p>W11 PROCESSING AND MANUFACTURING TECHNOLOGIES Chairs: SB Lee/ T Tanimoto</p> <p>W11-1 A COST-EFFECTIVE FABRICATION METHOD FOR CONTINUOUS FIBER CMCS WITH EXCELLENT FRACTURE TOUGHNESS T Tanimoto(Shonan Inst. of Technology) The author developed a low-cost production route to CMCS. The fabrication process does not require any expensive fabrication facilities and is concluded to be cost-effective and have a good potential for significantly increasing mechanical properties such as static strength, fracture toughness, and fatigue resistance.</p>	<p>W12 DAMAGE TOLERANCE AND IMPACT SESSION Chairs: R Butler/ JW Shih</p> <p>W12-1 THE INFLUENCE OF FIBRE ANGLE ON THE COMPRESSIVE STRENGTH OF DELAMINATED SURFACE PILES AT Rhead, R Butler, N Baker(Univ. of Bath) An efficient buckle-driven delamination propagation model is applied to artificially delaminated surface piles. Poisson's ratio mismatches inducing lateral compression in these piles reduced delamination propagation resistance; induced transverse tension improved resistance. The most favourable surface ply angles, in terms of strength and buckling-resistance are ± 45 degrees, as verified by experiments.</p>
09:35	<p>W7-2 HELIX GEOMETRY MODEL AND MECHANICAL PROPERTY OF 3D BRAIDED COMPOSITES T Zeng, Y Gao, S Yan(Harbin Inst. of Technology), D Fang(Peking Univ.) A helix geometry cell model of 3D braided composites is proposed. Based on the model, the stress field of the unit cell and the stress-strain curve is obtained. The study revealed that the helix geometry model prediction is more accurate than the conventional unit cell model.</p>	<p>W8-2 NANO REINFORCED INTERFACES FOR ADVANCED GLASS FIBRE/EPOXY COMPOSITES N Wiegand, J Rausch, O Srb, E Mader(Leibniz Inst. of Polymerforschung) CNTs and titanium dioxide particles were used in sizing formulations in order to affect the failure mechanism of the GF/EP composites. Results of the single fibre pull out as well as macro-mechanical tests with regard to the interphase modification by nanoparticles will be presented in this study.</p>	<p>W9-2 ESTIMATE THE PEAK LOAD AND PERFORATION ENERGY OF FIBRE METAL LAMINATES SUBJECTED TO LOW VELOCITY IMPACT J Fan, Z Guan, W Cantwell(Univ. of Liverpool) In this paper, using the validated finite element models, a series of parametric study results of fibre metal laminates subjected to low velocity impact were presented. This follows development of empirical formula to estimate the peak load and perforation energy of various FMLs, with good correlation to the experimental results.</p>	<p>W10-2 ELECTRICAL AND MECHANICAL PROPERTIES OF POLY(VINYLIDENE FLUORIDE) NANOFIBRILLAR MATERIALS NK Kim, BJ Lee, S Fakirov, Kean C Aw, D Bhattacharyya(Univ. of Auckland) Poly(vinylidene fluoride) (PVDF) is attractive for many applications due to its good electroactive properties as well as excellent processability. PVDF was processed using a microfibrillar composites production method and then thermo-electrically poled to obtain the β-phase crystal structure. The electrical and mechanical properties of nanofibrous PVDF samples were characterised.</p>	<p>W11-2 DESIGN AND FABRICATION OF MICRO EV BODY MADE OF GF/FRP K Sakata, G Ben, H Onishi(Nihon Univ.) EVs driving distance with one time full charge is relatively short. One method for solving this problem is a weight reduction of EVs body. We developed a micro EV made of GF/FRP by using manufacturing tools equipped with our laboratory and executed driving experiments.</p>	<p>W12-2 NON LOCAL APPROACH FOR PREDICTION OF DELAMINATION ONSET P Nimmuno, J Renard(ENSMIP) The objective in this study is to predict initiation of delamination in epoxy reinforced carbon fiber of 2/2 twill weave fabric composites laminates during static testing. Then, we shall propose a criterion for onset of delamination under static loading. Validation was made with tensile tests performed on angle-ply textile...</p>
09:55	<p>W7-3 THE HIGH RATE DEFORMATION RESPONSE OF 3D WOVEN COMPOSITES M Pankow, A Waas(Univ. of Michigan), CF Yen, S Ghiorse(Army R.Lab) 3D Woven composites were tested under both static and dynamic conditions to determine the mechanical properties. Dynamic tests were performed using the split Hopkinson pressure bar technique. Strains were measured using a digital image correlation (DIC) technique. These full field strain measurements were able to determine accurately the strains on...</p>	<p>W8-3 EVALUATION OF THE INTERFACE STRENGTH IN METAL/POLYMER COMPOSITE SYSTEMS S Chatter, OT Thomsen(Aalborg Univ.) To understand the interface stress transfer and failure process in metal/polymer interfaces, fragmentation tests were performed using steel filaments embedded in a polyester resin system. Finite element analysis (FEA) was used to predict the critical fragment length, and the model simulation results matched the experimentally obtained values closely.</p>	<p>W9-3 PREDICTING LOW VELOCITY IMPACT DAMAGE - A MIXED MODE DEGRADATION MODEL E Ehrlich, Lannucci, J Ankersen(Imperial College London), M Founneiteau(AIRBUS Operations S.A.S.) A novel 2D mixed mode damage model for low velocity impact damage prediction in composite materials is presented. It is based on a combination of damage mechanics and fracture mechanics and accounts for a damage mode interaction in the post-failure regime.</p>	<p>W10-3 FULLY ISOTROPIC LAMINATES MADE OF (0°, +45°, -45°, 90°) LAYERS WITH UP TO 24 PLYS JW Lee, JW Kim(KARI), MH Park(Aeronautics R&D) The present study provides fully isotropic stacking sequences for relatively thin composite laminates made of (0°, +45°, -45°, 90°) layers with up to 24 plies. Three independent fully isotropic solutions are found for 24-ply laminates. The present study proves that no fully isotropic solution exists for other laminates.</p>	<p>W11-3 DEVELOPMENT AND EVALUATION OF MECHANICAL PROPERTIES FOR CARBON FABRIC/PHENOLIC COMPOSITES WITH INJECTION MOLDING H Fujisaki, G Ben(Nihon Univ.) We developed a method of fabricating a new type of phenolic / CF fibrics FRP. As a result, the CF/phenolic composite will have a possibility to be employed as the structural members in the railway carriages and aircrafts.</p>	<p>W12-3 COMPOSITE LAMINATE IMPACT DAMAGE ASSESSMENT BY HIGH RESOLUTION 3D X-RAY TOMOGRAPHY AND LAMINOGRAPHY DJ Bull, J Sinclair, M Spearing(Univ. of Southampton) High-resolution 3D damage assessments were undertaken on impacted carbon fibre reinforced polymer (CFRP) material, comparing toughened and non-toughened systems. To achieve this, synchrotron radiation computed laminography (SRL) and computed tomography (SCT) techniques were successfully used to capture various 3D damage modes at resolutions of 0.7µm and 1.4µm respectively.</p>
10:15	<p>W7-4 TENSILE PROPERTIES AND FINITE ELEMENT MODELING OF BIAXIAL WFT KNITTED COMPOSITES O Demircan, Q Demircan, A Nakai, AR Torun(Kyoto Inst. of Technology), T Kosul(Total Design Center) Within the design of our experiments, it was compared the effect of aramid and glass yarn as a stitch yarn in the biaxial wft knitted composite. After production of one layer composites, tensile properties of them had been investigated both in experimental and finite element analysis (FEA).</p>	<p>W8-4 INTERFACIAL EVALUATION OF TRANSPARENT AND CONDUCTIVE CNT AND ITO COATINGS ON PET SUBSTRATES WITH NANO-STRUCTURAL ASPECTS ZJ Wang, DI Wron, GY Gu, JM Park(Gyeongang National Univ.), KL Davies(Univ. of Utah) Transparent and conductive CNT coatings were fabricated by dip-coating method on PET substrate. Electrical and optical properties of CNT coating depended mainly on the number of coatings and the CNT concentration. CNT coating exhibited no change, and ITO coating exhibited an increase in surface resistance up to 1000 loading cycles.</p>	<p>W9-4 EVALUATION STUDY ON COMPOSITE HULL STRUCTURE SUBJECTED TO SLAMMING LOADS Z Xue, Z Liu, H Gao, P Hu(Beijing Composite Materials Co., Ltd.) Three local composite hull structures with the length of 1 meter were made and used to study the influence of slamming loads by drop tests. Experimental results showed that sandwich structure has better impact resistance, mix structure was follow. And kevlar fiber should be adopted in the design.</p>	<p>W10-4 FINITE ELEMENT ANALYSIS OF THE MECHANICAL PROPERTIES OF WOVEN COMPOSITE YQ Wang, JSong, JQ Zhai(Changwon National Univ.), J Cho(Korea Maritime Univ.) In this studying, the elasticity properties of plain weave fabrics using FEM. The geometric model was based on microphotograph measurements which were translated into a solid model and an FE model using commercial software. The elasticity values predicted by the FEM were thought to be reasonable for the weave fabrics.</p>	<p>W11-4 INTERFACIAL PROPERTY AND WELDING PROPERTY OF CONTINUOUS FIBER REINFORCEMENT THERMOPLASTIC COMPOSITE A Nakai, T Enomoto, Y Tanaka, H Hamada, (Kyoto Inst. of Technology), S Tsujii(Research Center, Toyobo Co., Ltd.), N Ikuta(Shonan Inst. of Technology) Welding is one of the secondary processing methods of the CFRTP. To examine the effect of interfacial shear strength on welding strength, tensile test and evaluation of fracture surface by SEM were carried out. From this study, interfacial shear strength affected both welding strength and fracture surface.</p>	<p>W12-4 NUMERICAL INVESTIGATION OF FIBRE-METAL LAMINATES SUBJECT TO IMPACT DAMAGE M Rathasabapathy, A Mouric, A Orlic(RMIT Univ.) Fibre-Metal Laminates (FMLs) are a hybrid of metal and composite laminates that are increasingly being used in aerospace applications. In this work, a numerical investigation was conducted to analyse the complex damage responses and deformation that lead to the strength and stiffness loss of FML structures subject to impact damage.</p>
10:35	<p>W7-5 FORMATION OF NOVEL COMPOSITE FIBRES EXHIBITING THERMOCHROMIC BEHAVIOUR L Van Der Werff, IL Kyrtzias, R Cranston, G Peeters(CSIRO), A Robinson (Monash Univ.) A novel composite fibre has been developed which clearly and reversibly changes colour through the full visible spectrum as the temperature is increased or decreased through a pre-defined temperature range. Applications include incorporation into wound dressings for full thermal mapping across wound bed surfaces without the use of electronic equipment.</p>	<p>W8-5 MICROFAILURE MECHANISMS AND INTERFACIAL EVALUATION OF SINGLE FIBER REINFORCED EPOXY COMPOSITES AT CRYOGENIC TEMPERATURES DJ Kwon, ZJ Wang, JM Park (Gyeongang National Univ.), MK Um(Composite Materials Group), KL Davies(Univ. of Utah) Micro-mechanical techniques were used to investigate interfacial properties of fiber reinforced two kinds of epoxy composites at ambient, low and cryogenic temperatures. Carbon fiber and glass fiber reinforced epoxy YDF-175 composites showed higher interfacial adhesion, work of adhesion and apparent modulus than room temperature.</p>	<p>W9-5 EFFECTS OF GAGE LENGTH AND LOADING RATES ON THE STRENGTH OF PPTA FIBERS JY Lim(Hyundai Motor Company), JQ Zheng, K Masters(US Army PM-Soldier Equipment), W Chen(Purdue Univ.) Axial tension and transverse compression experiments on single fibers were performed to investigate the mechanical behavior of three high-performance fibers (Kevlar®, Kevlar®129, and Twaron®) with diameters in the order of 9~12 µm. A miniaturized tensile Kolsky bar was used to determine the tensile response of PPTA single fibers.</p>	<p>W10-5 DYNAMIC CHARACTERISTICS MEASUREMENT OF ULTRA-THIN SEMICONDUCTOR LAYER BH Park, JH Park, HS Kim, EB Jeon(Hanyang Univ.) The dynamic properties of thin semiconductor layers were investigated using the vibration analysis adopting wave approach. From the base-excited response of the beam, the frequency dependent bending stiffness and loss factor were obtained, which were used to calculate Young's modulus and loss factor of the thin semiconductor layers.</p>	<p>W11-5 PULTRUSION SYSTEM FOR CONTINUOUS FIBER REINFORCED THERMOPLASTIC COMPOSITE WITH BRAIDING TECHNIQUE D Hatanjo, Y Tanaka, S Matubara, A Nakai(Kyoto Inst. of technology), M Takagi (Kaj Group Co. Ltd.), A Onitani(SA) We have developed the combination system of pultrusion and braiding technologies to produce continuous fiber reinforced thermoplastic composites. Carbon fiber as the reinforcement while the PA66 resin fiber (Z35dtx) was used as the matrix resin.</p>	<p>W12-5 EXPERIMENTAL STUDY OF IN-PLANE COMPRESSIVE BEHAVIOUR OF UNSYMMETRICAL SANDWICH PANELS S Zhou, P Nash, L Boston, N Coles, L Campbell(Loughborough Univ.) An in-plane compression of unsymmetrical sandwich panels was conducted experimentally. Two skin thickness combinations were 8/6 and 16/12 plies. Both cross ply and quasi-isotropic lay-ups were used. All panels were impact-damaged and their dominant damage mechanisms were established. All impact-damaged and baseline panels were compression tested.</p>
10:55	<p>W7-6 MODELLING VARIABILITY OF TOW ORIENTATION FOR WOVEN TEXTILE COMPOSITES F Ebdewe, P Harrison(Univ. of Glasgow) Accurately characterising and modelling a fabric's inherent tow misalignment is important when predicting the effect of this variability on the fabric's draping behaviour and the composite's final mechanical properties. To this end, a computer code 'Varifab' has been written to predict variability in tow orientation across a textile sheet.</p>	<p>W8-6 FRACTURE TOUGHNESS ENHANCEMENT WITH REINFORCING FIBERS FOR ADHESIVELY BONDED JOINTS UNDER REPEATED THERMAL SHOCKS CS Bang, JG Kim, DG Lee(KAIST) The bonding performance of adhesively bonded secondary barrier composed of aluminum face and stainless filler, was investigated with respect to adhesive thickness and fiber volume fraction. A suitable adhesive thickness of adhesively bonded joints and optimum volume fraction of fiber were suggested for robust adhesive joint against repeated thermal shocks.</p>			<p>W11-6 INVESTIGATION OF VISCOELASTICITY AND CURE SHRINKAGE IN AN EPOXY RESIN DURING PROCESSING T Shimizu, H Koinuma, K Nagai(Mitsubishi Heavy Industries, Ltd.) Viscoelastic properties and resin cure shrinkages were investigated for implementation to process simulation and could be aligned using the degree of cure. The elastic moduli during cure were determined from multiplication of the storage stiffness to fit the FE analysis with asymmetric lay-up plate test results.</p>	<p>W12-6 DAMAGE TOLERANCE ANALYSIS OF ADHESIVELY BONDED REPAIRS TO COMPOSITE STRUCTURES CH Wang, J Goh, J Ahamed(RMIT Univ.), A Glynn, A Georgiadis(Boeing Research & Technology Australia) A damage tolerance methodology is developed to predict the strength of bonded repairs containing manufacturing flaw or in-service damage. Scarf joints with disbond of varying lengths were tested under tension. The results, which showed a mixture of cohesive and interfacial failure, were compared with model predictions.</p>
11:15			Break			

	Halla A	Halla B	Samda A	Samda B	201A	202A
11:30	<p>W13 POLYMER NANOCOMPOSITES AND THEIR APPLICATIONS Chairs: LQ Liu/Z Liang</p> <p>W13-1 SLIDING WEAR PROPERTIES OF CARBON NANOFIBER AND NANOTUBE REINFORCED RUBBERS J Karger-kocsis(Tshwane Univ.) The sliding friction and wear of carbon nanofibers (CNF) and carbon nanotubes (CNT) modified rubbers of both thermoplastic and thermoset types were investigated and compared with those containing traditional fillers. To exploit the beneficial properties of these fillers in wear-resistant rubbers several tasks should be solved which were outlined.</p>	<p>W14 TEXTILE COMPOSITES Chairs: P Potluri/KJ Kang</p> <p>W14-1 ANALYSIS OF VISCOELASTICITY OF 3-D BRAIDED COMPOSITE MATERIALS H Sun, F Zhang, B Zhang(Nanjing University of Aeronautics and Astronautics) The effects of braiding angles and fiber volume fractions on the viscoelastic properties are analyzed through the numerical simulation for 3-D braided composites. A 3-D braided composite with a smaller braiding angle and a higher fiber volume fraction has better creep-resistance ability.</p>	<p>W15 DURABILITY OF POLYMER MATRIX COMPOSITES Chairs: F Jacquemin/ T Morii</p> <p>W15-1 COUPLING MOISTURE DIFFUSION AND INTERNAL MECHANICAL STATES IN POLYMERS AND COMPOSITES - A THERMODYNAMICAL APPROACH BE Sar, S Freour, F Jacquemin(Univ. de Nantes), P Davies(Service Materiaux et Structures) In the present study, the thermodynamics based approach, starting from the definition of the chemical potential of the water, was used, to establish a model coupling the in-depth moisture profile to the internal mechanical states experienced by the material.</p>	<p>W16 AEROSPACE APPLICATIONS Chairs: JH Han/ SK Cheong</p> <p>W16-1 APPLICATION OF A BIO-INSPIRED DESIGN STRATEGY TO DELAY INITIAL DAMAGE IN A FRP T-JOINT UNDER BENDING LA Burns, AP Mouritz, S Feih(RMIT Univ.) This study incorporates finite element analyses, an optimisation program and experimental testing to achieve the objective of validating the use of a bio-inspired design strategy to improve the design load of aerospace fibre-polymer composite T-joints under bending.</p>	<p>W17 RESEARCH AND DEVELOPMENT OF GREEN COMPOSITES Chairs: K Goda / H Takagi</p> <p>W17-1 DEVELOPMENT OF HIGH STRENGTH BIOMASS COMPOSITES MADE FROM BAMBOO H Takagi(Inst. of Technology and Science), H Mori, JK Pandey, T Mori(Univ. of Tokushima), S Sujito(Univ. of Jember) The stream-exploded bamboo column and bamboo fibers were hot-pressed in order to fabricate biomass composites. The effects of molding conditions on the bulk density, tensile and bending strength are discussed. It was confirmed that the molding pressure has little effect on the mechanical properties of the composites.</p>	<p>W18 EXPERIMENTAL TECHNIQUES Chairs: Y Tanaka/ M Li</p> <p>W18-1 ESTIMATION OF LOCAL PERMEABILITY WITH ARTIFICIAL VISION TECHNIQUES USING A DIRECT METHOD LDomenech, N Montes, F Sanchez(Univ. Cardenal Herrera CEU) Our goal is to measure the permeability in LCM process using artificial vision as source of flow front information. For that, we use the simulation but, instead of calculating the flow front using the permeability, we calculate the permeability using the flow front.</p>
11:50	<p>W13-2 ELECTRO-OSMOTIC DRAG EFFECT ON THE METHANOL PERMEATION FOR SPEEK AND NAFION MEMBRANES NTQ Chi, LX Dinh, DJ Kim (Sungkyunkwan Univ.) Electro-osmotic drag effect on the methanol permeation was investigated for sPEEK membrane, and its result was compared to that of Nafion. The electro-osmotic drag coefficient was determined from the limiting current density which is a function of applied potential and temperature.</p>	<p>W14-2 ANALYSIS FOR MECHANICAL BEHAVIOR IN HYBRID BRAIDED COMPOSITE MATERIALS S Kentaro, N Asami(Kyoto Inst. of technology) In this study, the prediction of stress-strain curve of resin hybrid composites became realized by finite element model considering geometry of textile and micro fractures. The fracture mechanism was different by changing position and the number of fiber impregnated flexibility resin. Finally, some kinds of design guides were proposed.</p>	<p>W15-2 AGING OF CARBON FIBER/BIS-MALEIMIDE COMPOSITES IN OXIDATIVE CONDITIONS X Lv, R Wang, W Liu, L Jiang(Harbin Inst. of Technology) Flexural strength and ILS testing followed by SEM analysis were performed in order to determine the effects of thermal-oxidative aging on the mechanical properties of carbon fiber reinforced BMI composites. The results indicated that carbon fiber reinforced bis-maleimide composites has good mechanical strengths at 150oC after aging up to 1000h.</p>	<p>W16-2 COMPOSITE COMPLIANT MECHANISM BASED, PITCH-CONTROLLABLE ROTOR BLADE TIPS DS Dancila(Mechanical and Aerospace Engineering), S Mahadev(The Univ. of Texas at Arlington) An initial investigation of an extension-twist coupled composite airfoil-shaped generalized modified star-beam concept is presented. The use of elastomeric strips to bridge the gap between the star-beam strips is shown to be effective in increasing the torsional stiffness of the cross section without sacrificing the level of extension-twist coupling.</p>	<p>W17-2 DEVELOPMENT OF A CONTINUOUS RAMIE SINGLE YARN REINFORCED COMPOSITE STRAND HB Kim, J Noda, K Goda(Yamaguchi Univ.), H Marutani, K Aoki, S Arai(Kayaku Akzo Co., Ltd), F Tomonaga(Yamaguchi Prefectural Industrial Technology Inst.) Glass fiber reinforced composites have disadvantages. Natural fibers have become suitable alternatives to glass fibers. In this study, thus, the continuous ramie single yarn reinforced polypropylene (PP) composite strands were developed using a new and relatively simple technique. The strands were pelletized and injection-moulded, and their tensile properties were investigated.</p>	<p>W18-2 FULLY SUBMERGED COMPOSITE CRYOGENIC TESTING R Nicholls-lee, T Bostock(Univ. of Southampton), P Watt(Advanced Composites Group) The concept design of a lightweight, cryogenic, marine, heavy lift, buoyancy system has a central composite cryogenic Dewar with operating conditions of -196oC to 30oC and 1bar to 35 bar. This work discusses fully submerged composite cryogenic testing for qualification of the materials for use in the Dewar.</p>
12:10	<p>W13-3 LOW DENSITY POLYETHYLENE/MGO NANOCOMPOSITES AS INSULATION FOR HVDC CABLES Z Jiang, S Ju, Z Zhang(National Center for Nanoscience and Technology) We prepared Nano-MgO/LDPE by twin-screw extruder. Nano-scale observation of the nano-MgO showed the good dispersion. The breakdown strength measured under a dc electric field increased firstly and then decreased with the increase of MgO content. The nano-MgO effectively restricted the charge injection from the electrode...</p>	<p>W14-3 A NEW CONCEPT OF FABRICATION OF SANDWICH PANELS WITH TRUSS-LIKE CELLULAR CORES HH Kwak, HH Lee, KJ Kang, AR Kim(Chonnam National Univ.), HK Hurr(Agency for Defense Development), BK Lee(JACC), JH Byun(KIMS) In this work, a new fabrication technique of sandwich panels which have good resistance against face-core debonding as well as high compressive and shear strength is introduced. The validity is evaluated through experiments with the specimens prepared according to the new technique and comparative analytic solution.</p>	<p>W15-3 HYDROTHERMAL AGING OF JUTE FIBER REINFORCED POLYPROPYLENE INJECTION MOLDINGS T Morii(Shonan Inst. of Technology), H Hamada(Kyoto Inst. of Technology) This study dealt with the influence of water on weight changes and tensile properties of jute fiber reinforced polypropylene (PP) composites. Jute fiber easily absorbed water even in matrix, and it brought the degradation of jute fiber and jute/PP interface. Such degradation brought significant reduction in mechanical properties.</p>	<p>W16-3 EXACT SOLUTION OF SHEAR FLEXIBLE LAMINATED THIN WALLED I BEAMS USING A COUPLED FIELD FORMULATION R Srinivasan(Mahindra Satyam Private, Ltd.), DN Kumar(EADS DS India Pvt. Ltd.) The exact static solutions of shear flexible thin walled laminated I-beams are derived using a coupled field formulation. The formulation accommodates all the nonclassical effects of a thin walled composite beam. Numerical results for both Bending and twisting response of laminated thin walled beams are presented.</p>	<p>W17-3 EFFECT OF HYBRID COMPATIBILIZERS ON MECHANICAL PROPERTY OF TERNARY BLEND WITH POLYPROPYLENE, POLY (LACTIC ACID) AND TOUGHENING MODIFIER HS Lee (Honam Petrochemical Corp. Daeduk Research Inst.), JD Kim (KAIST) In this study, Ternary blend, PP/PLA/Toughening modifier, with hybrid compatibilizers like PP-g-MAH and PE-g-GMA showed improvement of compatibility and balanced mechanical properties. As for the annealing effect, we found out that the HDT of ternary blends after 2 hours showed the maximum value and the HDT increased to 120°C.</p>	<p>W18-3 CHEMICAL SHRINKAGE AND THERMO-MECHANICAL CHARACTERIZATION OF AN EPOXY RESIN DURING CURE BY A NOVEL IN SITU MEASUREMENT METHOD E Ruiz, C Billotte(Ecole Polytechnique of Montreal), F Cara(TFX ThermoFlux), H Bauerier(AREVA) As the composite industry grows, the use of thick parts and pieces of complex shape is increasingly in demand notably for structural applications requiring larger cross-sections to respond to mechanical stresses. The curing of thick parts remains a challenge because of their low thermal conductivity and the high heat of...</p>
12:30	Lunch					
13:30	<p>P11: CHALLENGES IN COMPOSITES RESEARCH: ONR PERSPECTIVES Yapa D.S. Rajapakse (Office of Naval Research)</p> <p style="text-align: right;">(Chair: Y Miyano)</p>		<p>P12: CARBON FIBER INNOVATION! Kazuro Kageyama(University of Tokyo)</p> <p style="text-align: right;">(Chair: T Aoki)</p>			
14:00	Break					

	202B	203	301	302	401	402A
11:30	<p>W19 TEXTILE COMPOSITES Chairs: JH Byun/T Zeng</p> <p>W19-1 EFFECT OF SURFACE TREATMENT ON THERMAL AND MECHANICAL PERFORMANCE OF JUTE FABRIC REINFORCED ENGINEERING THERMOPLASTIC COMPOSITES S Thittanasarn, K Yamada, H Nishimura(Kyoto Inst. of Technology), H Hamada, YW Leong(Institute of Materials Research and Engineering) Thermal degradation analysis results suggest that the epoxy and UP surface treatments were effective in improving the thermal degradation resistance of the jute fibers. This allowed the processing of jute fibers with high temperature engineering thermoplastics.</p>	<p>W20 FIBRES, MATRICES AND INTERFACES/ EXPERIMENTAL CHARACTERIZATION Chairs: JM Park</p> <p>W20-1 LOW VELOCITY IMPACT DAMAGE CHARACTERISTICS OF INTERLAYER TOUGHENED COMPOSITE LAMINATES Z Xie, P Bao, R Bi, X Li(Northwestern Polytechnical Univ.) An experimental investigation was conducted on the damage characteristics of untouched and interlayer toughened composite laminates. The damage mechanisms of the two laminates under quasi-static indentation force were studied by using a numerical model. The numerical results had a good agreement with the test data.</p>	<p>W21 IMPACT AND DYNAMIC RESPONSE Chairs: HK Lee</p> <p>W21-1 ANALYSIS OF SHOCK RESPONSE OF SANDWICH COMPOSITES A Goodarzi, A Alikhani, H Hosseini(AmirKabir Univ. of Technology), H Taylor(Imperial College London) Sandwich composites are being aggressively pursued as structural materials by various defense and commercial industries. Of particular interest in this study is to investigate the behavior of the foam materials and their sandwiches under high strain rate (HSR) loading which are very much prevalent in their actual applications.</p>	<p>W22 MECHANICAL AND PHYSICAL PROPERTIES Chairs: DS Dancila/ CM Wu</p> <p>W22-1 TENSILE AND IN-PLANE/INTER-LAMINAR SHEAR FAILURE BEHAVIOR OF NITE-SiC/SiC COMPOSITE YB Choi, K Matsugi, G Sasaki(Hiroshima Univ.), T Hinokii(Kyoto Univ.), K Ozawa, Y Katoh(Oak Ridge National Lab) This study aims to evaluate failure behavior of SiC/SiC composites by various mode tests such as tensile, in-plane shear and inter-laminar shear modes. These trends well agreed with the experimental results, showing a possible applicability of the model.</p>	<p>W23 PROCESSING AND MANUFACTURING TECHNOLOGIES Chairs: P Hubert/ G Fernlund</p> <p>W23-1 RTM PROCESS SIMULATION BY USING XFEM AND LEVEL SET METHOD YH Jung, WS Han, A Vautrin(Ecole nationale superieure des mines de Saint-Etienne), SJ Kim(Seoul national Univ.) A numerical simulation program for Resin Transfer Molding (RTM) manufacturing process is developed using eXtended Finite Element Method (XFEM) combined with the level set method. XFEM allows to obtaining better accuracy of the resin pressure field in the flow front region than the classical FEM.</p>	<p>W24 DELAMINATION AND INTERLAMINAR REINFORCEMENT Chairs: M Hojo/ HK Hur</p> <p>W24-1 A SIMPLE METHOD FOR CALCULATING STRESS INTENSITY FACTORS FOR INTERLAMINAR CRACKS IN COMPOSITE LAMINATES Y Morioka, CT Sun(Purdue Univ.) In this study, a finite element based method to calculate stress intensity factors for interfacial cracks in composite lamina is proposed. Throughout a set of numerical analyses, it was found that the method is very simple without requiring any complex mathematical procedures, and computes accurate stress intensity factors.</p>
11:50	<p>W19-2 FEM ANALYSIS ON OUT-OF-PLANE THERMAL EXPANSION IN PLAIN WEAVE COMPOSITE S Takahashi, N Watanabe, H Hoshi(Tokyo Metropolitan Univ.), Y Iwahori(Japan Aerospace Exploration Agency) The purpose of this study is to confirm the out-of-plane coefficient of thermal expansion (CTE) of CF/epoxy plain weave composite mainly by finite element method (FEM) analysis. Because the analytical result was corresponding to the experimental result with good accuracy, the tendency of the coefficient of thermal expansion was confirmed.</p>	<p>W20-2 A NUMERICAL AND EXPERIMENTAL INVESTIGATION ON DELAMINATION BUCKLING BEHAVIOR IN LAMINATED COMPOSITES UNDER COMPRESSIVE LOAD L Zhang, R Wang, W Liu, C Dai, L Hao, X He(Harbin Inst. of Technology) The objective of this paper is to systematically investigate the factors of delamination behavior with both experimental method and cohesive element method which is based on a mixed-mode failure criterion and adopts softening relationships between tractions and separations. The numerical results are obtained by standard ABAQUS procedures.</p>	<p>W21-2 EVALUATION OF STRUCTURAL BEHAVIOR OF LNG INSULATION SYSTEM UNDER IMPACT LOADS SJ Kim, DS Han, JM Lee(Pusan National Univ.), MS Chun, SE Chun(Samsung heavy industris, Co., Ltd.) In the present study, the structural behavior of the damper under impact loads is investigated. A series of the impact test for damper are carried out with respect to various drop weights and heights. Moreover, the obtained results are compared with the without damper experimental results.</p>	<p>W22-2 EFFECTS OF CRYSTALLINE MORPHOLOGIES ON THE MECHANICAL PROPERTIES OF CARBON FIBER REINFORCING POLYMERIZED CYCLIC BUTYLENES TEREPHTHALATE COMPOSITES C.Wu, C.Chang, C.Jiang(Feng-Chia Univ.) Carbon/pCBT composites were prepared by utilizing the modified film stacking technique. Three crystalline morphologies of polymerized cyclic butylene terephthalate were crystallized at different temperatures. Tensile, flexural, short beam shear and impact tests were evaluated. The relationship between crystalline morphology, process and mechanical properties of carbon/pCBT composites was investigated.</p>	<p>W23-2 PROCESS OPTIMIZATION OF COMPOSITE PANELS WITH COMPRESSION MOLDING WS Han, A Vautrin(Ecole Nationale Supérieure des Mines de Saint-Etienne) The objective of this study is to optimize the precharge conditions such as the location and dimensions of the precharge which give significant effects on fiber states to improve the mechanical performance of composite structures manufactured by the compression molding process.</p>	<p>W24-2 NUMETRICAL STUDY ON CARBON FIBRE PULLOUT USING A COHESIVE ZONE MODEL Y Jia, W Yan(Monash Univ.), H Liu(Univ. of Sydney) Cohesive zone modelling was applied to numerically simulate the fibre pullout test in this paper. A finite element (FE) model was firstly established and validated by comparing with the experiment results. A parametric study was carried out to examine the effects of relevant parameters on the fibre pullout behaviour.</p>
12:10	<p>W19-3 DYNAMIC COMPRESSIVE PROPERTIES OF WOVEN FABRIC REINFORCED COMPOSITES N Wang, CD Cho, SK Lee, G Shi(Inha Univ), KWK Choi(Illinois Inst. of Technology) In this study, dynamic mechanical properties and failure modes of satin weave E-glass/epoxy composite laminates with layups of [45/-45/0/90]ns are investigated experimentally along in-plane direction. From the experimental result, it was found that compressive properties and failure modes were affected by strain rate and stacking sequence.</p>	<p>W20-3 LOW COST HIGH STRENGTH 3D COMPOSITES N Han(Advanced Fiber Materials Technologies Co., Ltd.) This paper provides a new approach of using Velcro (hook and loop fasteners) on both sides of fiber plies to make 3D composites to increase their strengths and enable automation for laying up fabrics. A car body model is made by the partially automatic laying-up fabric and RTM processes.</p>	<p>W21-3 PERFORMANCE ANALYSES OF A 10MW COMPOSITE WIND-TURBINE BLADE CONSIDERING AEROELASTIC EFFECTS DH Kim, YH Kim(Gyeongsang National Univ.) SH Kim(CAE-Korea Co., Ltd) In this study, aeroelastic performance analyses have been conducted for a 10MW Composite wind-turbine blade model. Advanced computational analysis system based on computational fluid dynamics (CFD) and computational structural dynamics (CSD) has been developed in order to investigate detailed dynamic responses of wind turbine blade.</p>	<p>W22-3 THERMAL AND MECHANICAL BEHAVIOR OF ANGLE SECTION OF COMPOSITES WITH A SINGLE AND DOUBLE CURVATURE V Stawrovsky, Z Padovec, M Ruzicka, H Chlup(Czech Technical Univ.) The paper describes distortion effect of corner section in continuous fibre reinforced composite. The classical lamination theory is used for analytic prediction of this spring-forward effect of corner section. Using of MATLAB program script the spring-forward is calculated for C/PPS composite. Also the experimental measurement of springforward and FE model...</p>	<p>W23-3 MULTI-MATERIAL SYSTEMS FOR TAILORED AUTOMOTIVE STRUCTURAL COMPONENTS J Dau, C Lauter, U Damerow, W Homburg, T Troster(Univ. of Paderborn) Manufacturing processes of prepreg-pressing and integrated forming of sheet metal and CFRP prepreps are presented. Compared to common CFRP-processing, cycle times of less than five minutes are realisable. Findings concerning the certain process parameters and process control are discussed. Furthermore, component tests concerning quasi-static properties and crash performance are presented.</p>	<p>W24-3 STUDY OF DYNAMIC AND PERMANENT INDENTATION OF LAMINATES SUBJECTED TO LOW-VELOCITY IMPACT D Liu, Z Guan, W He, J Wang(Beihang Univ.) A modified Hertzian Contact Law is validated with a new experimental technique using a Non-contact Vibration Measurement (NCVM). Moreover, the relationship of permanent and dynamic indentation is presented in this study, and a new computational method to predict the permanent indentation is developed, which proved to be effective...</p>
12:30	Lunch					
13:30						
14:00	Break					

	Halla A	Halla B	Samda A	Samda B	201A	202A
14 : 15	<p>W25 NANOCOMPOSITES Chairs: ZY Liang/YB Park</p> <p>W25-1 THE HIGH CURRENT-CARRYING CAPACITY OF CNT ENHANCED COMPOSITES P Azamian, JQ Park, Z Liang, B Wang, C Zhang (Florida State Univ.) This study investigates the use of CNTs to enhance the composite conductivity and explores their basic current-carrying capability (HCC). During testing, samples were exposed to electrical currents and high temperatures induced by Joule heating at atmospheric conditions. The effects of CNTs on the composite HCC performance were analyzed.</p>	<p>W26 ONR SESSIONS - RESEARCH IN COMPOSITES MATERIALS AND SANDWICH STRUCTURES Chairs: Y Rajapakse/ Y Kwon</p> <p>W26-1 DYNAMIC RESPONSE AND FAILURE OF COMPOSITE AND SANDWICH STRUCTURES UNDER FLUID STRUCTURE INTERACTION YW Kwon, RD McCallis (Naval Postgraduate School) The effect of fluid-structure interaction is significant to composite and sandwich structures under dynamic loading. To evaluate the effect on dynamic responses and failure modes of those structures, low velocity impact testing was undertaken when the structures were submerged in water or in dry air under the same impact condition.</p>	<p>W27 DURABILITY OF POLYMER MATRIX COMPOSITES Chairs: Y Kim/ A Kudo</p> <p>W27-1 THE EFFECT OF THERMO-OXIDATION ON MATRIX CRACKING OF CROSS-PLY [0/90]S COMPOSITE LAMINATES DQ Yu, M. Gigliotti, MC Lafarie-Frenot (Univ. de Poitiers) The effects of thermo oxidation on matrix cracking in cross-ply [0/90]s composite laminates. IM7/977-2 carbon/epoxy samples were firstly aged at 150°C under 1.7 bars of oxygen for 24h and 48h, respectively. Both un-aged and pre-aged are then undergone tensile test.</p>	<p>W28 AEROSPACE APPLICATIONS Chairs: JH Kweon/ HJ Jeon</p> <p>W28-1 MICRO DEFORMATION MEASUREMENT SYSTEM CONSTRUCTION FOR HIGHLY DIMENSIONAL STABLE COMPOSITE DUE TO OUT-GASSING IN SPACE JS Yoon, HI Kim, JH Han (KAIST), HS Yang (KRISS) Space-borne telescope needs dimensionally stable composite structure which shrinks due to out-gassing in space environment. Highly precise mechanical dilatometer, using optical scale sensor, is developed to measure out-gassing deformation of composite. Longitudinal and transverse fiber direction of M55J/Cyanate laminas are measured in simulated space out-gassing environment.</p>	<p>POSTER SESSION (3F LOBBY)</p>	<p>W29 FULL-FIELD MEASUREMENTS FOR COMPOSITES TESTING Chairs: F Pierron/MR Wisnom</p> <p>W29-1 THROUGH-THICKNESS SHEAR MODULUS IDENTIFICATION FROM FULL-FIELD SURFACE MEASUREMENTS F Pierron (Arts et Metiers ParisTech) This paper presents a novel technique to identify the through-thickness shear moduli of laminated composite plates using only displacement measurements on their in-plane surface. Finite element validation of the identification formulae is presented and a first experimental implementation using speckle interferometry showed promising initial results.</p>
14 : 35	<p>W25-2 PROCESS-PROPERTIES RELATIONSHIPS OF THERMOPLASTIC POLYURETHANE BASED MATERIALS FILLED WITH CARBON NANOTUBES P Russo (National Council of Research of Italy), L Maior (Univ. of Salerno), D Acerno (Univ. of Naples Federico II) Melt blended thermoplastic polyurethane/multi walled carbon nanotubes compounds have been studied in terms of processability, flow behavior and physical properties. Films were prepared by cast film extrusion and by blown film coextrusion procedure. Processing conditions were related to mechanical performances and morphological aspects of the films.</p>	<p>W26-2 UNDERWATER EXPLOSIVE LOADING OF E-GLASS / VINYL ESTER COMPOSITE PLATES: CORRELATION OF EXPERIMENTS AND SIMULATIONS J Leblanc (Naval Undersea Warfare Center), A Shukla (Univ. of Rhode Island) Composite materials subjected to underwater explosive loading have been studied. Work consists of experimental testing and computational simulations. The composite plates are round and have a thickness of 1.3mm. The transient response is captured through a Digital Image Correlation (DIC) system. The DIC data and computational results show good agreement.</p>	<p>W27-2 FATIGUE BEHAVIOR OF FLAX/EPOXY COMPOSITE S Liang, PB Gning (Inst. Supérieur de l'Automobile et des Transports), L Guillaumat (Ecole Nationale Supérieure d'Arts et Métiers) Flax/epoxy composites having [0/90]3S and [±45]3S sequences respectively, were tested under quasi-static tensile and fatigue loading. Test results revealed that composite reinforced with the natural fibre can have comparable confidence level than conventional composite. A stiffening phenomenon of around 2~3% during fatigue test is observed on composite having [0/90]3S stacking sequence.</p>	<p>W28-2 A PARAMETRIC STUDY OF THE IMPACT BEHAVIOR OF A HONEYCOMB SANDWICH STRUCTURE KH Nguyen, JH Kweon, JH Choi (Gyeongang National Univ.) A parametric study of the high velocity impact behavior of a sandwich structure is numerically conducted. The parameters of interest is the oblique angle to the sandwich. The core of the sandwich structure, impacted by a spherical steel impactor, is modeled using a combination of meso-scale and macro-scale modeling.</p>		<p>W29-2 COMPOSITE REINFORCEMENT FORMING SIMULATION: CONTINUOUS AND MESOSCOPIC APPROACHES P Wang, OT Thomsen (Aalborg Univ.), F Pierron (LMPF Research Group) This paper presents a methodology developed to identify all the constitutive (elastic) parameters of polymer foams in one single test using Digital Image Correlation in combination with the Virtual Fields Method. The results will be compared with the reference parameters obtained using a more conventional approach for mechanical testing.</p>
14 : 55	<p>W25-3 ELECTRICAL AND THERMAL CONDUCTIVITIES OF AU NANOPARTICLE DECORATED GRAPHENE NANOPATELET 'PAPER' J Jiang, L Drazal (Michigan State Univ.) This work explores the thermal and electrical conductivity of a highly ordered 'paper' prepared by vacuum assisted self assembly consisting of graphene nanoplatelets decorated by monodispersed Au nanoparticles. The effects of thermal annealing, cold compaction on conductivities of the nano-structured paper are investigated.</p>	<p>W26-3 INVESTIGATION INTO THE BLAST LOADING OF POLYMER COMPOSITE MATERIALS IN MARINE STRUCTURES JP Dear, H Arora, P Hooper (Imperial College London) This research relates to the in air and underwater blast tolerance of glass-fibre composite (GFRP) sandwich and laminate structures. This is to provide for procedures for monitoring the structural response of such materials during blast events. Air-blast loading of GFRP sandwich panels used high-speed photography with Digital Image Correlation.</p>	<p>W27-3 ESTIMATION OF WEATHERABILITY FLEXURAL PROPERTIES FOR CFRP SUBJECTED TO LONG-TERM OUTDOOR EXPOSURE A Kudo (National Defense Academy), G Ben (Nihon Univ.) The present paper discusses the degradation mechanism for weatherability flexural properties of unidirectional CFRP and epoxy matrix resin subjected to outdoor and accelerated exposures. The experimental values of flexural strength to the long-term outdoor exposure could be estimated on the data of short-term outdoor or accelerated exposure.</p>	<p>W28-3 DEVELOPMENT OF SINGLE CRYSTALLINE SILICON SOLAR CELLS LAY-DOWN PROCESS ON COMPOSITES JC Kim, DH Kim, SK Cheong (Seoul National Univ.), JH Choi (Korea Aerospace Research Inst.) Recently, photovoltaic power energy appears to be one of the major technologies for the global sheared concerns in protecting environment. Up until now, many studies for the development of solar cell have focused on better stability and higher efficiency. However, the solar industry will be developed for combining solar cells...</p>		<p>W29-3 DETECTING BARELY-VISIBLE IMPACT DAMAGE IN COMPOSITES USING FULL-FIELD SLOPE MEASUREMENTS C Desvieux, F Pierron (Arts et Metiers ParisTech, France), MR Wisnom (Univ. of Bristol) A method is presented for detecting delamination using deflectionometry. Damage is located and a 'signature' is provided in the form of surface slopes. The procedure is applied to specimens with artificial delaminations and impact damage and the results using experimental data are compared with finite element simulations.</p>
15 : 15	<p>W25-4 INTERLAMINAR PROPERTIES OF CFRP COMPOSITES WITH CNF-BUCKY PAPER INTERLEAVES SU Khan, JK Kim (Hong Kong Univ. of Science and Technology) The effects of partially cured carbon nanofiber-bucky paper-epoxy interleaves on mechanical properties of carbon fiber reinforced composites have been studied. The bucky paper interleaves are fabricated based on three different techniques, which are integrated into CFRP composites. The mechanical properties are measured and analysed.</p>	<p>W26-4 FLUID-SOLID INTERACTION DURING A SHOCK WAVE IMPACT ON A CONVERGING COMPOSITE STRUCTURE V Eliasson (Univ. of Southern California) Shock focusing in water is of interest in many applications, and in particular for marine structures subjected to dynamic loading events. Here we are investigating how fluid-solid interaction influences the shock focusing effects in convergent water-filled carbon fiber composite structures.</p>	<p>W27-4 NUMERICAL ANALYSIS OF STOCHASTIC EFFECTIVE PROPERTIES FOR THE POLYMER-BASED COMPOSITES M Kaminski (Technical Univ. of Lodz), B Lauke (Inst. of Polymer Research) Determination of the probabilistic moments for effective properties of the elastomers reinforced with the silica and carbon black nanoparticles is the main aim of this work. They are computationally modeled using the stochastic generalized perturbation technique implemented in the computer algebra system MAPLE.</p>	<p>W28-4 STRENGTH OF COMPOSITE SANDWICH JOINTS UNDER HYGTROHERMAL CONDITION YB Park, JH Kweon, JH Choi (Gyeongang National Univ.) In this study, the composite sandwich joints designed for a Korea indigenous aircraft were experimentally investigated with a focus on the effect of test environment on the strength and failure. Two test environments are examined including elevated temperature-wet (ETW) and room temperature-dry (RTD) conditions under pull-out and shear loading.</p>		<p>W29-4 FATIGUE TESTING OF COMPOSITES WITH IN-SITU FULL-FIELD STRAIN MEASUREMENT S Sisodia, S Kazemahzay, D Zenkert (KTH Royal Inst. of Technology), F Edgren (VoVo Aero Corp.) A novel fatigue test method is presented for the study of defects and failure modes of composites. The paper looks at materials and defects, loading conditions, strain measurement scheme, sampling and test procedure, manufacturing and preparation of test specimen, example of results and discussion, conclusive remarks, acknowledgements, and references.</p>
15 : 35	<p>W25-5 FABRICATION AND OPTICAL PROPERTIES OF AIR SPHERE/SILICON NANOCOMPOSITE X Liu, Y Zhang, Y Li, D Ge (Harbin Inst. of Technology) The Si photonic crystal obtained as an air-sphere/Si nanocomposite with periodical ordered pores in three dimensions has high application potentials in photonics, ultra fast optical switching, low-loss optical waveguides and solar cell. Here we report for the first time on the synthesis of air-sphere/Si nanocomposite by template-assisted electrodeposition.</p>	<p>W26-5 DYNAMIC PERFORMANCE OF MARINE SANDWICH PANEL STRUCTURES M Battley, T Allen (Univ. of Auckland) This paper describes an experimental study of sandwich composite panels subjected to transverse water impact loads in a controlled laboratory test facility. The focus is to determine the differences in panel responses during a slamming event to those predicted by traditional analysis approaches based on uniform pressure loads.</p>	<p>W27-5 A STUDY ON THE ENHANCEMENT OF DURABILITY PERFORMANCE OF FACED SLAB CONCRETE IN CFRD KS Woo, CY Song (Korea Electric Power Research Inst.), PJ Won (Konkuk Univ.) The main purpose of this research was to enhance the durability in both the design and construction of dams. Especially, in case of rockfill dams, the durability of face slab concrete in a concrete-faced rockfill dam (CFRD) is achieved by optimizing the fly ash replacement for cement and application of blended ...</p>	<p>W28-5 COMMERCIAL TRANSPORT AIRCRAFT COMPOSITE WING BOX TRADE STUDY WG Kang, IS Hwang (KARI) Composite wingbox concepts are estimated for the 90 seats turboprop transport airplane in this work. The wing of 90 seats turboprop transport is designed as an upper wing type. The wing consists of a center wing box, two outer wingbox at the right and left sides, LE and TE.</p>		<p>W29-5 THERMAL DEGRADATION OF POLYMERIC FOAM CORE MATERIALS FOR SANDWICH STRUCTURES S Zhang, JM Dullea-barton, RK Fruhmhann (Univ. of Southampton), OT Thomsen (Aalborg Univ.) The present paper proposes a new methodology to characterise the thermal degradation of the polymeric foam core material properties using DIC, focusing on the elastic shear properties. A master curve is proposed to describe the thermal degradation of polymeric foam core materials.</p>
15 : 55	<p>W25-6 CARBON FIBER COMPOSITES REINFORCED WITH CARBON NANOMATERIALS HS Kim (KIST), H Hahn (Univ. of California), E Belyarova (Carbon Solutions, Inc.), E Oh, GH Lee (POSTECH) The published papers and authors' research work on the mechanical properties and the electrical conductivities of the carbon fiber composites with the nano-reinforcements such as carbon nanotubes (CNTs) and graphite nanoplatelets (GNPs) are discussed in this paper.</p>	<p>W26-6 EFFECT OF FACESHEET THICKNESS ON DYNAMIC RESPONSE OF COMPOSITE SANDWICH PLATES TO UNDERWATER IMPULSIVE LOADING S Avachat, M Zhou (Georgia Inst. of Technology) The response of sandwich structures to underwater blast loading is analyzed. The analysis focuses on the effect of varying structural attributes on energy dissipation and deformation. The structures analyzed are planar sandwich plates with polymer foam cores and fiber-reinforced polymer composite facesheets.</p>	<p>W27-6 MECHANICAL BEHAVIOR ANALYSES OF PLASTICS UNDER ENVIRONMENTAL CHANGES H Kwon, WJ Choi, JH Choi, YK Kim (Korea Aerospace Univ.) The physical and mechanical property of engineering plastics changes under environmental conditions due to their unique amorphous molecular structure. In this study, the mechanical and physical properties of ABS, ABS+Polycarbonate, Polypropylene compared with under environmental changes, i.e. moisture absorption, isothermal degradation, and thermal cycling fatigue.</p>	<p>W28-6 STRUCTURES DEVELOPMENT OF SMART UAV JJ Lee, JM Kim (KARI) This paper presents a brief overview of development process of structures of smart UAV from initial conceptual design to final structural testing. The structural design criteria are based on airworthiness requirements. For the structural integrity and robustness of the composite airframe, the building block approach for testing and evaluation was processed.</p>		<p>W29-6 A METHOD FOR MEASUREMENT OF THREE-DIMENSIONAL CONSTITUTIVE PROPERTIES FOR COMPOSITE MATERIALS A Makeyev, Y He, Y Nikishkov (GaTech), B Shonkwiler (Clark Atlanta Univ.), E Lee (Bell Helicopter Textron), H Schreier (Correlated Solutions) Accurate three-dimensional stress-strain constitutive properties are essential for understanding of deformation and failure mechanisms for highly anisotropic materials. This work shows that simple short-beam shear specimens are well-suited for measurement of 3D constitutive properties for composite materials, and that can enable a major shift toward accurate 3D material characterization.</p>
16 : 15	Break					

	202B	203	301	302	401	402A
14:15	<p>W30 STABILITY OF THIN WALLED STRUCTURES Chairs: H Abramovich/ JH Choi</p> <p>W30-1 THIN WALLED COMPOSITE SHELLS UNDER AXIAL IMPULSIVE LOADING H Abramovich, P Pevsner, T Weller(I.I.T) The present study deals with 'dynamic buckling', where a composite cylindrical shell, which is subjected to an axial impact load, loses its stability once its lateral transient behavior becomes unbounded in response to the applied impulsive load and may buckle under its static load.</p>	<p>W31 BIOMEDICAL COMPOSITES Chairs: YD Zheng/ SS Jeon</p> <p>W31-1 PRELIMINARY STUDY ON MECHANICAL PROPERTIES OF BACTERIAL CELLULOSE/PVA MULTILAYER COMPOSITE HYDROGELS J Tan, Y Zheng, Y Ma, J Wu, R Tian(Univ. of Science and Technology) Bacterial cellulose (BC)/Poly vinyl alcohol (PVA) multilayer composite hydrogels was prepared, which could be used as biocompatible artificial cartilage implant materials. The mechanical properties and interface combination of the composite hydrogels with different PVA contents and different BC layers were investigated.</p>	<p>W32 TEXTILE COMPOSITES: 3D PREFORMING AND DAMAGE TOLERANCE Chairs: P Pottluri/ SW Jeon</p> <p>W32-1 A SPOOL PATTERN TOOL FOR CIRCULAR BRAIDING J Van Ravenhorst, R Akkerman(Univ. of Twente) A procedure is presented for relating braid patterns to spool patterns in circular braiding. The procedure can assist in the reduction of trial-and-error in the product manufacturing process and enables new features in computational braiding simulation and optimization.</p>	<p>W33 CARBON AND CERAMIC MATRIX COMPOSITES Chairs: H Ito/ A Romanenko</p> <p>W33-1 HIGH THERMAL CONDUCTIVITY OF THIN-WALL INJECTION MOLDED PARTS FOR ALN/PBT COMPOSITES H Ito, T Watanabe, T Takayama(Yamagata Univ.), Y Matusita, M Yamazaki(Mitsubishi Chemical Gr. Sci and Tech. Center, Inc) Thin-wall injection molded products of Aluminum Nitride (AlN) filler/poly (butylenes terephthalate) (PBT) composites with various AlN compositions were produced to investigate thermal diffusivity and process-ability of molded parts. In addition, effects of molding condition in injection compression molding on the thermal properties of molded parts were evaluated.</p>	<p>W34 PROCESSING AND MANUFACTURING TECHNOLOGIES/THERMOPLASTIC COMPOSITE MATERIALS Chairs: A Maffezzoli / C Kim</p> <p>W34-1 TRANSVERSE FLOW DURING IMPREGNATION OF FABRICS WITH THERMOPLASTIC MATRICES R Gennaro, M Gabrieli, A Greco, A Maffezzoli(Univ. of Salerno) Permeability of fabrics is a key characteristic for composite manufacturing. Permeability measurements in composite manufacturing are mainly studied in relation with, resin transfer moulding. However through-thickness flow occurring during processing of thermoplastic matrix composites requires the study of permeability of fabrics to high viscous fluids, in some cases even non-Newtonian.</p>	<p>W35 DELAMINATION AND INTERLAMINAR REINFORCEMENT Chairs: M Hojo/ M Arai</p> <p>W35-1 COMPARISON OF TWO FINITE ELEMENT METHODS WITH EXPERIMENTS OF DELAMINATED COMPOSITE PANELS K Branner, P Berring, M Galotti, C Rizzo(Technical Univ. of Denmark) This paper focuses on two different modeling approaches for delaminated multilayer composite panels. The results obtained from the two finite element modeling methods are compared with experimental results from testing flat composite panels with and without delaminations.</p>
14:35	<p>W30-2 ANALYTICAL STUDY ON POST-BUCKLING RESIDUAL STRENGTH OF STEEL FRAME HM Park, JH Kim, DY Abebe, JH Choi(Chosun Univ.) In this study, we analyzed the non-linear finite element of a one-story 4-span steel frame to assess energy absorption for accidental loss of columns. We did limit analysis to compare and examine the level of decrease of vertical loads.</p>	<p>W31-2 GOLD NANOPARTICLE MODIFIED PVA/GOX BIOCOMPOSITE MEMBRANES VIA ELECTROSPUN FOR BIOSENSOR APPLICATIONS C Wu, S Liu, H Chiu, Y Wang, C Ho, W Huang(Feng Chia Univ.) This study successfully combined the advantages of electrospun technology, gold nanoparticles and electrochemical biosensor to produce a high-sensitive glucose biosensor. We prepared the biocomposite electrospun nanofiber membranes by electrospun a solution of PVA, GOx and Gold nanoparticles. The 0.5% of nanoparticles was the best proportion in this experiment.</p>	<p>W32-2 MODELING OF 3D WOVEN COMPOSITES CONTAINING MULTIPLE DELAMINATIONS M Song, B Sanjar, T Walter, G Subhash(Univ. of Florida), C Yen(US Army Research Laboratory) This paper will focus on the simulation of short beam shear tests on 3D woven composites. Our objective is to simulate the experiments that have already been performed and to shed light on the various failure mechanisms. The results from the study will be able to explain the role of...</p>	<p>W33-2 DENSIFICATION OF AL4SiC4-SIC CONTAINING TYRANO-SA SIC FIBER SH Lee, BH An, HD Kim(KIMS) Al₄SiC₄ was used as a sintering additive of SiC. Dense SiC was obtained after SPS at 1600 - 1800°C when using 0.5 - 10wt% Al₄SiC₄. In spite of the high efficiency as a sintering additive, Al₄SiC₄ rather strongly deteriorated pyro-carbon coating and promoted the deformation of SiC.</p>	<p>W34-2 NANO-MODIFIED THERMOPLASTIC PREFORMS FOR THE MANUFACTURING OF COMPOSITE STRUCTURES P Krausz, G Seide, T Griess(RWTH Aachen Univ.), I Hassinger, T Burkhardt(Inst. fuer Verbundwerkstoffe GmbH) Within the presented research project "NanoOrgano" innovative, semi-impregnated pre-forms are being developed. These hybrid pre-forms allow the simultaneous consolidation and molding of thermoplastic composite parts. In order to improve the impact- and the tensile-strength of the composite, the thermoplastic component is modified additionally by nano particles.</p>	<p>W35-2 MONITORING OF DELAMINATION ONSET IN COMPOSITE LAMINATES USING LAMB WAVE SIGNALS D Wang, Y Lu, Y Tang, L Ye(Univ. of Sydney) Delamination is one of the major failure modes for composite laminates. In this study, a simple but reliable delamination monitoring method on the basis of Lamb wave propagation was proposed for characterizing Mode I and Mode II delamination onset in carbon fiber/epoxy (CF/EP) composite laminates.</p>
14:55	<p>W30-3 NONLINEAR BUCKLING OPTIMIZATION OF LAMINATED COMPOSITES INCLUDING "WORST" SHAPE IMPERFECTIONS E Lund, E Lindgaard(Aalborg Univ.) This objective of this work is nonlinear buckling optimization of multi-material laminated composite structures, where sensitivity to geometric imperfections is taken into account. The approach is gradient based, and the formulation includes the determination of the "worst" shape imperfection. Results presented include an example from a wind turbine blade.</p>	<p>W31-3 SPARK PLASMA SINTERED HYDROXYAPATITE - ZIRCONIA COMPOSITES: STRUCTURAL AND MECHANICAL PROPERTIES C Balazsi, G Gergely(Research Inst. for Technology) FC Sahin, G Goller(Istanbul Technical University) Nano hydroxyapatite-zirconia composites (Hap / ZrO₂) were studied. The Hap powder was reinforced with the mesh yttria stabilized zirconia. The composites were prepared by fast and direct spark plasma sintering (SPS). During the SPS process low temperatures (650-9500C) were applied.</p>	<p>W32-3 ESTIMATION OF MECHANICAL BEHAVIORS FOR TEXTILE COMPOSITES BASED ON MULTI-SCALE ANALYSIS T Kurashiki, Y Watanabe, Y Fujita, T Watanabe, M Zako(Osaka Univ.) For evaluation of mechanical properties of NCF and Off-axis woven composites, FE modeling system with the mesh superposition method has been developed. The stiffness reduction of NCF has same tendency with the numerical and experimental results. Furthermore, effects of woven angle-ply on stress distributions can be also estimated conveniently.</p>	<p>W33-3 PREPARATION AND PROPERTIES OF SELF-HEALING CARBON FIBER REINFORCED EPOXY COMPOSITE R Wang, H Hu, WB Liu, CQ Dai, XD He, S Wang (Harbin Inst. of Technology) Self-healing carbon fiber reinforced epoxy composite was prepared using binary healing system consisting of epoxy-containing microcapsules and imidazolone derivatives curing agent based on anionic polymerization. The self-healing properties of composite were investigated so as to provide parameters for making self-healing composite products.</p>	<p>W34-3 EFFECT OF SANDBLASTING SUBSTRATE TREATMENT ON SINGLE LAP SHEAR STRENGTH OF ADHESIVELY BONDED PEEK AND ITS COMPOSITES R Ourahmoune, N Mesrati(Ecole Nationale Polytechnique Algeria), M Salvia, T Mathia, B Berthel, S Fouvy(Ecole Centrale de Lyon) The effect of sandblasting treatment on surface morphology, wettability and the adhesive bonding strength of PEEK matrix, carbon fibers (CF) and glass (GF) reinforced PEEK substrate was studied. The adhesive was an epoxy based system. The strength of bonded joints was tested with the use of single lap shear tests.</p>	<p>W35-3 DELAMINATION GROWTH MECHANISM FROM EMBEDDED DEFECTS IN COMPRESSION C Canturri, E Greenhalgh, S Pinho(Imperial College), S Nilsson(Swerea SICOMP AB) The influence of the orientation of the ply interface on the growth mechanisms from an embedded defect is investigated through fractographic observations. Complex secondary failure modes are frequently associated with delamination such as fibre failure, matrix cracking and delamination migration. The paper establishes the interaction between this failure modes and delamination.</p>
15:15	<p>W30-4 SMALL SCALE EFFECT ON THE BUCKLING ANALYSIS OF DOUBLE-LAYER GRAPHENE NANORIBBONS EMBEDDED IN AN ELASTIC MATRIX JX Shi, T Natsuki, X Lei, Q Ni(Shinshu Univ.) The tremendous potential of graphene nanoribbons as nanofillers inside the elastic matrix has generated much interest among researchers. In this work, based on a continuum model, a theoretical analysis is used to investigate the small scale effect on buckling instability of double-layer graphene nanoribbons (DLGNRs) embedded in an elastic matrix.</p>	<p>W31-4 POLYMER-BASED COMPOSITE NANOFIBRES FOR WOUND HEALING APPLICATIONS V Leung, J Yang, V Leung(Univ. of British Columbia), R Hartwell, E Rahmani-neishaboor, Y Li, A Ghahary (Vancouver General Hospital) Electrospun polymer composites are attractive for addressing the intricate series of challenges involved in wound healing. Our study demonstrated that using PCL-PVA-PCL sandwich structured composite nanofiber designs, drug release profile and mechanical properties can be controlled, which is beneficial for managing the healing process of a wide variety of wounds.</p>	<p>W32-4 DAMAGE DEVELOPMENT IN A GLASS/EPOXY NON-CRIMP 3D ORTHOGONAL WOVEN FABRIC COMPOSITE S Vadlamani, Z Kakaratsios, S Ogün, D Jesson, S Kaddour, P Smith, J Sirichantha, A Bogdanovich(Univ. of Surrey) Coupons of a glass/epoxy non-crimp 3D orthogonal woven fabric composite have been manufactured with a high degree of transparency in order to be able to monitor damage accumulation during tensile, flexural and quasi-static indentation loading. The damage development reflects the complexity of the 3D structure.</p>	<p>W33-4 INFLUENCE OF DIELECTRIC MATRIX ON ELECTROPHYSICAL PROPERTIES OF MWNT-BASED COMPOSITES Al Romanenko, OB Anikeeva, EN Tkachev, KR Zhdanov, KV Elumeeva(Nikolaev Institute of Inorganic Chemistry SB RAS), VL Kuznetsov, IN Mazov(Institute of Catalysis SB RAS), SI Popkov, KA Shaykhtudinov(Institute of Physics SB RAS) Temperature and magnetic field dependences of conductivity of composite materials containing different types CVD multivalued carbon nanotubes in dielectric matrices have been investigated. Two sets of MWNTs with narrow diameter distribution in the range of 8-10 and 20-22 nm, both pristine and heated in Ar flow were used.</p>	<p>W34-4 APPLICATION OF FULL THERMOPLASTIC COMPOSITE FOR TYPE IV 70MPa HIGH PRESSURE VESSELS S Villalonga, C Thomas, F Nony(DAM), F Thiebaut(MahyTec), M Geli(Toray-Soficar), A Lucas(ParisTech-Ensam), K Kremer-knobloch, C Maugy(PSA Peugeot Citroen) This paper presents the developments of compressed gaseous hydrogen (CGH2) storage vessels from the French collaborative research project HYPE. The HYPE project consists in developing a full thermoplastic composite type IV 70M Pa high pressure vessel.</p>	<p>W35-4 MIXED MODES INTERLAMINAR FRACTURE TOUGHNESS OF CFRP LAMINATES TOUGHENED WITH CNF INTERLAYER M Arai, T Sasaki(Shinshu Univ.) In the present study, interlaminar fracture toughness for mixed mode (modes I and II) were investigated for carbon fiber (CF)/epoxy laminates toughened by a carbon nanofiber (CNF) interlayer. 2 dimensional boundary element analysis were applied to estimate the fracture toughness and mixed mode ratio of the CF/epoxy/CNF laminates.</p>
15:35	<p>W30-5 SMALL SCALE EFFECT ON THE BUCKLING ANALYSIS OF DOUBLE-LAYER GRAPHENE NANORIBBONS EMBEDDED IN AN ELASTIC MATRIX JX Shi, T Natsuki, X Lei, Q Ni(Shinshu Univ.) The tremendous potential of graphene nanoribbons as nanofillers inside the elastic matrix has generated much interest among researchers. In this work, based on a continuum model, a theoretical analysis is used to investigate the small scale effect on buckling instability of double-layer graphene nanoribbons (DLGNRs) embedded in an elastic matrix.</p>	<p>W31-5 THREE DIMENSIONAL WOVEN BONE TISSUE ENGINEERING SCAFFOLDS OF MELT-SPUN POLY(LACTIC ACID) FIBRES SW Cho, M Persson, M Skrifvars(Univ. of Boras) In this study melt-spun poly(lactic acid) fibres were produced to serve as a scaffolding material for medical applications and characterized in terms of the mechanical/thermal properties and biodegradability using simulated body fluid solution. Finally, a three dimensional structure was successfully woven and investigated.</p>	<p>W32-5 PREFORMING OF FIBRE BRIDGING FOR IMPROVED DAMAGE TOLERANCE P Pottluri, M Arshad, D Jetavat, P Jamshidi, P Hogg(Univ. of Manchester) This paper presents the through thickness reinforcement techniques such as stitching, tufting and 3D weaving. 3D woven laminates have been evaluated for damage tolerance using compression after impact tests. 3D weaves show significant reduction in damage area and the damage has been found to be through thickness rather than interlaminar.</p>	<p>W33-5 CEMENT COMPOSITE STAY-IN-PLACE FORMWORKS: A CONCEPT FOR FUTURE BUILDING SYSTEMS Q Remy, S Verbruggen, J Wasthels, T Tysmans(Vrije Univ. Brussel) This paper presents a concept for a lightweight stay-in-place cement composite formwork. Full scale tests analyzing the structural behavior indicate the opportunities of this innovative forming technique. Results also show improved mechanical behavior of the composite beam as micro cracking in tension is better controlled and crack propagation is delayed.</p>	<p>W34-5 THERMOPLASTIC COMPOSITES FOR FUTURE WIND TURBINE BLADES - PROS AND CONS D Thirumala, T Andersen, J Bech, H Lilholt(Risø DTU) The article describes the pros and cons of different thermoplastic material systems like commingled, prepreg, and reactive based polymer systems and challenges ahead to wind industry in developing a large scale turbine rotor blade.</p>	<p>W35-5 TRIBOLOGICAL BEHAVIOR OF CARBON NANOTUBE REINFORCED BASALT/EPOXY WOVEN COMPOSITES MT Kim, KY Bheeg(Kyunghee Univ.), SJ Park(Inha Univ.) It is known that moisture absorption has an influence on the mechanical properties of epoxy/basalt composites. For a present study, the effect of moisture absorption on the flexural behaviors of carbon nanotubes (CNTs) modified epoxy/basalt (epoxy/CNT/basalt) composites was investigated. Epoxy/basalt woven composites and epoxy/CNT/basalt composites were fabricated by incorporating woven...</p>
15:55	<p>W30-6 COMPARISON OF NANOPOROUS SCAFFOLDS MANUFACTURED BY ELECTROSPINNING AND NANOFIBRILLAR COMPOSITE CONCEPT ST Lin, D Bhattacharyya, S Fakirov, BG Matthews, J Cornish(Univ. of Auckland) This paper compares the morphology and the cell-matrix interaction of PLA and PET scaffolds produced using electrospinning and the nanofibrillar composite (NFC) concept. An osteoblastic cell line has been successfully cultured on both the PLA and PET electrospun scaffolds, where the cells have infiltrated into the PET structure.</p>	<p>W31-6 COMPARISON OF NANOPOROUS SCAFFOLDS MANUFACTURED BY ELECTROSPINNING AND NANOFIBRILLAR COMPOSITE CONCEPT ST Lin, D Bhattacharyya, S Fakirov, BG Matthews, J Cornish(Univ. of Auckland) This paper compares the morphology and the cell-matrix interaction of PLA and PET scaffolds produced using electrospinning and the nanofibrillar composite (NFC) concept. An osteoblastic cell line has been successfully cultured on both the PLA and PET electrospun scaffolds, where the cells have infiltrated into the PET structure.</p>	<p>W32-6 FABRICATION OF HIGH ASPECT RATIO WRINKLES BY CARBON DEPOSITION ON SOFT POLYMER TK Ko, KH Oh(Seoul National Univ.), SF Ahmed, KR Lee, MW Moon(KIST) We employ glancing angle deposition (GLAD) for deposition of a high aspect ratio patterns with amorphous carbon coating. The amplitudes of several nm to submicron size can be achieved by varying the carbon deposition time. We can demonstrate a potential application for changing the structures with low surface energy materials.</p>	<p>W33-6 TEXTILE REINFORCED CEMENT COMPOSITES FOR THE DESIGN OF VERY THIN SADDLE SHELLS: A CASE STUDY T Tysmans, S Adriaenssens, J Wasthels, O Remy(Vrije Univ. Brussel) Applying textile reinforced cement (TRC) composites instead of traditional steel-reinforced concrete in small span shells enables the design of significantly thinner, and thus lighter, shell structures. This paper quantifies this material gain by designing a case study of a 10 m span TRC saddle shell.</p>	<p>W34-6 FABRICATION OF COPPER LINE PATTERN BY VARYING SCANNING SPEED USING NANO PARTICLE DEPOSITION SYSTEM (NPPS) FOR THE APPLICATION OF DIRECT PRINTING TECHNOLOGY KS Kim, JW Lee, YH Kim, SY Lee(Hanyang Univ.) 100-nm sized copper nanopowders were deposited on silicon substrate as a line using nano particle deposition system (NPPS) at varying scanning speed to optimize deposition condition of copper line. These test results suggest that the fabricating copper lines using NPPS is a highly promising method for a new printing technology.</p>	<p>W35-6 MONITORING OF DELAMINATION ONSET IN COMPOSITE LAMINATES USING LAMB WAVE SIGNALS D Wang, Y Lu, Y Tang, L Ye(Univ. of Sydney) Delamination is one of the major failure modes for composite laminates. In this study, a simple but reliable delamination monitoring method on the basis of Lamb wave propagation was proposed for characterizing Mode I and Mode II delamination onset in carbon fiber/epoxy (CF/EP) composite laminates.</p>
16:15	Break					

	Halla A	Halla B	Samda A	Samda B	201A	202A
08:30	PL13: COMPOSITES AND THE EVOLUTION OF ENGINEERED MATERIALS Tia Benson Tolle (AFRL/ML)		PL14: POLYMER NANOCOMPOSITES WITH IMPROVED MULTI-FUNCTIONAL PROPERTIES Yiu-Wing Mai (University of Sydney)			
		(Chair: SK Ha)		(Chair: D Zhang)		
09:00	Break					
09:15	TH1 NANOCOMPOSITES Chairs: ZY Liang/ P Ermanni	TH2 ONR SESSIONS - RESEARCH IN COMPOSITES MATERIALS AND SANDWICH STRUCTURES Chairs: Y Rajapakse/ R Batra	TH3 GREEN COMPOSITES Chairs: DH Cho/ Y Li	TH4 NUMERICAL METHODS IN COMPOSITE MATERIALS Chairs: SJ Kim/ M Hagenbeek	TH5 CARBON AND CERAMIC MATRIX COMPOSITES Chairs: HJ Su/ YT Zheng	TH6 HIGH-PRECISION COMPOSITES Chairs: J Koyanagi/ SS Jeon
	TH1-1 PREPARATION AND ELECTROMAGNETIC PROPERTIES OF MULTI-WALLED CARBON NANOTUBES BUCKYPAPER/EPOXY RESIN NANOCOMPOSITES T Bao, Y Zhao (Beijing Univ. of Aeronautics and Astronautics), L Chen, Y Duan (Shanghai Aircraft Manufacturing Co., Ltd.) MWNT buckypaper composite is prepared successfully with optimized MWNTs with an aspect ratio of 200. The dielectric property of buckypaper composite was extraordinarily higher than the traditional composite due to the uniformed distribution of MWNTs in the buckypaper...	TH2-1 PROGRESSIVE DAMAGE AND FAILURE OF CURVED SANDWICH STRUCTURES DUE TO WATER SLAMMING R C Batra, J Xiao (Virginia Tech) We study the hydroelastic interaction between a curved deformable sandwich hull and initially calm water. It is found that the curvature of the shell has a noticeable effect on the pressure distribution, and hence on deformations of the hull.	TH3-1 EFFECT OF ELECTRON BEAM IRRADIATION ON THE MECHANICAL AND IMPACT PROPERTIES AND WATER ABSORPTION OF RANDOM AND 2-D JUTE/PLA GREEN COMPOSITES D Cho, SG Ji, JH Hwang (Kumoh National Inst. Of Technology) It has been addressed that the fiber-matrix adhesion is critically important in a composite system, particularly in green composites with natural fibers and polymer. Jute is one of the most attractive plant-based resources for manufacturing cost-effective and lightweight composites. However, the interfacial bonding between the natural fiber and the polymer...	TH4-1 NUMERICAL MODELLING OF FIBRE METAL LAMINATES UNDER THERMO-MECHANICAL LOADINGS M Hagenbeek (Holland Univ. of Applied Sciences), S Turellaa (Delft Univ. of Technology) A thermo-mechanical finite element model, based on a solid-like shell element, has been developed. This numerical model is used to characterise the behaviour of fibre metal laminates under thermo-mechanical loadings. Benchmark tests demonstrate the performance of the thermo-mechanical solid-like shell element.	TH5-1 MICROSTRUCTURE AND MECHANICAL PROPERTIES OF EUTECTIC COMPOSITE CERAMIC AL₂O₃/ZrO₂ BY EXPLOSION SYNTHESIS Y Zheg, T Zhou, G Ye, X Zhang (Harbin Inst. of Technology) Al ₂ O ₃ /ZrO ₂ eutectic ceramics were fabricated by explosion synthesis. The Al ₂ O ₃ /ZrO ₂ eutectic showed rod-like ZrO ₂ embedded in Al ₂ O ₃ matrix. The reaction temperature was in favor of larger volume fraction and finer structure of the eutectic. The Vickers hardness and fracture toughness can reach 21 GPa and 11.7 MPa·m ^{1/2} , respectively.	TH6-1 TIME AND TEMPERATURE DEPENDENCE OF SURFACE ACCURACY OF HIGH-PRECISION CFRP MIRRORS J Koyanagi (Japan Aerospace Exploration Agency), Y Arai, H Kawada (Waseda Univ.), S Utsunomiya, S Takeda (JAXA) We present sustainability and temperature dependence of surface accuracy of high-precision CFRP mirror. This study aims to clarify the critical ability regarding high precision of CFRP structure. The test result shows the CFRP mirror can be applied for infrared electro-magnetic wave observation.
09:35	TH1-2 FUNCTIONALIZATION OF SWCNTs: IMPACT ON TENSILE PROPERTIES AND MORPHOLOGY OF CNT-PAPER S Steiner, S Busato, P Ermanni (Swiss Federal Inst. of Technology Zurich) SWCNTs were chemically functionalized using different sidegroups. The nanotubes were processed into CNT paper subsequently. Tensile testing of CNT paper showed that the mechanical strength was increased. SEM-Micrographs also revealed that depending on the type of sidegroup attached, the morphology of the CNT-paper changed significantly.	TH2-2 NON-LINEAR THERMO-MECHANICAL RESPONSE OF FOAM CORE CIRCULAR SANDWICH PLATES OT Thomsen (Aalborg Univ.), Y Frostig (Technion) A geometrically nonlinear high-order sandwich panel theory is presented for circular sandwich plates with a compliant core with temperature dependent mechanical properties and subjected. It is found reveal that combined mechanical and thermal loads may shift the response from being linear and stable to nonlinear with limit point behavior...	TH3-2 BIODEGRADATION AND LIFE TIME OF SOY OIL BLENDED PLA AND RAMIE/PLA COMPOSITES SG Lee, TS Lee, TM Hong, HC Son, JW Yang (Chungnam National Univ.) Polylactic acid (PLA) is a biodegradable thermoplastic that can be produced from corn starch. It has not only high modulus and strength as well as biocompatibility, but also a brittle nature and a low toughness. The brittleness of PLA limits its general applications in extensive areas because it cannot provide...	TH4-2 MECHANICAL PROPERTIES OF VECTRAN STITCHED COMPOSITES: NUMERICAL MODELING AND EXPERIMENTAL VALIDATION A Yudhanto, N Watanabe, H Hoshi (Tokyo Metropolitan Univ.), Y Iwahori (Japan Aerospace Exploration Agency) This paper presents a prediction of in-plane mechanical properties of stitched composites based on homogenization method (asymptotic expansion technique). Experimental validation is carried out to verify the predicted properties.	TH5-2 OUT OF AUTOCLAVE MATERIAL "SEMI-PREG" / TECHNICAL DEVELOPMENT OF RESIN TRANSFER MOLDING Y Umemoto (Toho Tenax Co., Ltd.), N Kawamura (Toyota Motor Corp.) We have positively developed "semi-preg" as a method that can be molded low-cost. A new development material "semi-preg" is equal to mechanical property with "pre-preg" without autoclave. In addition this material can use thick fabric such as NCF. These material was adopted the white body of Toyota Lexus LFA.	TH6-2 GEOMETRICAL STABILITY OF CFRP LAMINATE CONSIDERING PLY ANGLE MISALIGNMENT Y Arai, H Kawada (Doshisha Univ.), J Koyanagi, S Takeda, S Utsunomiya (Japan Aerospace Exploration Agency) Strict geometrical stability is required for the precise structures like telescopes. It was reported that symmetrical CFRP (Carbon Fiber Reinforced Plastics) laminates show unpredictable deformation due to the ply angle misalignment and temperature change. This ply angle misalignment is unavoidable. One of the answer to mitigate the deformation due to ...
09:55	TH1-3 SYNTHESIS OF CARBON NANOTUBE REINFORCEMENT IN ALUMINUM POWDER BY IN SITU CHEMICAL VAPOR DEPOSITION X Yang, N Zhao, CS Shi, E Liu, CN He, J Li (Tianjin Univ.) Homogeneously dispersed CNTs reinforcement with the average diameter of 10 nm was fabricated in Al powders via in-situ chemical vapor deposition by using Co catalyst. The as-obtained composite powders with well-crystallized CNTs may pave a new way to prepare CNTs/Al composite with high properties.	TH2-3 FATIGUE OF SANDWICH BEAMS UNDER LOCALISED LOADS D Zenkert, S. Kazemhazaj, M Burman (Royal Inst. of Technology) In this paper we investigate the fatigue behavior of sandwich beams subjected to localised loads. The growth of the crushed core zone is monitored while increasing the fatigue loading.	TH3-3 TOWARDS IMPROVEMENT ON MECHANICAL PROPERTIES OF BASALT FIBER/POLYLACTIC ACID COMPOSITES BS Kim (KIMS), D Kurniawan, J Y, HY Lee, JY Lim (Dongguk Univ.) In an attempt to obtain improved mechanical properties of basalt fiber/poly(lactic acid) composites, this study examines various compatibilizing methods: desizing, silane treatment, maleic anhydride coupling agent, and atmospheric plasma polymerization. Tensile test were conducted on the composites and selected samples were further characterized.	TH4-3 FAILURE PREDICTION AND DAMAGE MODELING OF MATRIX CRACKING IN QUASI-ISOTROPIC LAMINATES AT THE PLY LEVEL GM Vyas, ST Pinho, P Robinson (Imperial College London) Matrix cracks under quasi-static loading can lead to significant stiffness reduction and other forms of damage in quasi-isotropic laminates. A user subroutine in a finite element code is presented, simulating the subsequent stress field and stiffness reduction after the onset of matrix cracking is detected using the chosen failure criterion.	TH5-3 LASER REMELTED AL₂O₃/ER₂O₃ EUTECTIC IN SITU COMPOSITE CERAMICS FOR HIGH TEMPERATURE THERMAL EMISSION APPLICATIONS H Su, J Zhang, YF Deng, W Guo, L Liu, HZ Fu (Northwestern Polytechnical Univ.) Al ₂ O ₃ /Er ₂ O ₃ eutectic composite is rapidly prepared by laser remelting at high growth rate. The eutectic presents ultra-fine irregular lamellar structure in submicron range. At the wavelength 1.5 um, the composite shows strong selective emission bands, which can be matched with GaSb PV cell as promising emitter material in TPV systems.	TH6-3 DIMENSIONAL STABILITY OF CFRP MIRRORS FOR SPACE TELESCOPES UNDER LOW TEMPERATURE ENVIRONMENT S Utsunomiya, T Kamiya, R Shimizu (Japan Aerospace Exploration Agency) Dimensional stability of CFRP mirrors for space telescopes under cryogenic environment was studied. Concave mirrors of 10 nm RMS surface roughness were manufactured using a replica technique. Surface profile of mirrors was changed in lower temperature than 210 K. Irreversible deformation due to fiber tow after cooling was observed.
10:15	TH1-4 SYNTHESIS OF TIGHTLY BOUNDED CNT FORESTS ON CARBON FIBERS FOR COMPOSITES E Oh, KH Lee (POSTECH), HS Kim, DM Yoon, T Hahn (UCLA) We successfully synthesized the tightly bounded CNT forests on CFs. We assessed the adhesion between CNT forests and CFs using the Scotch-tape test (ASTM D3359). The specimen, tightly bounded CNT forests grown on CF fabrics, was supplied to T. H. Hahn's group for the fabrication of composites, and further evaluation.	TH2-4 BUCKLING OF SANDWICH BEAMS USING THE EXTENDED HIGH-ORDER SANDWICH PANEL THEORY AND COMPARISON WITH ELASTICITY CN Phan, GA Kardomateas (Georgia Inst. of Technology), Y Frostig (Technion Israel Inst of Technology) The accuracy of the Extended High-Order Sandwich Panel Theory (EHSAPT) is shown with respect to Elasticity for global buckling and wrinkling of a simply supported sandwich beam undergoing edge beam loading. Allen's thick faces formulation and critical loads from the High-Order Sandwich Panel Theory (HSAPT) are also shown for comparison.	TH3-4 MECHANICAL PROPERTIES OF RENEWABLE SOYBEAN OIL THERMOSET REINFORCED WITH JUTE FIBRES AND LYCCELL FIBER Kf Adekunle, A Kalantar, M Skrifvars (Univ. of Bors), C Patzelt (Univ. of Applied Sciences) Composites and hybrid composites were manufactured from renewable materials which are based on jute fibers, regenerated cellulose fibres (Lyocell) and thermosetting polymer from soybean oil. Hybridization with Lyocell fiber increased the mechanical properties of the composites.	TH4-4 WAVELET BASED DISCRETIZATION TECHNIQUE FOR ANALYSIS AND DESIGN OF COMPOSITE STRUCTURES J Majak, K Kers, M Pohlak, M Eerme, K Luiga (Tallinn Univ. of Technology) The Haar wavelet based discretization method is adopted for the analysis of the composite structures. The discretization scheme developed has been validated by solving model problems. The obtained numerical results are found to be in good agreement with those available in literature (FEM, quintic splines interpolation technique).	TH5-4 PROGRESS IN DEVELOPING SiC/SiC COMPOSITE MATERIALS FOR ADVANCED NUCLEAR REACTORS STRUCTURES C Lorrette, C Sauder, L Chaffron (CEA) SiC/SiC composite is a refractory material which presents an excellent mechanical behavior in very harsh conditions. This material has been recently envisaged by CEA for different core structures of Nuclear reactors. We describe herein the last improvements regarding fabrication of tubular SiC/SiC composites through CVI route.	TH6-4 LONG-TERM MONITORING OF STRAIN CHANGES IN CFRP USING FBG SENSORS S Takeda, J Koyanagi, S Utsunomiya (Japan Aerospace Exploration Agency), Y Arai, H Kawada (Waseda Univ.) FBG sensors are one of the promising devices for SHM in CFRP structures. They have some advantages, small size, light weight, and immunity to electromagnetic interference. The authors report a fundamental demonstration about the monitoring of internal strain changes caused by physical aging in CFRP.
10:35	TH1-5 SYNTHESIS OF CO₂ NANOWIRES ON NICKEL FOAM BY A NOVEL MICROWAVE-ASSISTED TEMPLATE FREE METHOD JY Lee, KH Hui (Pusan National Univ.), CI Yin, KS Hui (City Univ. of Hong Kong), SK Lee (KIER) Spinel cobalt oxide (Co ₃ O ₄) nanowires grown on Ni foam are successfully synthesized using a novel microwave-assisted template-free method. The effect of reaction temperature, concentration of reactants, and reaction time on the morphology and crystalline structures of the prepared nanowires is studied.	TH2-5 FINITE ELEMENT ANALYSIS OF LOW VELOCITY IMPACT & COMPRESSION STRENGTH AFTER IMPACT OF SANDWICH COMPOSITE STRUCTURES BA Gama, SC Chowdhury, JW Gillespie Jr. (Univ. of Delaware) Present research will utilize the state-of-the-art progressive composite damage model, MAT162, in explicit dynamic finite element analysis code LS-DYNA and study the low velocity impact (LVI) and compression after impact (CAI) behavior of spherical floating objects on sandwich composite hull structures.	TH3-5 BIOBASED MATERIALS: POTENTIALS AND OBSTACLES FOR STRUCTURE, STRENGTH AND PERFORMANCE OF CELLULOSE FIBRES AND THEIR COMPOSITES H Lilholt, B Madsen, A Thygesen (Technical Univ. of Denmark) Biobased materials are potential structural materials. A useful concept is fibre reinforcement. The bioresources can contribute strong cellulose fibres and biopolymers from hemicelluloses. This offers the potential for stiff and strong composites, although with some limitations. Focus is on structure and strength of cellulose fibres and their composites.	TH4-5 LENGTH-SCALE-DEPENDANT STRENGTHENING OF PARTICLE-REINFORCED METAL MATRIX COMPOSITES WITH STRAIN-GRADIENT PLASTICITY YS Suh, MS Park, S Song (Hankyong Univ.) The length-scale dependent strength of particle-reinforced metal matrix composites is predicted by the displacement based low order finite element method with strain gradient plasticity. The predicted and experimental composite true stress true strain curves for spherical particle revealed distinct length scale depending on the particle size with reasonable accuracy.	TH5-5 SILVER NANOPARTICLES GRAFTED CARBON NANOTUBE CAPSULES: SYNTHESIS AND CHARACTERIZATION EA Lopez, SH Ryu, S Am (Kyung Hee Univ.) Carbon nanotube capsules (CNCs) are prepared via self-assembly of acid modified carbon nanotubes in a water-in-oil emulsion system. Silver nanoparticles are encapsulated in the carbon nanotube capsules through microwave assisted reduction reaction. Several characterization techniques revealed the successful formation of the carbon nanotube capsules and the grafting of the silver nanoparticles.	TH6-5 IMPROVEMENT OF THE CFRP COMPOSITE MIRROR SURFACE USING A REPLICA METHOD K Tomohiro, U Shin, K Keiji, S Ryu (Japan Aerospace Exploration Agency) CFRP have excellent properties for satellite structures. However, there is fiber print-through on the surface and it's necessary to overcome it for applying to space telescope mirrors. We achieved the improvement of micro roughness to several nm using a replica method and overcome fiber print-through.
10:55	TH1-6 TRANSPARENT CONDUCTIVE CNT/POLYMER NANOCOMPOSITES FOR ORGANIC SOLAR CELL APPLICATION SH Jin, GH Jun, SW Jeon, SH Hong (KAIST), SI Cha (KERI) We fabricate the SWNT/PEDOT:PSS nanocomposites for TCs. Non-covalent functionalized SWNT/PEDOT:PSS nanocomposites showed the high electrical conductivity due to non-destructive functionalization of SWNTs having high electrical conductivity. Furthermore, we applied non-covalent functionalized SWNT/PEDOT:PSS nanocomposites as hole conducting layer in OSC. It showed 30% enhancement PCE compared to OSC using raw PEDOT:PSS.	TH2-6 HOMOGENIZATION OF SANDWICH PANELS WITH COMPLEX MICROSTRUCTURE B Ravishanker, A Sharma, B Sankar, R Haftka (Univ. of Florida) The homogenization of a corrugated core sandwich panel as a 2D orthotropic plate was performed through finite elements. A method is also proposed to estimate the transverse shear stiffness of the equivalent plate. Deflection comparison of the panel with and without shear stiffness demonstrated the importance of transverse shear stiffness.		TH4-6 ON FIBER DIRECTION AND POROSITY CONTENT USING ULTRASONIC PITCH-CATCH TECHNIQUE IN CFRP COMPOSITE SOLID LAMINATES KH Im, W Yang, TH Kim, YH Hwang, CH Song (Woosuk Univ.), JW Park (Jowa State Univ.), DK Hsu (Chosun Univ.) A nondestructive technique would be very useful for evaluating the CFRP composite laminates. Extensive ultrasonic measurements were made on the unidirectional CFRP solid laminates. It is found that a pitch-catch signal was more sensitive than normal incidence backwall echo of longitudinal wave to subtle flaw conditions in the composites.	TH5-6 INCREASING THERMAL CONDUCTIVITY OF ENGINEERED FLOORING THROUGH EXFOLIATED GRAPHITE COMPOSITES FOR BUILDING ENERGY CONSERVATION JK Seo, SM Kim (Sooongsil Univ.) In this study, to increase thermal conductivity, xGNP is used with adhesives for surface bonding of wood-based flooring. The study is aimed at investigating the effect and dispersion of xGNP in adhesive, and bond strength and thermal conductivity.	TH6-6 HIGH-PRECISION HYBRID COMPOSITE STRUCTURES FOR SPACE OPTICS T Yokoyama, T Ozaki (Super Resin, Inc.) A new lightweight hybrid composite structure for space optics was designed and a structural demonstrator was successfully fabricated. The measured results show the good feasibility of this structure for the optical parts such as mirrors and focal planes.
11:15	Break					

	202B	203	301	302	401	402A
08:30						
09:00	Break					
09:15	TH7 SANDWICH TECHNOLOGIES Chairs: SW Jeon/ WR Yu	TH8 BIOMEDICAL COMPOSITES Chairs: T Takayama/ C Cimini Jr.	TH9 MULTISCALE MODELING AND SIMULATION OF NANOCOMPOSITES Chairs: MH Cho/ C Kim	TH10 SMART COMPOSITE MATERIALS Chairs: J Leng/FY Yeh	TH11 NEW ADVANCEMENTS IN MANUFACTURING THERMOPLASTIC FIBER REINFORCED POLYMER COMPOSITES FOR LARGE-SCALE Chairs: P Mitschang/ T Czigrany	TH12 PROGRESSIVE DAMAGE AND FAILURE Chairs: TE Tay/ H Dharan
	TH7-1 EXPERIMENTAL INVESTIGATION ON ULTIMATE STRENGTH OF CORRODED WEB-CORE SANDWICH PANEL STRIPES J Jelovica, J Romanoff, S Ehlers, J Aromaa(Aalto Univ.) The paper presents the ultimate strength results from the three-point bending tests that were performed on corroded web-core sandwich panel stripes. Specimens were submerged into the sea for one and two years. Different types of corrosion avoidance measures are considered, including the foam-filled core.	TH8-1 DEVELOPMENT OF BIOACTIVE POLYSULFONE NANOCOMPOSITES FOR BONE TISSUE REPLACEMENT AJ Jose, M Alagar(Anna Univ.) The work combines orthopedics and nanotechnology to prepare polysulfone nanocomposite bone implant with integrated bioactivity and mechanical properties for healing fractures and treating musculoskeletal disease. Polysulfone (PS) nanocomposites with variable amounts of stearic acid modified nano hydroxyapatite (n-SHA) were prepared for investigating the mechanical, hydrophobic and biocompatible properties.	TH9-1 MODELING OF MECHANICAL PROPERTIES OF MULTI-LAYERED PILLARED GRAPHENE NANOSTRUCTURES SW Shin(Univ. of Dayton Research Institute), V Varshney(Univ. Technology Corporation), AK Roy(AFLR/RXT), BL Farmer(AFLR/RX) A computational finite element analysis-based structural mechanical mechanics was conducted to predict effective mechanical properties of a 3-D novel carbon structure, multi-layered pillared graphene nanostructure (MPGS), which is constituted with several multi-layered graphene sheets and multi-walled carbon nanotubes as pillars.	TH10-1 SELF-SENSING CEMENT-BASED COMPOSITE FOR STRAIN MEASUREMENT AND DAMAGE DETECTION FY Yeh, CH Yu(National Center for Research on Earthquake Engineering), KC Chang, WC Liao, JC Lin(National Taiwan Univ.) This article shows that CFRP with the functionality similar to piezoresistivity material can be used as a self-sensing material for strain measurement and damage detection. The self-sensing ability of CFRP cement-based composite has been well demonstrated under compression and flexure.	TH11-1 HEATING OF POLYMER-POLYMER COMPOSITES BY INDUCTIVE MEANS T Bayerl, P Mitschang(IWV GmbH) Polymer-polymer composites consist of polymer matrix and polymer reinforcement. They offer extreme light-weight design possibilities with excellent impact behavior. A new approach of heating polymer-polymer composites by inductive means is introduced in this work. Heating promoters are exclusively used in the matrix phase to avoid the melting of the reinforcement.	TH12-1 PROGRESSIVE DAMAGE IN STITCHED COMPOSITES UNDER IMPACT LOADING KT Tan, N Watanabe(Tokyo Metropolitan Univ.), A Yoshimura, Y Iwahori, T Ishikawa(Japan Aerospace Exploration Agency) Progressive damage in stitched composites is studied using quasi-static indentation test. Damage progression is characterized into three stages: damage initiation, damage propagation and final failure. The effect of stitching, particularly stitch density, is investigated using ultrasonic c-scan analysis, x-ray radiography and micro computed tomography to elucidate fracture and damage mechanisms.
09:35	TH7-2 COMPRESSION PROPERTIES OF X-COR SANDWICH STRUCTURE H Shao, J Xiao(Nanjing Univ. of Aeronautics & Astronautics) Comparison test of compress property was carried out on different z-pin angle, face sheet thickness, with and without foam. The paper established composite structure finite element model which was composed of shell element simplified from face skin, beam element simplified from z-pin, spring element imitated transverse support against z-pin buckling.	TH8-2 FLEXURAL STIFFNESS OF GRFP COMPOSITE ORTHODONTIC ARCHWIRES CA Cimini Jr.(UNICAMP), JDD Melo, AM Medeiros(UFRN), EBL Casas(UFMG) In this work, a three-point bending test program was conducted according to the ISO Standard 15841 in commercially available orthodontic archwires, in order to evaluate their flexural stiffness. Test specimens were cut from circular cross section GRFP archwires. Results were compared to stainless steel archwires data obtained from the literature.	TH9-2 MULTISCALE ANALYSIS OF THERMAL CONDUCTIVITY FOR PARTICULATED NANOCOMPOSITES SY Yu, SH Yang, MH Cho(Seoul National Univ.) A sequential multiscale model to characterize the size effects of nanoparticles and the Kapitza thermal interface resistance on the effective thermal conductivity of SiC/epoxy nanocomposites is developed through non-equilibrium molecular dynamics (NEMD) simulations and continuum micromechanics	TH10-2 DIELECTRIC ELASTOMERS MEMBRANE ACTUATOR UNDERGOING POLARIZATION SATURATION LJ Liu, YJ Liu, JS Leng(Harbin Inst. of Technology) In this paper, a free energy function which consists of nonlinear elastic strain energy and nonlinear electric field energy is proposed to construct the constitutive equation and predicate the electromechanical instability and the snap-through instability of dielectric elastomer undergoing polarization saturation.	TH11-2 CONTROLLED INFLUENCE OF COMPONENT PROPERTIES USING HYBRID TECHNIQUES BY COMBINING DIFFERENT LIGHTWEIGHT STRUCTURES R Holschub, P Mitschang(Institut fuer Verbundwerkstoffe GmbH), R Schledjewski(Montanuniversitaet Leoben) Hybrid structures can be produced by combining two or more material partners with different mechanical properties with the aim to increase the properties of the resulting component. The application of the reinforcements by thermoplastic tape placement process is a new approach and scope of this work.	TH12-2 A LEVEL SET MODEL FOR DELAMINATION ANALYSIS WITH LARGE ELEMENTS EP Van Der Meer(Delft Univ.), N Moes (Ecole Centrale de Nantes), B Sluys(Delft Univ.) A new approach to the modeling of progressive delamination is introduced. The crack front is represented with the level set method, which implies that it is a line which can be arbitrarily located within the elements. Larger elements can be used because no cohesive zone needs to be resolved.
09:55	TH7-3 STUDY ON THE DAMAGE PROPAGATION OF A COMPOSITE SANDWICH PANEL WITH FOAM CORE AFTER LOW VELOCITY IMPACT ZH Xie, J Tian, J Zhao, W Li, T Zhao, X Li(Northwestern Polytechnical Univ.) This paper introduces the work on the sandwich compression after impact test on composite sandwich panels with foam core and an analytical model that can successfully predict the damage propagation behavior of a foam core sandwich panel with a low-velocity impact damage.	TH8-3 PREPARATION OF ANODIC OXIDE FILM ON Ti-6Al-4V VIA ANODIZATION IN MONOCLICUMPHOSPHATE MONOHYDRATE (MCPM) ELECTROLYTE S Sripasertsuk, S Jinawath, DP Kashima(Research Unit of Advanced Ceramics) Anodic oxide film was obtained on Ti-6Al-4V by anodization from different concentration of MCPM electrolyte at different low current densities. The analysis of AFM revealed that higher current density was beneficial for the surface roughness and the hydrophilicity of the anodic oxide film which provide the osseointegration to the implant.	TH9-3 MULTISCALE MODELING OF COVALENTLY GRAFTED NANOPARTICLE/POLYMER NANOCOMPOSITES SH Yang, JM Choi, SY Yu, MH Cho(Seoul National Univ.) In this study an efficient multiscale modeling technique to describe the filler size dependent elastic stiffness of covalently grafted nanosilica/polymer nanocomposites is proposed.	TH10-3 MICROWAVE TUNABLE COMPOSITES WITH MELT-EXTRACTED MAGNETIC MICROWIRES FX Qin, HX Peng(Bristol Univ.), LV Pamina(Univ. of Plymouth), A Zhukov(Universidad del Pais Vasco) Microwave tunable properties of composites containing soft ferromagnetic microwires embedded were investigated. Electromagnetic parameters such as effective permittivity can be well tuned by applied field. It is shown that the microwire polymer composite is a truly multifunctional composite material for a variety of technological applications such as structural health monitoring.	TH11-3 INFLUENCE OF INHOMOGENEOUS TOOL TEMPERATURE ON THE INTERLAMINARE PRESSURE OF THE CONTINUOUS COMPRESSION MOLDING PROCESS M Christmann, P Mitschang(Institut für Verbundwerkstoffe GmbH) The examination of the interlaminare pressure distribution of the continuous compression molding process has clearly shown that there is a significant influence of an inhomogeneous tool temperature. A significant lack of pressure was found in the transition region from hot to cold which was treated back to the polymer shrinkage.	TH12-3 ANALYTICAL MODEL FOR THE PREDICTION OF THE FRACTURE TOUGHNESS OF MULTIDIRECTIONAL LAMINATES P Camanho, G Catalanotti(Univ. of Porto) This work proposes a simple model to predict the fracture toughness of multidirectional carbon-epoxy composite laminates using the fracture toughness of the 0 ply.
10:15	TH7-4 EVALUATION OF CRACK ARRESTER WITH SEMI-CYLINDRICAL SHAPE UNDER MODE II TYPE LOADING Y Hirose(Kanazawa Inst. of Technology), H Matsuda, G Matsubara (Kawasaki Heavy Industries, Ltd.), M Hojo(Kyoto Univ.) The simple crack suppression method for foam core sandwich panel structures, named the crack arrester, was proposed. This concept is to install the material with higher stiffness on the interfacial crack propagation path to suppress the crack propagation. Its effect was evaluated analytically and experimentally under mode II loading.	TH8-4 MECHANICAL PROPERTIES AND BIOCOMPATIBILITY OF Ti-Nb-X-HA COMPOSITES FBRICATED BY RAPID SINTERING USING HIGH ENERGY MECHANICAL MILLING POWDERS KD Woo, SH Park, JY Kim, SH Kim, SM Lee, HR Kor, SM Kim, MS Moon(Chonbuk National Univ.) Ti-6Al-4V ELI alloys have been widely used as alternative bone because of its excellent biocompatibility, although it still has many problems such as high elastic modulus and toxic. Therefore, biomaterial with low elastic modulus and nontoxic has to be developed. In order to overcome these problems, new Ti based alloys...	TH9-4 THE THERMOELASTIC BEHAVIOR OF POLYMERIC BASED NANOCOMPOSITES IN GLASSY AND RUBBERY STATES JM Choi, SY Yu, SH Yang, MH Cho(Seoul National Univ.) The filler size dependency of cross-linked epoxy-based nanocomposites are investigated through MD simulations. By embedding the SiC nanoparticles, the glass transition temperature(Tg) and thermoelastic properties of epoxy are improved. Especially regarding the CTE and elastic moduli of nanocomposites, the particle size dependency is clearly observed below and above the Tg.	TH10-4 ALIGNED NICKEL NANOSTRAND IN NANOPAPER ENABLED SHAPE-MEMORY NANOCOMPOSITE FOR HIGH SPEED HB Liu, J Leng(Harbin Inst. of Technology) J Gou(Univ. of Central Florida) A series of experiments were conducted to study the synergistic effect of MWNT nanpaper and vertical aligned nickel nanostrands on the SMP nanocomposites. The actuation of the SMP nanocomposites was achieved by electrically resistive heating. These blended vertically aligned nickel nanostrands also significantly optimized the heat transfer.	TH11-4 FRICTION STIR WELDING OF FIBER REINFORCED POLYMER COMPOSITES T Czigrany, Z Kiss(Budapest Univ.) The applicability of friction stir welding to fiber reinforced thermoplastic matrix composites is demonstrated by mechanical tests, optical and electron microscopic studies.	TH12-4 FRACTURE PROCESSES IN MULTI-SCALED CARBON NANOTUBE/GLASS FIBER REINFORCED COMPOSITES SUBJECTED TO FATIGUE LOADING CS Grimmner, CKH Dharan(Univ. of California, Berkeley) The addition of 2wt. % carbon nanotubes improves the high-cycle fatigue life of glass fiber composites by a factor of at least 2.5 times. This effect is seen in both delamination crack propagation rates as well as in in-plane cyclic loading and is attributed to distributed nano-level damage mechanisms.
10:35	TH7-5 PROPERTY EVALUATION OF CFRP SANDWICH PANEL UNDER CRYOGENIC TEMPERATURE K Kudoh, M Koyama, H Fukuda(Tokyo Univ. of Science) The demand of large-size primary mirrors for infrared telescopes is increasing. Structural material demands superior characteristics such as lightweight, high stiffness, stable mechanical properties at low temperature and high surface accuracy. In the present study, we focus on the development of primary mirror made of sandwich panel with CFRP skin.	TH8-5 BIOMIMETIC AND BIOCOMPATIBLE CHITOSAN-CARBON NANOTUBE COMPOSITE SCAFFOLDS FOR BONE TISSUE ENGINEERING J Venkatesan, SK Kim(Pukyong National Univ.) We have developed a novel chitosan/F-MWCNT composite scaffold by freeze drying method to mimic the function of extracellular matrix of bone. Based on improved physicochemical and biological properties of composite scaffolds, we conclude that F-MWCNT/chitosan scaffold will have great potential applications in the field of bone tissue engineering.	TH9-5 MULTISCALE HOMOGENIZATION METHOD TO PREDICT FILLER SIZE-DEPENDENT THERMOELASTIC PROPERTIES OF POLYMER NANOCOMPOSITES SM Chang, SH Yang, SY Yu, MH Cho(Seoul National Univ.) The thermoelastic multiscale homogenization method was suggested to describe the particle-size effect on the nanocomposites. The thermoelastic properties of the effective interphase numerically obtained using the homogenization method and the properties of composites including many particles having various radii are calculated and verified or stochastic analysis of real nanocomposites.	TH10-5 BEHAVIOR OF CARBON-EPOXY COMPOSITE FOR HYPERVELOCITY IMPACTS AT OBLIQUE ANGLE ON SPACECRAFT IN LOW EARTH ORBIT ENVIRONMENT AHK Baluch, CG Kim, JB Moon, G Lim(KAIST) HVI impacts at oblique angle on spacecraft composite wall with stacking sequence [0/±45/90]. Is is studied in scenario of LEO environment. 0.40% mass loss and the energy absorption because of space debris attack on wall was found 35% more in comparison to that of normal impacts on Composite and Aluminium plates.	TH11-5 THERMOPLASTIC HIGH PERFORMANCE COMPOSITES: ENVIRONMENTAL REQUIREMENTS FOR FUTURE HELICOPTER AIRFRAMES PP Parveller, C Weimer(Eurocopter Deutschland GmbH) Future helicopter (HC) airframe structures are aimed to provide higher value to the end-users. This target can be achieved by increased payload, enlarged mission capabilities (range, flight envelope, speed,...), optimised long-life solutions, improved availability, economical operation, environmental impact and other factors (passenger comfort, noise,...). Thermoplastic composites materials deliver unique opportunities.	TH12-5 NON-LINEAR PROGRESSIVE FAILURE ANALYSIS OF COMPOSITE AEROSPACE STRUCTURES M Gunesl, A Kayran(Middle East Technical Univ.) Article presents a study of geometrically non-linear progressive failure analysis of composite aerospace structures subjected to combined in-plane and out-of-plane loadings. Ply and constituent based failure criteria, progressive degradation schemes have been coded into a PCL code in Nastran. Progressive failure analyses of sample composite laminates with cut-outs are executed.
10:55	TH7-6 FAILURE PREDICTION IN HONEYCOMB SANDWICH BEAMS UNDER LOW-VELOCITY IMPACT I Ivanez, C Santisteban, E Barbero, S Sanchez-Saez(Universidad Carlos III de Madrid) In this work, the low-velocity impact response of composite sandwich beams with carbon fibre/epoxy face-sheets and aluminium honeycomb core was studied by developing a three dimensional finite-element (FE) model, which was validated through a series of flexural tests conducted in a drop-weight tower.		TH9-6 HOMONGENIZATION AND DIMENSIONAL REDUCTION OF THE NANO-SIZED HONEYCOMB STRUCTURES CONSIDERING SURFACE EFFECTS YH Lee, J Jeong, MH Cho(Seoul National Univ.) The mechanical properties of the nano-sized honeycomb with surface effect are compared without that. The analysis method based on the continuum theory is applied for considering surface effect. For the more efficient computations, the homogenization and dimensional reduction by applying the asymptotic expansion method is carried out.	TH10-6 RADAR ABSORBING STRUCTURE WITH PERIODIC PATTERN SURFACES FOR WIND TURBINE BLADES HK Jang, WH Choi, JH Shin, TH Song, JK Kim, CG Kim(KAIST), JB Kim, DW Lim(KIMS) The purpose of research is to present the RAS with periodic patterns surface made by conductive paste for the wind blades in order to reduce the reflected signals. The RCS declined by nearly 99 % at the target frequency and was decreased more than 80 % on the larger X-band.	TH11-6 NEW MATERIAL DEVELOPMENTS FOR LARGE SCALE PRODUCTION IN AUTOMOTIVE SECTOR YK Kil, GH Jung, HJ Kim(LG Hausys), M Christmann, P Mitschang(Institut für Verbundwerkstoffe) A new development of continuous fiber-reinforced thermoplastics (CFTs) having excellent mechanical properties are presented in this paper. Basic mechanical properties of CFT (PP/GF) are evaluated. Also, full-size vehicle bumper beams reinforced by the new CFTs are manufactured and evaluated to demonstrate feasible weight reduction or performance enhancement for automotive applications.	TH12-6 TOUGHNESS DETERMINATION IN COMPOSITE MULTIMATERIAL CLOSED CORNERS D Vicentini, A Barroso, J Justo, V Marent, F Paris(Univ. of Seville) A general procedure for the experimental evaluation of the generalized fracture toughness (GFT) in multimaterial corners is proposed. The procedure obtains the GFT associated to each singular term. The whole procedure has been applied to a CFRP-Al bimaterial corner obtaining a failure envelope which predicts accurately the failure initiation.
11:15	BREAK					

	Halla A	Halla B	Samda A	Samda B	201A	202A
11:30	<p>TH13 PROBABILISTIC APPROACHES AND DESIGN Chairs: HC Noh/ N Dimitrov</p> <p>TH13-1 ENFORCING SYSTEM APPROACH TO COMPOSITE FAILURE CRITERIA FOR RELIABILITY ANALYSIS N Dimitrov(Siemens Wind Power A/S), P Friis-hansen(Det Norske Veritas), C Berggreen(Technical Univ. of Denmark) The presence of multiple failure modes impose challenges to applying reliability analysis to composites. When failure is assessed using a multi-modal failure criterion using single FORM analysis will result in an incorrect reliability estimate. This is rectified by adopting a system analysis approach.</p>	<p>TH14 ONR SESSIONS - RESEARCH IN COMPOSITES MATERIALS AND SANDWICH STRUCTURES Chairs: Y Rajapakse/ TW Chou</p> <p>TH14-1 RECENT PROGRESS IN RESISTANCE-BASED DAMAGE SENSING OF CARBON NANOTUBE-FIBER COMPOSITES A Wu, TW Chou, ET Thostenson(Univ. of Delaware) Resistance-based damage sensing provides a unique matrix cracking, delamination, fiber pull-out and breakage methodology for sensing the onset of local damage, such as matrix cracking, delamination, fiber pull-out and breakage in composite materials in situ. A review of recent research into carbon nanotube-based damage sensing in composite materials under quasi-static and dynamic loading scenarios is presented herein.</p>	<p>TH15 NATURAL FIBER COMPOSITE MATERIALS Chairs: JI Song/ AL Duigou</p> <p>TH15-1 CHARACTERISATIONS OF HYBRID COMPOSITES A Kalam, MN Berhan(Univ.Teknologi MARA), H Ismail(Univ. Sains Malaysia) Previous report showed that the addition of PPNanoclay into hybrid composites has improved its tensile and flexural moduli. Hence, this report will further investigates the effect of PPNanoclay loading on the other properties such as water absorption, thermal behaviour and impact strength of OPFB/ PPNanoclay/PP hybrid composites.</p>	<p>TH16 INFRASTRUCTURE / LIFE CYCLE ANALYSIS AND SUSTAINABILITY Chairs: HK Liu/ WC Liao</p> <p>TH16-1 VACUUM AND PRESSURE BAGGINGS TO IMPROVE THE CFRP WRAPPINGS OF CONCRETE CYLINDERS WC Liao, YK Chang, WT Su(Feng Chia Univ.), MD Hwang(Tungnan Univ.) The vacuum bagging, pressure bagging and hand layup methods are used in the FRP wrapping of concrete cylinders. Through the axial compressive strength testing, the hand layup method has the highest compressive strength. The pressure bagging and non-adhesive vartm systems can reach 90% and 84% of the hand layup method.</p>	<p>TH17 STANDARDIZATION Chairs: J Pandey/ M Li</p> <p>TH17-1 STANDARDIZATION OF BOEHM TITRATION ANALYSIS OF SURFACE OF FUNCTIONALITIES OF CNTS AS REINFORCEMENTS FOR COMPOSITES YS Kim, SJ Yang, SW Kim, HJ Lim, TH Kim, CR Park(Seoul National Univ.) A standard for the analysis of Boehm titration curves of carbon nanotubes (CNTs) of which the reaction bases were affected by acidic carbon fragments and atmospheric carbon dioxide was proposed to support the systemic study related with interfacial interaction between CNTs and polymer matrix in the CNT composites.</p>	<p>TH18 HIGH-PRECISION COMPOSITES Chairs: J Koyanagi/ G Verchery</p> <p>TH18-1 DYNAMIC PERFORMANCE OF HB-CESIC® UNDER SEVERE CONDITIONS AND ITS APPLICATIONS M Kroedel(ECM Engineered Ceramics Materials GmbH), I Ozaki(Composites Research and Development Co. Ltd.) HB-Cesic® is a European and Japanese trademark of ECM Engineered Ceramic Materials GmbH® is a Hybrid Carbon-Fiber Reinforced SiC composite. The test results according to shock tests, performed on HB-Cesic® samples and representative optical structures to demonstrate the high performance of HB-Cesic® also under such...</p>
11:50	<p>TH13-2 A PROBABILISTIC APPROACH TO ACCOUNT FOR THE "WEAR-IN" SCATTER OF A HYBRID COMPOSITE MATERIAL B Burk, M Kumosal(Univ. of Denver) In this work a framework to numerically account for geometric and material property variability inherent to the fatigue and material of a hybrid composite material was developed. Geometric variability was incorporated via a mesh morphing scheme, while the material property variability was included through Monte Carlo sampling of the Eshelby method.</p>	<p>TH14-2 MECHANICAL CHARACTERIZATION AND MODELING OF HIERARCHICALLY-STRUCTURED COMPOSITE MATERIALS H Bruck, S Haldar(Univ. of Maryland) The mechanical behavior of a biological hierarchically-structured composite material, Palmetto wood, has been characterized under quasi-static and impact loading in three-point bending. A model has been developed based on partitioning of elastic and inelastic strain to capture evolution of damage relative to plastic strain, and a bio-inspired composite structure developed.</p>	<p>TH15-2 PULLOUT BEHAVIOUR OF CHAMBIRA FIBER (COLOMBIAN NATURAL FIBER) EMBEDDED IN POLYLACTIC ACID (PLA) MATRIX DC Paez, A Porras, A Maranon(Universidad de los Andes) In this paper, interfacial shear strength (IFSS) of Chambira fiber bundle embedded in Polylactic acid (PLA) was measured by single fiber pullout test. It was found that IFSS fit well the two-parameter Weibull distribution, using both relationships: the apparent diameter and the perimeter of the fiber bundle cross section.</p>	<p>16-2 MECHANICAL BEHAVIOUR OF FRP-CONFINED CONCRETE COLUMNS UNDER AXIAL COMPRESSIVE LOAD V Tamuzs, V Valdmanis(Univ. of Latvia) The strength, deformability and stability of concrete confined columns is considered. The formulas for prediction of ultimate strength, ultimate strain, and the tangent modulus above the limit of nonlinearity are given. Confined reinforced concrete columns also are considered. The loss of stability of columns is analyzed.</p>	<p>TH17-2 DETERMINATION OF THERMODYNAMIC SURFACE CHARACTERISTICS OF CARBON NANOTUBES VIA INVERSE GAS CHROMATOGRAPHY METHOD HJ Lim, YS Kim, CR Park (Seoul National Univ.) Thermodynamic surface characteristics of CNTs determined by IGC were studied. To be met ZSC condition, Effects of IGC condition on the surface characteristics of CNTs were examined. With this condition, surface characteristics of CNTs could be obtained and hence the dispersion behavior of CNTs in solvents is possibly predicted</p>	<p>TH18-2 THERMALLY STABLE LAMINATES G Verchery(SMANS) The condition for thermal stability of arbitrary laminates is derived. For laminates made of the same plies with different orientations, it reduces to square symmetry of membrane and coupling stiffness, and isotropy of membrane thermal term. Consequently, balanced fabrics reinforcement provides an easy and efficient way to obtain thermal stability.</p>
12:10	<p>TH13-3 EFFECT OF SPATIAL RANDOM POISSON'S RATIO ON THE IN-PLANE BEHAVIOR OF COMPOSITE PLATES HC Noh, DW Seo, DY Kim (Sejong Univ.) The randomness in the Poisson's ratio is taken into account in the stochastic finite element analysis of the composite laminate plate. By using the Taylor's expansion a series expansion in ascending order of stochastic field function is obtained. With this, the response variability can be obtained.</p>	<p>TH14-3 STRENGTH OF MULTI-AXIAL LAMINATES WITH MULTIPLE RANDOMLY DISTRIBUTED HOLES S Kazemabadi, D Zenkert(Royal Inst. of Technology) A simple and cost effective model to predict the residual strength of laminates with multiple holes has been developed. The model is based on percolation theory and experiments and FE-simulations have been conducted for model calibration.</p>	<p>TH15-3 COMPARISON OF MORPHOLOGICAL AND MECHANICAL PROPERTIES OF DIFFERENT VARIETIES OF FLAX FIBRES F Destaing, M Gomina(Crismat), JP Jernot(CNRS), P Jouannot-Cheaney(ENSCAEN), J Breard(LDMC) The industrial production of flax-fibre reinforced composites is underdeveloped and, it will be necessary to know more about morphological and mechanical properties of the fibres. In the present study, seven varieties of flax were compared in terms of the mean values and the dispersions of their morphological and mechanical properties.</p>	<p>TH16-3 EFFECT OF CYCLE NUMBER ON FATIGUE OF CONCRETE COLUMNS REINFORCED BY NON-ADHESIVE FILAMENT WOUND COMPOSITES HK Liu, WC Liao, CF Tsai(Feng Chia Univ.), CC Chen(Chung-Shan Inst. of Science & Technology) This paper is to study compression after fatigue (CAF) strength of concrete columns reinforced by filament wound glass/epoxy composites. CAF strength of composite/concrete columns is 53.6% higher than that of concrete columns. Excellent fatigue strength on the concrete columns is provided by the glass/epoxy composite jackets.</p>	<p>TH18-3 DEVELOPMENT OF HIGH STABILITY TELESCOPE STRUCTURE FOR SPACEBORNE OPTICAL CAMERA DG Lee(KARI) WH Song, SR Kwon(Korean Air), SH Lee, SW Choi, HJ Choi, SR Lee(KOREA AEROSPACE RESEARCH INSTITUTE) KARI and Korean Air have developed, manufactured and tested a dimensional stable and load carrying CFRP Camera Structure for a spaceborne optical camera. The main purpose of this project is to establish the manufacturing process and the performance verification method of CFRP CAMERA STRUCTURE in Korean industries. Two Qualification Models...</p>	
12:30	Lunch					
13:30	<p>PL15: MULTIFUNCTIONAL MICROVASCULAR COMPOSITE MATERIALS Scott White (University of Illinois) (Chair: D Inman)</p>	<p>PL16: COMPOSITES: APPLICATION AND ASSESSMENT OF MARKET Yong Jun Cho (Hankuk Fiber) (Chair: R Kim)</p>				
14:00	Break					

	202B	203	301	302	401	402A
11:30	<p>TH19 LIGHTWEIGHT SANDWICH PLATE WITH THREE-DIMENSIONAL CORES Chairs: S Idapalapati</p> <p>TH19-1 MECHANICAL BEHAVIORS OF A NEW WIRE-WOVEN CELLULAR METAL MG Lee, GD Ko, KI Kang(Chonnam National Univ.) A few years ago, a cellular metal named wire-woven bulk Kagome (WBK) and wire-woven bulk diamond (WBD) are introduced. The third cellular metal named wire-woven bulk cross (WBC) is introduced. The basic analytic solutions for geometrical properties, relative density, strength and stiffness are presented and verified by experiments and FEM</p>	<p>TH20 BIOMEDICAL COMPOSITE MATERIALS AND STRUCTURES Chairs: KD Woo/ S Kobayashi</p> <p>TH20-1 EFFECTS OF INTERFACIAL TREATMENT USING L-LACTIC ACID ON MECHANICAL PROPERTIES OF B-TCP/PLLA COMPOSITES R.Nagao, S Kobayashi(Tokyo Metropolitan Univ.) In the study, in order to improve interfacial strength between poly(L-lactic acid) (PLLA) and b-tricalcium phosphate (b-TCP), b-TCP surface was treated by L-lactic acid solution. b-TCP/PLLA compound was obtained by kneading and specimens were fabricated by hot-pressing. Mechanical properties of b-TCP/PLLA composites were investigated by tensile test.</p>	<p>TH21 HIGH PERFORMANCE AND SUSTAINABLE COMPOSITE MATERIALS Chairs: K Kageyama</p> <p>TH21-1 A NEW THERMOFORMING CFRP BY PENETRATING PHENOL-MODIFIED PP INTO CF MAT T.Kawasaka, I.Itoh, S.Nishitani, T.Inoue(Yamagata Univ.), N.Hirano, M.Hashimoto, M.Homma(Toray Industry) A new thermoforming CFRP (carbon fiber reinforced plastics) was developed. It was prepared by press-penetrating a high-flow PP modified with phenol resin into CF mat. Compared with a control sample prepared by simple melt-blending CF and PP in the extruder, the melt-penetrated composite showed extremely high rigidity and impact strength.</p>	<p>TH22 INTELLIGENT TEXTILES AND COMPOSITES/ MECHANICAL PROPERTIES AND MECHANICS OF SHORT FIBER COMPOSITES Chairs: S Lomov/ C Kim</p> <p>TH22-1 IMPACT PROPERTIES OF JUTE FIBER MAT REINFORCED UNSATURATED POLYESTER MARTIX COMPOSITES EA Elbadry, MS Aly-hassan, H Hamada(Kyoto Inst. of Technology) The Izod impact strength and impulse impact energy increase as the fiber content increases and the improvement had occurred at 11 wt% compared to that of the neat resin and the fracture surface has demonstrated that fiber pull out mechanism is the predominant failure mode for different fiber weight contents...</p>	<p>TH23 MODELING AND SIMULATION OF COMPOSITES MANUFACTURING PROCESSES Chairs: F Chinesta</p> <p>TH23-1 SHEAR RELAXATION BEHAVIOUR IN LINEAR REGIME OF DILUTED CARBON NANOTUBE SUSPENSIONS C.Cruz, I.Illoul, G.Regnier(Arts et Metiers ParisTech), F.Chinesta(Ecole Centrale Nantes) Brownian dynamics simulations are used to obtain the rheological response of a dilute carbon nanotube suspension after a shear-strain step. Despite a general quasi-instantaneous relaxation of the shear modulus, non-negligible differences in the spectra of relaxation times are registered when varying length, bending rigidity and pristine structure of the nanotubes.</p>	<p>TH24 FATIGUE AND LIFE PREDICTION OF COMPOSITES Chairs: M Kawai</p> <p>TH24-1 A CONTINUUM DAMAGE MODEL FOR COMPOSITE LAMINATED STRUCTURES SUBMITTED TO STATIC AND FATIGUE LOADINGS P Nimdum, J Renard(ENSM) This study is mainly focused on two major types of damage: intra-laminar ply cracking and inter-ply delamination in fiber-reinforced composite under static and fatigue loading. Damage evolution based on continuum damage mechanics is considered for prediction intra-laminar ply cracking. The delamination onset criterion based on average stress has been proposed.</p>
11:50	<p>TH19-2 NOVEL CHARACTERISATION TECHNIQUE FOR ASSESSMENT OF DAMAGE TO PLATES BY BALLISTIC IMPACT K Kandan, B Russell, V Deshpande, N Fleck(Univ. of Cambridge) A characterisation technique is proposed to assess ballistic damage of plates and residual capacity to sustain further ballistic loading. We consider the reduction in penetration-velocity of a plate, previously hit. Carbon-fibre/epoxy-composite plates and stainless-steel plates of identical areal-mass were impacted with spherical projectiles. Maps showing regions of survival/failure are generated.</p>	<p>TH20-2 EVALUATION OF MECHANICAL PROPERTIES AND BIOACTIVITY OF HYDROXYAPATITE/B-TRICALCIUM PHOSPHATE COMPOSITES S Kobayashi, T Murakoshi(Tokyo Metropolitan Univ.) Mechanical properties and bioactivity of HA/b-TCP composites which were prepared with sintering of HA and β-TCP powder mixture were decreased with increasing β-TCP content. MgO addition improved sinterability due to its high reactivity, however, SiO₂ did not improved it due to its strong chemical binding.</p>	<p>TH21-2 NOVEL CARBON FIBER REINFORCED STAMPABLE THERMOPLASTIC SHEET WITH HIGH STRENGTH M.Homma, A.Tsuchiya, Noriyuki Hirano, T Hashimoto(Toray Industries, Inc.) Novel stampable CFRTP sheet was developed. This sheet was found to be suitable for press molding and effectively reduced the weight of molded products.</p>	<p>TH22-2 EFFECT OF FIBER ORIENTATION ON THE MECHANICAL PROPERTY OF INJECTION MOLDED JUTE AND JUTE HYBRID REINFORCED COMPOSITES Y.Yang, H Hamada(Kyoto Inst. of Technology) The main setback of natural fiber composite is their low mechanical properties as compared to glass fiber composite. To overcome it, one of the solutions of hybridization of natural with glass fibers was proposed. The tensile property of injection moldings was investigated based on the effect of fiber orientations ...</p>	<p>TH23-2 PART FORM PREDICTION METHODS FOR CARBON FIBRE REINFORCED THERMOPLASTIC COMPOSITE MATERIALS PD Han, J Butterfield, M Price, A Murphy, M.Mullan(Queen's Univ. Belfast) This paper introduces predictive technologies for carbon fibre reinforced thermoplastic composite which can be integrated with assembly simulations. Equation calculation and simulation strategy are presented for the study of the deformation behaviour of a 90°, V-shaped angle thermoformed using carbon fibre reinforced polyphenylene sulphide (PPS) matrix.</p>	<p>TH24-2 IDENTIFICATION OF THE LOCAL MATERIAL PARAMETER DEGRADATION IN A BIAXIAL FATIGUE TEST ON CRUCIFORM COMPOSITE SPECIMENS C Ramault, D Van Hemelrijck, H Sol(Vrije Universiteit Brussel), W Van Paepegem(Ghent Univ.) The material properties in a cruciform composite specimen subjected to biaxial fatigue loading will degrade according to the stress state present in the considered zone of the specimen. This paper investigates the use of a stress based inverse method to identify these local material parameters at several load stages.</p>
12:10	<p>TH19-3 THE BLAST RESISTANCE OF DYNEEMA COMPOSITE BEAMS UNDER SHOCK LOADING K Kandan, B Russell, V Deshpande, N Fleck(Univ. of Cambridge) The Dyneema, Carbon fibre/epoxy composite (CFC) and the same in pre-reg state (CFC-P) beams are investigated under shock loading. It is found that the CFC beams was the weakest of all the beams, but the CFC-P beams with low shear strength matrix had superior blast resistance than the Dyneema beams.</p>	<p>TH20-3 DEVELOPMENT OF A COMPOSITE BONE PLATE FOR FIXATION OF A FRACTURED TIBIA M Sutcliffe, Y Huang(Cambridge Univ.), HJ Kim, SH Chang(Chung-Ang Univ.) A finite element model is used to show how a composite bone fixation device compares in performance with an equivalent stainless steel plate. The effect of friction between bone and plate is explored. A cohesive zone model is used to model failure of the healing callus.</p>	<p>TH21-3 NOVEL CARBON FIBER REINFORCED STAMPABLE POLYPROPYLENE SHEET WITH HIGH INTERFACIAL STRENGTH A.Tsuchiya, M Honma, M Hashimoto, H Sasaki, N Hirano(Toray Industries), Tomonaga Okabe(Iohoku Univ.) We developed a novel high-performance CFRTP stampable sheet with polypropylene matrix. A new interfacial layer was developed to improve the interfacial strength between CF and polypropylene matrix. Interfacial strength was evaluated by using fragmentation method.</p>	<p>TH22-3 PREPARATION OF SILVER NANOPARTICLES DOPED PVDF: FORMATION OF PIEZOELECTRIC POLYMORPH M Dipankar, S Yoon, KJ Kim (Kyunghee Univ.) The preparation of poly(morphism control of poly(vinylidene fluoride) (PVDF) by silver nanoparticles (Ag NPs) is investigated. The Ag NPs were prepared by simple one step process from AgNO₃, where N,N-dimethylformamide (DMF) acts as reducing agent as well as the solvent of the host polymer, PVDF.</p>	<p>TH23-3 A THREE SCALE APPROACH TO MODELING BONDED COMPOSITE JOINTS R Done(Imperial College London) Commonly in the design of composite wing structures, a compromise has to be made between the detail ...</p>	<p>TH24-3 FATIGUE BEHAVIOR OF UNIDIRECTIONAL JUTE SPUN YARN REINFORCED BIODEGRADABLE RESIN H.Katogi, Y Shimamura, K Tohgo, T Fujii(Shizuoka Univ.) Natural fiber reinforced composites with unidirectional reinforcement have been developed for improvements of modulus and strength. Fatigue property of the unidirectional reinforced composites should be investigated to assure the structural integrity. In this study, fatigue behavior of unidirectional jute yarn reinforced biodegradable was investigated.</p>
12:30	Lunch					
13:30						
14:00	Break					

	Halla A	Halla B	Samda A	Samda B	201A	202A
14 : 15	<p>TH25 POLYMER NANOCOMPOSITES Chairs: S Hoa/ A Zeinolebadi</p> <p>TH25-1 IN-SITU SAXS INVESTIGATION OF THE TRANSIENT NANOSTRUCTURE OF METALLOCENE POLYPROPYLENE/MONTMORILLONITE COMPOSITES UNDER UNIAXIAL LOADING N Stribeck, A Zeinolebadi, MG Sari(Hamburg Univ.) Oriented polypropylene samples with and without nano-clay were subjected to uniaxial mechanical load, while the evolution of the nano-structure was being monitored by two-dimensional small-angle X-ray scattering. Nanostructure parameters have been evaluated by the chord distribution function (CDF) method.</p>	<p>TH26 ONR SESSIONS - RESEARCH IN COMPOSITES MATERIALS AND SANDWICH STRUCTURES Chairs: Y Rajapakse/ G Ravichandran</p> <p>TH26-1 STATIC AND DYNAMIC FAILURE AND FRACTURE BEHAVIOR OF POLYMER FOAM CORE A Kidane, G Ravichandran(California Inst. of Technology.) An experimental investigation on the effects of holes, cracks and notches on tensile strength of polymer foam is performed. Fracture experiments have been also performed over a wide range of loading rates.</p>	<p>TH27 GREEN COMPOSITES/NATURAL FIBRE COMPOSITES Chairs: Y Li/ I Verpoest</p> <p>TH27-1 FABRICATION AND MECHANICAL PROPERTIES OF SHORT SISAL FIBER REINFORCED COMPOSITES USED FOR DENTAL APPLICATION J Xu, L Gong, Y Li(Tongji Univ.) This study investigated the influence of short sisal fiber on the flexural strength and modulus of auto-polymerized denture base resin, and proved that short sisal fiber (2 mm, less than 10 wt%) reduced the flexural strength but increased the flexural modulus of PMMA-resin.</p>	<p>TH28 BIOCOMPOSITES: SYNTHESIS, PROCESSING, PERFORMANCE AND APPLICATIONS OF BIOBASED COMPOSITE MATERIALS (CO-SPONSORED WITH BIRN) Chairs: S Pillay/ M Hosur</p> <p>TH28-1 STUDIES ON THE FABRICATION AND CHARACTERIZATION OF FLAX FIBER/BIO-COMPOSITES M Harika, M Hosur, S Jeelani(Tuskegee Univ.) In this study, effect of surface treatment using sodium hydroxide on the morphology and flexural properties of flax fiber reinforced polyester and ENVIRESZ-biopolymer was investigated. It was found that 2.5 wt % was most optimal. Flexural and thermomechanical properties of composites with EnviRez were found to be superior.</p>	<p>POSTER SESSION (3F LOBBY)</p>	<p>TH29 HIGH-PRECISION COMPOSITES/ STRENGTH & LIFE PREDICTION FOR COMPOSITES Chairs: JD Melo/ T Massard</p> <p>TH29-1 MICROMECHANICAL MODELLING OF TEST SPECIMENS FOR ONSET OF DILATATIONAL DAMAGE OF POLYMER MATRIX IN COMPOSITE MATERIALS TD Tran, D Kelly, G Prusty, G Pearce(The Univ. of New South Wales) This paper focuses on the dilatational strain invariant and modeling of the 90deg test specimen to extract the critical values for the onset failure theory. The result will provide insight into the use of micromechanical enhancement and will support the simpler procedures for extracting the dilatational strain invariants for the theory.</p>
14 : 35	<p>TH25-2 PROCESSING AND MECHANICAL BEHAVIOUR OF HALLOYSITE FILLED POLYAMIDE-6 NANOCOMPOSITES K Prashantha, H Schmitt, M Lacrampe, P Krawczak(Ecole des Mines de Douai) Reinforcing thermoplastic polymers with nanotubes or nanoplatelets to form nanocomposites is a way to increase the usage of polymeric materials by improving their mechanical properties. Therefore, in the present work processing and mechanical behaviour of halloysite filled polyamide-6 nanocomposites has been investigated.</p>	<p>TH26-2 MIXED MODE FRACTURE BEHAVIOR OF CELLULAR FOAM CORES USED IN SANDWICH STRUCTURES A Sirinuk, P Penumadu, KG Thomas(Univ. of Tennessee) A modified DCB specimen with a V-shaped edge notch along the length of the specimen provided a promising new approach to measure mixed mode fracture behavior of pure polymeric foam core materials, allowing the crack front to propagate within the notched section.</p>	<p>TH27-2 CROSSLINKING OF STAR-SHAPED POLYLACTIDE AND ITS CURING BEHAVIOR SK Chang, C Zeng, J Ren(Tongji Univ.) A new bio-based unsaturated polyester resin consisting of methacrylated star-shaped polylactide was developed for thermoset composite applications. The effect of star architecture, e.g. different arm length, on the properties of crosslinked polylactide was studied and its non-isothermal and isothermal cure behavior was investigated by differential scanning calorimetry.</p>	<p>TH28-2 IN-PLANE UNSATURATED PERMEABILITY OF NATURAL FIBER MATS MJ Ehesmann, CA Ulven, S Mekic(North Dakota State Univ.), J Fouk(USDA), S Metherall(Composites Innovation Centre Manitoba Inc.) In-plane unsaturated permeability is a processing value for modeling the manufacturing of composite materials. This study examines the effect of different fiber types, shive contents, simulated resin viscosities, and fiber volume fractions on the wettability and in-plane permeability of hemp flax and kenaf mats.</p>		<p>TH29-2 STRENGTH OF LAMINATES WITH SURFACE MODIFIED POLYMER/MWCNT NANO-COMPOSITE INTERLAYERS K Bilge, E Ozden, E Simsek, YZ Menciloglu, M Papila(Sabancı Univ.) This study presents a demonstration of the toughening by nano-fibrous interlayers composed of epoxy cross-linking PI(st-co-GMA) and PI(st-co-GMA)/MWCNT electrospun nano-fibers. Overall the experimental results herein underline the potential by the nano-fibrous interlayers chemically tailored for the matrix to increase the delamination resistance of laminated composites with almost no weight penalty.</p>
14 : 55	<p>TH25-3 IMPROVEMENT OF BARRIER PROPERTIES OF POLYESTERS USING NANOCLAY PJ Carreau(Ecole polytechnique) Polyethylene terephthalate (PET) is extensively used for packaging applications. In the recent years, a biopolymer, poly(lactic acid) (PLA), has been introduced as a suitable, more environmentally acceptable substitute for PET. We will summarize key results obtained on the improvement of PET and PLA barrier properties using an organo-modified nanoclay.</p>	<p>TH26-3 PARTICLE-TO-PARTICLE INTERACTIONS IN SYNTACTIC FOAMS G Tagliavia, M Porfiri, N Gupta(Polytechnic Inst. of New York Univ.) Syntactic foams are a special class of closed cell foams where porosity appears in the form of air enclosed inside thin shells that are embedded in a matrix material. This study focuses on understanding the effect of particle-to-particle interactions on the elastic behavior of these composites.</p>	<p>TH27-3 YARN OPTIMIZATION AND PLANT FIBRE SURFACE TREATMENT USING HYDROXYETHYLCELLULOSE FOR THE DEVELOPMENT OF STRUCTURAL BIO-BASED COMPOSITES DU Shah, PJ Schubel, MJ Clifford, P Licence(Univ. of Nottingham) This study concerns three aspects. Firstly, it evaluates the mechanical performance of vacuum infused thermoset unidirectional plant fibre composites (PFCs) against E-glass composites. Secondly, it investigates the effect of yarn twist on PFC manufacturing and mechanical properties. Finally, it trials a novel plant fibre surface treatment using hydroxyethylcellulose.</p>	<p>TH28-3 DETERMINING COMPOSITE CONSTITUENT CONTENT IN NATURAL FIBRE COMPOSITES USING NIR SPECTROSCOPY E Nickel, S Metherall(Composites Innovation Centre) This study investigates the capabilities and limitations of using NIR spectroscopy to determine constituent proportions of natural fibre thermoset composites. Two PLS prediction models were created; one to determine fibre retardant content and one to determine natural fibre content, and the model's performance evaluated based on statistical accuracy and precision.</p>		<p>TH29-3 STIFFNESS AND STRENGTH OF LAMINATES FABRICATED WITH BI-DIRECTIONAL TAPE JD Melo(Federal Univ. of Rio Grande do Norte), K Parnell(Santa Clara Univ.), C Tower(Stanford Univ.) Stiffness and strength data of tensile specimens cut in various angles from [45/0/-45/90]s panels manufactured with [45/0] IM7/8552 bi-directional prepreg tape were measured and the properties were compared to the same properties of specimens cut from panels with continuous plies. Finite element analyses were also conducted.</p>
15 : 15	<p>TH25-4 ANALYZING THE KINETICS OF FLOW-INDUCED STRUCTURE BUILD-UP IN CARBON NANOTUBE-EPOXY SUSPENSIONS F Khalkhal, P Carreau(Ecole Polytechnique de Montreal) In this work, the kinetics of structure development upon cessation of shear flow is analyzed in MWCNT-epoxy suspensions under the influence of flow history, concentration and temperature. It has been shown that the structure reconstructs faster by increasing the concentration or temperature. Preshearing-rate becomes important only at very low concentrations.</p>	<p>TH26-4 MECHANICAL AND THERMAL PROPERTIES OF CARBON/EPOXY NANOCOMPOSITES EXPOSED TO SYNERGISTIC EFFECT OF UV RADIATION AND CONDENSATION A Therbi-martheh, M Hosur, S Jeelani(Tuskegee Univ.) In this study effect of nanoclay on the mechanical and thermal properties of carbon/epoxy nanocomposites subjected to UV radiation and condensation is studied. Synergistic effect of UV and condensation can be detrimental to polymer composite, and the addition of nanoclay can mitigate degradation to properties.</p>	<p>TH27-4 ANALYSIS OF SHEAR PROPERTIES OF FLAX FIBRES - INFLUENCE OF DRYING PROCESS A Le Duigou, C Baley, B Bourmaud, P Davies(Laboratoire d'Ingenierie des Materiaux de Bretagne) Vegetal fibres can be described as a stack of composite plies reinforced by cellulose fibrils with particular orientation. This work investigates the effect of drying on mechanical behaviour of flax fibres.</p>	<p>TH28-4 IN VITRO SYNTHESIS OF BACTERIAL CELLULOSE/POLY(VINYL ALCOHOL) NANOCOMPOSITES CI Castro, R Zuluaga, G Caro, P Ganani(Univ. Pontificia Bolivariana), JL Putaux(CERMAV-CNRS), I Mondragon(Univ. del Pais Vasco) Bacterial cellulose is mainly synthesized by Gluconacetobacter genera bacteria. This microorganism produces cellulose ribbons in nanometric size forming a uniform and continuous three-dimensional network. It is possible to produce nanocomposites reinforced with cellulose from by modifying the culture medium of these bacteria with a water-soluble matrix.</p>		<p>TH29-4 PROGRESSIVE DAMAGE ANALYSIS OF OPEN-HOLE COMPOSITE PLATE UNDER COMPRESSION M Ridha, TE Tay(National Univ. of Singapore) Open-hole composite plate under compressive loading is one of the most studied and tested case on the fiber reinforced composite laminate. In this study, progressive damage simulations using material property degradation method and cohesive elements are used to predict the open-hole compression strength and its damage mode.</p>
15 : 35	<p>TH25-5 ELECTRICALLY CONDUCTIVE STRUCTURAL ADHESIVES BASED ON BUCKYPAPERS ID Rosca, SV Hoa(Concordia Univ.) We have developed a new conductive adhesive based on buckypapers with high conductivity and outstanding mechanical properties. Using buckypapers it is possible to develop tape adhesives as the buckypaper acts as conductive and reinforcing medium as well as a spacer that allows maintaining a constant bondline</p>	<p>TH26-5 HIGH STRAIN RATE BEHAVIOR OF HYGRO-THERMALLY CONDITIONED SYNTACTIC FOAMS FOR MARINE APPLICATIONS B Demissie, M John, E Woldesenbet(Southern Univ. and LSU) Syntactic foams are widely used in aerospace, defence and marine structures due to their superior mechanical properties and light weight. This study summarizes the high strain rate testing and analysis of syntactic foams used in marine applications by employing a Split Hopkinson Pressure Bar (SHPB) test setup.</p>	<p>TH27-5 DETERMINATION OF THE OPTIMAL FLAX FIBRE PREPARATION FOR USE IN UD-EPOXY COMPOSITES J Baets, P Dries, J Ivens, I Verpoest(Katholieke Universiteit Leuven) In this work the influence of the twist on the mechanical properties of flax fibres is investigated. Therefore flax from different stages in the fibre production process are taken. Attention is paid to the properties of the produced composites, and the dry bundle strength.</p>	<p>TH28-5 VACUUM ASSISTED RESIN TRANSFER MOLDING WITH BIOBASED RESINS AND NATURAL FIBRE REINFORCEMENT JS Schuster(Univ. of Applied Sciences Kaiserslautern) Q Givignon, S Bickerton, D Bhattacharyya(The Univ. of Auckland) Composite panels made of flax reinforcements and bio-based resin were produced using vacuum assisted resin transfer moulding. The resin used were epoxy, unsaturated polyester, and tannin. Prior to infusion, rheology measurements were performed. Mechanical properties were measured and compared to values derived with conventional chemical-based epoxy.</p>		<p>TH29-5 A DESIGN METHODOLOGY USING BI-ANGLE PLY LAMINATES MADE FROM NCF CARBON FIBER MATERIALS TN Massard(CEA), R Harry(Univ. de Bordeaux), P Sanial (HOUMARAT), JP Charles(Univ. Aix-Marseille) A design concept for using bi-axial NCF composites is presented. The building block being of [0/25], we show that it can be manufactured using the NCF technology. Systematic investigation of the loading space for slender structures show an exceptional potential for weight saving. The optimisation tool is presented.</p>
15 : 55		<p>TH26-6 INFLUENCE OF UNCERTAINTIES ON THE RELIABILITY OF SELF-ADAPTIVE COMPOSITE ROTOR YL Young, MR Motley(Univ. of Michigan) The objective of this research is to investigate the effects of material, geometry, and loading uncertainties on the response and reliability of self-adaptive composite marine propellers. Results are shown for a pair of CFRP propellers optimized for a twin-shafted naval combatant, although methodology is generally applicable to general composite structures.</p>	<p>TH27-6 EFFECT OF SURFACE TREATMENT ON MECHANICAL BEHAVIOR OF JUTE FIBER-REINFORCED POLYPROPYLENE COMPOSITE GB Nam, JW Kim, JM Byeon, JI Song(Changwon National Univ.), BS Kim(KIMS), TG Kim(Busan National Univ.) The main objective of this study is to manufacture jute fiber reinforced composites with fiber surface treatment effect. Surface treatments methods are different percentage of NaOH solutions and high temperature different time table, silane solutions and plasma treatment.</p>	<p>TH28-6 INVESTIGATION OF CORE-FACING BOND IN RECYCLABLE SANDWICH PANELS S Rao, D Bhattacharyya(Univ. of Auckland) The contribution of this paper is to present a detailed statistical analysis based on Taguchi method in determining the honeycomb core-to-facing peel strength.</p>		<p>TH29-6 DEVELOPMENT OF CFRP PRECISION GANTRY BEAMS FOR 11TH GENERATION LCD PANEL MANUFACTURING B Bhandari, Gy Lee, DS Choi, SH Ahn(Seoul National Univ.), JH Kim(Justek Inc.) In this study, parametric study of several hollow gantry beams were designed and developed for 11th generation Liquid Crystal Display (LCD) panels manufacturing. Using numerical analysis methods a composite gantry beam was optimized for maximum stiffness (min deflection) and minimum mass. Experimental results matched well with the numerical results.</p>
16 : 15						

Break

	202B	203	301	302	401	402A
14:15	<p>TH30 LIGHTWEIGHT SANDWICH PLATE WITH THREE-DIMENSIONAL CORES Chairs: KJ Kang/ NS Choi</p> <p>TH30-1 LOW-VELOCITY IMPACT BEHAVIORS OF A DEFORMABLE THIN METALLIC SANDWICH PLATE DG Ahn, SH Kim, GY Han(Chosun Univ.), GH Nam(Shin Chang Electronics Ltd.), DY Seong, DY Yang(KAIST) This paper investigates into the impact behaviors of a deformable thin metallic sandwich plate with metallic sheared dimple cores and face sheets subjected to low-velocity impact loading through experiments and numerical analyses. The metallic sandwich plate was compared to DP780 sheet to examine the performance of the designed sandwich plate.</p>	<p>TH31 BIOMEDICAL COMPOSITE MATERIALS AND STRUCTURES Chairs: M Todo/ SS Jeon</p> <p>TH31-1 MECHANICAL PROPERTIES OF HA/PLLA COMPOSITES WITH BIMODAL PARTICLE DISTRIBUTION T Takayama, H Ito(Yamagata Univ.), M Todo(Kyushu Univ.) HA/PLLA composites with both micro-size and nano-size HA particles were fabricated, and their mechanical properties were evaluated to assess the effect of bimodal particle distribution on those properties. Mechanical properties of Bimodal exhibited the highest, considering that dispersibility of nano- HA is improved by dispersed micro-HA.</p>	<p>TH32 HIGH PERFORMANCE AND SUSTAINABLE COMPOSITE MATERIALS Chairs: WR Yu/ K Kageyama</p> <p>TH32-1 RESEARCH ON THE JOINTING METHOD OF CFRTP FOR STRUCTURAL APPLICATIONS K Suzuki, K Nagata, K Uzawa, T Matsuo, J Takahashi(Univ. of Tokyo) We focused on the welding joint by using the thermal plasticity of FRTP itself to apply to automotive members. As a result, we clarify the basic characteristic of the joint in the fibrous reinforcing material by making comparative study of the joint efficiency of some methods of welding joint.</p>	<p>TH33 MICROMECHANICS OF COMPOSITES AND HETEROGENEOUS MATERIALS: MULTISCALE MODELING AND HOMOGENIZATION Chairs: J Tsukrov/ S Nomura</p> <p>TH33-1 MECHANICS OF INTRA-HIERARCHICAL INTERACTIONS AND ITS POTENTIAL IN DESIGN OF TOUGH MATERIALS L Gorbaldy, SV Lomov, I Verpoest(KU Leuven) The objective of this work is to illustrate that structure of a material can be exploited to eliminate stress concentrations at internal inhomogeneities/defects and thus to change material failure behavior in a profound way. We show that the synergetic effect is possible due to sophisticated communication between-and-within hierarchical levels.</p>	<p>TH34 MANUFACTURING PROCESSES FOR COMPOSITE MATERIALS Chairs: WR Hwang/ S Lundstrom</p> <p>TH34-1 MODELLING PARTICULATE FLOW DURING IMPREGNATION OF DUAL-SCALE FABRICS V Frisfields, S Lundstrom(Lulea Univ. of Technology) Filtration of particles during impregnation of dual-scale fabrics is studied numerically for a number of configurations with a previously derived model. The initial position and size of the particles are varied. The main result is that structural composites can be tailor-made as to additional properties by such an approach.</p>	<p>TH35 PROGRESSIVE DAMAGE AND FAILURE Chairs: TE Tay/ S Pinho</p> <p>TH35-1 HIGH FIDELITY MODELLING OF TAPERED LAMINATES WITH INTERNAL PLY TERMINATIONS LF Kawashita, MJ Jones, SR Hallett, MR Wisnom(Univ. of Bristol), S Giannis(MERL) This paper describes the development and validation of finite element modelling tools for the analysis of delamination in tapered laminated composites under quasi-static and fatigue loading. Novel meshing tools are used to generate high-fidelity ply-level models with custom cohesive elements between every ply.</p>
14:35	<p>TH30-2 TRUSS WAVINESS EFFECTS ON MECHANICAL BEHAVIORS OF WIRE-WOVEN BULK KAGOME KW Lee, KJ Kang(Chonnam National Univ.) The mechanical performance of WBK has been estimated on assumption that WBK is composed of straight struts. Because WBK is assembled with helically-formed wires, it results in errors about previous theoretical solution. To improve solutions, waviness effect is taken into account to estimate the strength and stiffness of WBK.</p>	<p>TH31-2 INFLUENCE OF STRUCTURAL ANISOTROPY ON COMPRESSIVE FRACTURE PROPERTIES OF HYDROSTATIC-PRESSURE-EXTRUSION-MOLDED HA/PLLA COMPOSITE M Tanaka, Y Hachiya, I Kimpara(Kanazawa Inst. of Technology), M Hojo, SH Hyon(Kyoto Univ.), M Honda(BMC Inc.) Compression tests were carried out for PLLA and HA/PLLA composite prepared by the hydrostatic-pressure-extrusion-molding. The influence of hydrolytic absorption on their compressive properties was evaluated by immersion into the pseudo bio-environment. The effects of microstructural anisotropy and hydrolytic absorption on their compressive properties were discussed from the viewpoint of microstructures.</p>	<p>TH32-2 TENSILE STRENGTH PROPERTY OF THERMOPLASTIC PRESS SHEET WITH IN-PLANE RANDOMLY ORIENTED DISPersed CARBON FIBERS M Hashimoto, N Hirano, M Honma(Toray Industries Inc.), T Okabe (Tohoku Univ.) Novel stampable sheet composed of discontinuous carbon fibers and thermoplastic resin for press molding of composite materials has been developed. Micromechanical analyses revealed that the strength of composites made of the sheet is almost equivalent those of continuous fiber reinforced plastics.</p>	<p>TH33-2 ELASTIC-VISCOPLASTIC ANALYSIS OF ULTRA-FINE PLATE-FIN STRUCTURES WITH LAMINATE MISALIGNMENT USING A HOMOGENIZATION THEORY N Yamamoto, T Matsuda(Univ. of Tsukuba) In this study, elastic-viscoplastic properties and macroscopic compressibility of ultra-fine plate-fin structures with random laminate misalignment subjected to uniaxial tension were analyzed using a newly proposed method based on the time-dependent homogenization theory.</p>	<p>TH34-2 CONSOLIDATION OF Si, N₂/Cu COMPOSITE POWDERS FABRICATED BY ELECTROLESS DEPOSITION TECHNIQUE W Daouh(Central Metallurgical R&D Inst.), W Bradbury, E Olevsky, RM German(San Diego State Univ.) Si₃N₄/Cu composite powders fabricated by electroless copper deposition on the Si₃N₄ particles. The produced powders underwent cold compaction and sintering. The relative green density as well as the sintered density decreased however the hardness increased by increasing the reinforcement phase (Si₃N₄) in the copper matrix.</p>	<p>TH35-2 ANALYTICAL MODEL TO PREDICT FAILURE OF WOVEN COMPOSITES ST Pinho, NV Carvalho, P Robinson(Imperial College London) An analytical model is proposed which is capable of capturing the response of the load-aligned tows under compression and tension. Different degrees of support provided by the adjacent layers, and the effect of the weave pattern are considered. Results show good agreement with experiments.</p>
14:55	<p>TH30-3 ORIENTATION DEPENDENCY ON THE ELASTIC BEHAVIOR OF WIRE-WOVEN BULK KAGOME PS Kim, KJ Kang(Chonnam Nat. Univ.), H Hur(ADD) Wire-woven Bulk Kagome(WBK) is fabricated by assembling metallic wires spatially formed in 3-dimensional directions. To date, it has been presumed that WBK is isotropic in the mechanical properties, but it has never been verified, yet. So, the orientation dependency on the elastic behavior of WBK is investigated hierarchically and numerically.</p>	<p>TH31-3 ANALYSIS OF MICROSTRUCTURE AND COMPRESSIVE DEFORMATION BEHAVIOR FOR REINFORCED BIODEGRADABLE POROUS POLY (L-LACTIDE) MATERIAL JE Park, M Todo(Kyushu Univ.) In the tissue engineering field, three-dimensional porous structures have extensively been studied as scaffolds for cell seeding and growth. A regenerated tissue consisting of a scaffold and cell is supposed to be implanted into the damage portion of the target tissue to be reconstructed.</p>	<p>TH32-3 FUNDAMENTAL RESEARCH ON REPAIR OF CARBON FIBER REINFORCED THERMOPLASTICS M Tamaru, T Kin, T Matsuo, J Takahashi, K Uzawa(Univ. of Tokyo) The objective of this paper is introduce repair technology.</p>	<p>TH33-3 THREE-DIMENSIONAL ANALYSIS OF MICROSCOPIC STRESS DISTRIBUTION AT A FREE EDGE OF A CROSS-PLY CFRP LAMINATE K Goto, T Matsuda(Univ. of Tsukuba) In this study, the distribution of microscopic stress at a free edge of a cross-ply carbon fiber-reinforced plastic laminate (CFRP laminate) is analyzed three-dimensionally, based on a homogenization theory. It is shown that complex microscopic stress distribution occurs especially around the interlaminar at the free edge.</p>	<p>TH34-3 NUMERICAL SIMULATION OF THE RTM LIGHT MANUFACTURING PROCESS J Timms, S Bickerton, P Kelly (Univ. of Auckland) This paper focuses on the development of a 2D finite element based simulation of the RTM light process, capable of flow front and fill time predictions, as well as estimates of part thickness during filling. Performance is demonstrated with case studies based on simple geometries and injection schemes.</p>	<p>TH35-3 COMPRESSION STRENGTH OF CONTINUOUS STEEL FIBER REINFORCED POLYMERS LP Mikkelsen, FN Jespersen, JI Bech(Technical University of Denmark) A smeared out non-linear material model has been implemented in a finite element code. Thereby, it has been possible to simulate kink-band formation in a block of material under compression. The model has been used to study the influence of non-linear steel fibers on the compression strength of a composite.</p>
15:15	<p>TH30-4 SHEAR CHARACTERISTICS OF WBK AND WBD JJ Song, GD Ko, KW Lee, KJ Kang (Chonnam National Univ.) The mechanical properties of WBD and WBK under shear loading are studied analytically and numerically compared to each other, and the merit, shortcomings and potential of WBD are discussed.</p>	<p>TH31-4 THE VARIATION OF MECHANICAL CHARACTERISTIC OF COLLAGEN SCAFFOLD WITH MESENCHYMAL STEM CELL T Arai(Kyushu Univ.), T Arahira, GP Chen(National Inst. for Materials Science) In this study, rat bone marrow mesenchymal stem cells (rMSC) were cultured in collagen scaffolds up to 28 days in order to assess the effect of cell growth on the mechanical behavior of the scaffolds. Compression tests were conducted periodically by using a conventional testing machine to evaluate the elastic modulus.</p>	<p>TH32-4 FUNDAMENTAL RESEARCH ON RECYCLING OF CARBON FIBER REINFORCED THERMOPLASTICS T Kawashima, I Ohsawa, J Takahashi, K Takahashi, K Uzawa, T Matsuo(Univ. of Tokyo) Carbon fiber reinforced thermoplastics (CFRTP) is good for recycling because it can be re-molded easily. In this paper, several method of recycling of CF/PP is done, plate recycling and mixed recycling with some kinds of condition. By changing conditions and materials, the best method of recycling of CFRTP is investigated.</p>	<p>TH33-4 STRUCTURAL OPTIMIZATION OF CARBON/CARBON COMPOSITE MATERIALS R Piatek, G Stasiuk, Y Simchuk(Karlsruhe Inst. of Technology) A microstructure optimization problem for estimation of the microstructure with prescribed stiffness is formulated. The design variables are the local fibers distribution and porosity. The volume fractions of the fibers and pores in the whole microstructure are fixed. Material properties of the local microstructure are calculated using virtual models.</p>	<p>TH34-4 ACCURATE FLOW FRONT ESTIMATION USING AREA-ARRAY SENSOR AND IMPLICIT INTERFACE FUNCTION R Matsuzaki, S Kobayashi, A Todoroki, Y Mizutani(Tokyo Univ. of Science) A full-field monitoring method was proposed using an area-sensor array for monitoring the resin flow process and detecting small dry spots during the VaRTM process. An accurate flow front identification scheme is constructed by combining area-array sensor and implicit interface function.</p>	<p>TH35-4 BENDING EFFECT ANALYSIS OF METALLIC Z-PINS ON MODE I DELAMINATION TOUGHNESS OF DCB SPECIMEN S Zhang(Chengdu Aircraft Design and Research Inst.), L Tong(Univ. of Sydney) In this paper, a new simple z-pin beam model is proposed to study the bending effect of z-pinning on mode I delamination toughness of double-cantilever-beam specimen. Favorable effect is observed. Some numerical results are presented and discussed and shown to be in agreement with existing experimental and numerical results.</p>
15:35	<p>TH30-5 DYNAMIC COMPRESSIVE RESPONSE OF COMPOSITE SQUARE HONEYCOMBS SH Park, B Russell, V Deshpande, N Fleck(Univ. of Cambridge) This study aims to experimentally investigate the dynamic compressive response of the square honeycomb fabricated from carbon-fibre/epoxy composite material. Dynamic compressive response of these honeycombs were investigated by use of direct impact of honeycombs on Kolsky bar. The impact velocities range from quasi-static to 150 m/s.</p>	<p>TH31-5 DEVELOPMENT OF MULTI-LAYER COMPOSITE SCAFFOLD FOR ARTICULAR REGENERATION SH Hwang, M Todo(Kyushu Univ.) In this study, multi-layer composite scaffolds were tried to be developed by using biodegradable polymers, PLLA and PCL, and bioactive ceramics, HA. These layered scaffolds are intended to be applied for regenerative medicine for severe damaged articular joints. The fundamental mechanical properties of the scaffolds under compressive loading were examined...</p>	<p>TH32-5 STUDY ON OPTIMAL AUTOMOTIVE STRUCTURE MADE BY CFRTP T Goto, T Matsuo, K Uzawa, I Ohsawa, J Takahashi(Univ. of Tokyo) STUDY ON OPTIMAL AUTOMOTIVE STRUCTURE MADE BY CFRTP</p>	<p>TH33-5 COMPUTATIONAL MICROMECHANICS FOR COMPOSITES WITH FINITE BOUNDARIES S Nomura, T Pathapalli(Univ. of Texas) A unified semi-analytical approach is presented to solve general boundary value problems that arise in the analysis of composite materials. The method is favorably compared with those results from the finite element method. As an example, an eigenfunction for a rectangular shaped medium that contains two elliptic shaped inclusions</p>	<p>TH34-5 MONITORING RTM PROCESS BY OPTICAL FIBER SENSOR M Waris(Ecole des Mines de Saint-Etienne), B Torteck, E Marin, A Vautrin(Universite de Lyon) The goal of this study is to monitor RTM process, during the manufacturing of flat part. Specific RTM tools are developed in order to embedded Optical fiber sensors inside a carbon fiber preform. Dual Bragg grating method based on different type of FBG are tested in order to discriminate T/E.</p>	<p>TH35-5 SIZE EFFECTS IN PROGRESSIVE DAMAGE OF NOTCHED AND HOLED COMPOSITES BY Chen, TE Tay(National Univ. of Singapore), PM Baiz, ST Pinho(Imperial College London) Size effect of progressive failure of notched composite is studied by FEM. A modified Tsai-Wu criterion with cohesive post-failure softening law is applied to determine failure onset and to model failure propagation. Good agreement with experimental data is achieved.</p>
15:55			<p>TH32-6 DEMAND AND DISPOSAL FORECAST FOR CARBON FIBRE BY BOTTOM-UP APPROACH T Kirihaara, T Kawashima, J Takahashi, T Matsuo, K Uzawa(Univ. of Tokyo) This paper mostly discussed anticipated amount of carbon fibre. To obtain the demand forecast, bottom-up approach is applied. Three important sectors are discussed in this paper, i.e. airplanes, cars, and wind blades.</p>	<p>TH33-6 ESTIMATE OF THE DOMAIN ORIENTATION DISTRIBUTION FUNCTION AND THE THERMOELASTIC PROPERTIES OF PYROLYTIC CARBON BASED ON A IMAGE PROCESSING TECHNIQUE T Bohleke, S Lin, TA Langhoff(KIT) The aim of this work is basing on the real microstructure to identify the parameter of the domain orientation distribution function. On the spot of DODF the orientations of all domains are reconstructed and applied to homogenize the thermoelastic properties of PyC.</p>	<p>TH34-6 MICROSTRUCTURES AND THERMOMECHANICAL PROPERTIES OF ALUMINIUM/CARBON FIBRES COMPOSITES ELABORATED BY HOT PRESSING AND SPARK PLASMA SINTERING G Lalet, JM Heintz, JF Silvain(CMCE-CNRS), A Kawasaki(Tohoku Univ.) This study compares the effects of hot pressing and spark plasma sintering on the microstructures and on the thermo-mechanical properties of aluminium/carbon fibres composites elaborated using the same conditions of atmosphere (vacuum), temperature (600°C), time and pressure (uniaxial pressure of 50MPa).</p>	<p>TH35-6 CORRELATING FIBER MECHANICAL PROPERTIES AND MOLECULAR STRUCTURE WITH BALLISTIC PERFORMANCE G Holmes, W McInnough, J Kim, H Kobayashi, K Rice(National Inst. of Standards & Technology), W Elban(Loyola College Baltimore) In this paper, a graphical approach that links the elastic energy storage capability of the fiber to its tensile wave speed is advanced as a generalized framework for interrogating the potential of high modulus fibers in soft body armor (SBA).</p>
16:15	Break					

	Halla A	Halla B	Samda A	Samda B	201A	202A
16:30	<p>TH36 POLYMER MATRIX COMPOSITES Chairs: Y Ishida/ SS Jeon</p> <p>TH36-1 RTM PROCESSING OF TOUGHENED INTEGRAL CFRP STRUCTURES X.F. An, X.S. Yi (Beijing Inst. of Aeronautical Materials) Carbon fabrics pre-loaded with toughening agent and tackifier particles are introduced into RTM processing technology, resulting in significantly improved impact damage resistance. A VARI-like injection technique resolves the difficulties in long distance resin flow through highly toughened preforms with large integral composite parts.</p>	<p>TH37 ONR SESSIONS - RESEARCH IN COMPOSITES MATERIALS AND SANDWICH STRUCTURES Chairs: Y Rajapakse/ Y Miyano</p> <p>TH37-1 LONG-TERM LIFE PREDICTION OF CFRP STRUCTURES BASED ON MMF/ATM METHOD Y. Miyano, M. Nakada (Kanazawa Inst. of Technology), H. Cai (Xi'an Jiaotong Univ.) The advanced accelerated testing methodology (ATM-2) for the fatigue life prediction of CFRP laminates proposed and verified theoretically and experimentally in the previous studies is expanded to the fatigue life prediction of the structures made of CFRP laminates as MMF/ATM method combined with the micromechanics of failure (MMF).</p>	<p>TH38 NATURAL FIBRE COMPOSITES Chairs: H Wang/S Mutasher</p> <p>TH38-1 WATER ABSORPTION BEHAVIOR AND ITS EFFECT ON THE MECHANICAL PROPERTIES OF KENAF NATURAL FIBER UNSATURATED POLYESTER COMPOSITES EA Osman, A. Vahkguelit, I. Sbarski, SA Mutasher (Swinburne Univ.) Treated kenaf fiber reinforced unsaturated polyester composites at different weight fractions (0, 10, 20, 30 and 40wt %) are fabricated and evaluated by their immersion in tap water at two different temperatures of 25 °C and 50 °C.</p>	<p>TH39 BIOCOPIMES: SYNTHESIS, PROCESSING, PERFORMANCE AND APPLICATIONS OF BIOBASED COMPOSITE MATERIALS (CO-SPONSORED WITH BIRN) Chairs: S Pillay/ C Ulven</p> <p>TH39-1 THERMAL, MECHANICAL AND WATER BARRIER PROPERTIES OF NANOCLAY TREATED SISAL FIBER REINFORCED EPOXY POLYMER COMPOSITES K. Kannu, TP Mohan (Durban Univ. of Technology) This paper is about the interfacial property improvement of sisal fiber reinforced thermoset epoxy polymer by using combined NaOH and clays surface treatments method.</p>	<p>TH40 APPLICATIONS OF COMPOSITES Chairs: SH Chang/ JH Byun</p> <p>TH40-1 EFFECT OF THE SMART CURE CYCLE ON MECHANICAL PROPERTY OF CARBON EPOXY COMPOSITE LAMINATE EB Jeon, DH Kim, HS Kim (Hanyang Univ.), SH Chang (Chung-Ang Univ.) In general, a thermal residual stress is generated during a curing process of composite laminates due to the difference of coefficient of thermal expansion of each layer. From the study, it was concluded that about 26% of thermal residual stress during fabrication could be reduced in a composite laminate.</p>	<p>TH41 MULTISCALE MODELING OF COMPOSITES: FROM MOLECULAR SCALE TO STRUCTURES Chairs: C Lee/ J Thomas</p> <p>TH41-1 MOLECULAR MODELING OF EPOXY POLYMERS A. Bandiyodha, G. Odegar (Technological Univ.) The objective of this research is to develop multiscale modelling strategies to efficiently and accurately predict the mechanical response of epoxy materials. Molecular Dynamics simulations have been conducted to predict T_g, thermal expansion, and elastic properties for a range of crosslink densities.</p> <p>TH41-2 ATOMISTIC SIMULATION OF THE MECHANICAL BEHAVIORS OF CU/SIC NANOCOMPOSITES Z. Yang, Z. Lu, T. Wang (Beijing Univ.) In this paper, molecular dynamics simulations were employed to investigate the mechanical behaviours of Cu/SiC nanocomposites. The effects of volume fraction of SiC, interfacial properties and temperature on the mechanical properties of this nanocomposites are characterized.</p>
16:50	<p>TH36-2 DEVELOPMENT OF "TRI A-X" POLYIMIDE / CARBON FIBER COMPOSITES PREPARED BY IMIDE SOLUTION PREPREGS Y. Ishida, T. Ogasawara, R. Yokota (Japan Aerospace Exploration Agency), M. Miyauchi (Kaneka Corp.) Novel phenylethynyl-terminated imide oligomers (n=4) derived from PMDA, p-ODA and BAPL were found to have high solubility and good processability. The imide oligomers were successfully converted to cured resins with high T_g and excellent mechanical properties. Polyimide composites without voids and cracks were obtained from the imide solution prepregs.</p>	<p>TH37-2 ADVANCED ACCELERATED TESTING METHODOLOGY FOR LONG-TERM LIFE PREDICTION OF CFRP M. Nakada, Y. Miyano (Kanazawa Inst. of Technology) The advanced accelerated testing methodology (ATM-2) for the long-term life prediction of CFRP laminates exposed to an actual loading having general stress and temperature history is proposed in this paper.</p>	<p>TH38-2 ESTERIFICATION EFFECT OF MALEIC ANHYDRIDE ON SWELLING AND MECHANICAL PROPERTIES OF NATURAL FIBER/POLYSTYRENE COMPOSITES J. Nalik, S. Mishra (North Maharashtra Univ.) Maleic anhydride treatment improves all mechanical properties of composites. Untreated banana fiber composites show least mechanical properties while maleic anhydride treated sisal fiber composites show highest mechanical properties. The absorption of water increases with increase in time in all fibers composites. The maleic anhydride treated fibers composites show lesser absorption.</p>	<p>TH39-2 PROCESSING AND PERFORMANCE OF LINEN/ HEMP FABRIC-POLYPROPYLENE COMPOSITES K. Jayaraman (Univ. of Auckland) Linen/hemp fabric composite laminates were successfully produced by compression moulding. The tensile strengths, Young's moduli and impact strengths of the composite laminates increased with increasing fibre weight fractions. All the laminates were successfully moulded using the sinusoidal, half-hexagonal and toe cap matched-dies.</p>	<p>TH40-2 SMART CURE CYCLE TO IMPROVE TENSILE LOAD STRENGTH OF THE ADHESIVELY BONDED JOINT D.H. Kim, H.S. Kim (Hanyang Univ.) In this work, the smart cure cycle with abrupt cooling and post curing at room temperature was devised to eliminate the thermal residual stress and obtain sufficient interfacial wetting simultaneously. For monitoring of the curing reaction, the dielectrometry was used, where the dissipation factor of adhesive joint was measured.</p>	<p>TH41-3 MULTISCALE MODELLING OF POLYMER-CLAY NANOCOMPOSITES Y. Chen, TE Tay, V. Tan (National Univ. of Singapore), J. Chia (A*STAR) In this study, a multiscale modeling approach of polymer-clay nanocomposites is presented. The mechanical properties of the matrix, clay particles and interfaces are obtained from MD simulations which are then imported into a representative volume element (RVE) modeled using the finite element method (FEM).</p>
17:10	<p>TH36-3 INJECTION MOLDING OF COMPOSITE USING COAL ASH R. Setsuda, Y. Kanda, I. Fukumoto (Univ. of the Ryukyus) Injection molded composites containing fly ash compounded in a LDPE matrix and PP matrix were fabricated. The results showed the LDPE composite had an improved shrinkage ratio, and increased flexural strength and modulus. In the case of PP, the composite showed similar results for the shrinkage and mechanical properties.</p>	<p>TH37-3 SEA WATER EFFECTS ON ULTIMATE TENSILE AND FRACTURE STRENGTH OF CARBON FIBERS WITH NANOTENSILE TESTING M.E. Kargi, D. Penumadu (Univ. of Tennessee) A novel nano tensile testing system was used for performing highly accurate tensile and fracture testing of individual small diameter (100 nm to 100 microns) fibers and demonstrated by measuring properties of single 7 micron T700 Toray carbon fiber(s), which are of significant interest to US Navy.</p>	<p>TH38-3 INVESTIGATING THE INTERFACIAL COMPATIBILITY AND ADHESION OF COIR FIBER COMPOSITES LQ Tran, C Fuentes, AW Vuure, I Verpoest (Katholieke Univ. Leuven), C Dupont-gillan (Univ. Catholique de Louvain) In this study, the interface properties of unidirectional (UD) composites of untreated and 5% alkali treated coir fibers in both polypropylene and epoxy matrices are investigated using wetting analysis and interfacial mechanical tests. The result of fibre-matrix work of adhesion is quite consistent with the interfacial strength of the composites.</p>	<p>TH39-3 BLENDING OF BIO-BASED FILLERS IN THERMOPLASTICS TO YIELD CONSISTENT PROPERTIES MA Fuqua, CA Ulven (Dakota State Univ.) One of the largest hurdles in gaining acceptance of biomass fillers in the plastics industry is that natural fillers are perceived as lacking quality and consistency. In this study, hybrid blends of multiple filler types with given global constituent levels are compared to single filler to improve consistency of properties.</p>	<p>TH40-3 OPTIMIZATION OF A STIFFENED COMPOSITE CYLINDER UNDER EXTERNAL HYDROSTATIC PRESSURE FOR UNDERWATER VEHICLES J.S. Kim, JH Kweon, JH Choi (Gyeongsang National Univ.) The stacking sequence of a stiffened composite cylinder was optimized. The objective is to maximize the design load considering both a static and buckling load. The design variables are the helical winding angle and hoop winding thickness. A micro genetic algorithm was adopted, and MSC.NASTRAN was used for the analyses.</p>	<p>TH41-4 MOLECULAR MODELING OF THERMOSETTING POLYMERS: EFFECTS OF DEGREE OF CURING AND CHAIN LENGTH ON THERMO-MECHANICAL PROPERTIES NB Shenogina, SM Mukhopadhyay (Wright State Univ.), M. Tigge (Univ. of Akron), SS Patnalki (Wright-Patterson AFB) In the present study we were able to generate a set of stress-free thermoset models with high degree of cure. We found densities and glass transition temperatures of the systems in good agreement with experimental data, however, the mechanical values were found to be higher than in real macroscopic samples.</p>
17:30	<p>TH36-4 MECHANICAL PROPERTIES OF BORON AND KEVLAR-49 REINFORCED THERMOSETTING COMPOSITES KK Yeung, PR Kamini (City Univ. of Hong Kong) The mechanical properties of four selected composites using fibers of Boron and Kevlar in Polyimide and Polyester matrices were investigated using micromechanics models and experimentally. Except for the tensile properties, the model estimations matched closely with Xu-Reifsnider model for compression and Inverse Rule of Mixtures (ROM) for flexural properties.</p>	<p>TH37-4 THREE DIMENSIONAL MICROSTRUCTURE OF POLYMERIC COMPOSITE MATERIALS USED IN SANDWICH STRUCTURES USING DUAL MODALITY FROM COMBINED HIGH RESOLUTION X-RAY AND NEUTRON TOMOGRAPHY F. Kim, D Penumadu, A Sirinuk, J Bunn (Univ. of Tennessee), N Kardjilov (Helmholtz Center Berlin for Materials and Energy) Use of dual modality to study polymeric composite materials with high resolution X-ray and neutron tomography is demonstrated. 3-D image based registration is performed to combine the two modalities that account for varied resolutions and contrast. Some example analysis techniques and limitations are explained.</p>	<p>TH38-4 INVESTIGATION OF THE IMPACT PROPERTIES OF GLASS FIBRE/HMPP FIBRE HYBRID COMPOSITE MATERIALS FOR CIVIL INFRASTRUCTURE CONSTRUCTIONS J. Malvern, JA Epaarachchi, A. Lau (Univ. of Southern Queensland) The recent development of less expensive, high modulus synthetic fibre has opened a new path for the development of high performance, impact resistant composites which are affordable for civil infrastructure development. This paper details a study of lower cost, high-energy absorbent high modulus polypropylene (HMPP) fibers and hybrid composites.</p>	<p>TH39-4 EFFECT OF MOISTURE EXPOSURE DURING FABRICATION ON FLAX/POLYESTER COMPOSITES M. Mišo, SZ Shen (CSIRO), N Milanovic (RMIT Univ.) The interlaminar shear strength (ILSS) of flax/polyester composites was nearly halved due to the presence of moisture in the flax fibres during composite fabrication. This is similar to the effect of water immersion for 40 days on the same composites fabricated at dry conditions.</p>	<p>TH40-4 A STUDY ON FAILURE STRENGTH EVALUATION OF HYBRID COMPOSITE JOINT JH Park, KW Jeong, JH Choi, JH Kweon (Gyeongsang National Univ.) As composites have become popular in recent years, the design of the composite joint has become a very important research area because the structural efficiency of the composite structure is determined by its joints, not by its basic structures.</p>	<p>TH41-5 MULTI SCALE AND GEOMETRY EFFECT ON THE ELECTROMAGNETIC BEHAVIOUR OF Fe₃O₄/CARBON COMPOSITE NANOFIBERS M. Bayat, H. Yang, D. Michelson, E. Ko (Univ. of British Columbia) Multifunctional composite nanofibers have attracted increasing interest in the recent years due to their potential for a broad range of applications. These composite nanofibers can be produced by incorporating various functionalities into the polymer solution using different nanofillers with specific properties. For example electrical and magnetic properties are suitable candidates ...</p>
17:50			<p>TH38-5 KINK BANDS IN FLAX AND HEMP POLYESTER COMPOSITES M Symington, WM Banks, JL Thomason, RA Petherick, O David-west (Univ. of Strathclyde) Natural fibre composites are a large area of interest in the academic community at present. Many shortfalls in material properties have been traced to fibre defects, such as kink bands, which are folds or bends in the fibre walls. This paper discusses some of our own findings concerning kink bands.</p>	<p>TH39-5 CHARACTERIZATION, CHEMICAL MODIFICATION, AND PROCESS OPTIMIZATION OF FLAX FIBER NATURAL COMPOSITES N Mfalali, B Thattai, SB Pillay, U Vaidyan (Univ. of Alabama at Birmingham), J Fouli (SDA ABS CQES) Recent legislation and consumer education programs has accelerated the demand for components manufactured from sustainable and biodegradable materials. Flax fibers provide a suitable, sustainable alternative to synthetic fibers like e-glass in composite materials. This work investigates the chemical treatment, process optimization and characterization of polypropylene, flax fiber composites.</p>	<p>TH40-5 THE DESIGN AND FABRICATION OF THE COMPOSITE-ALUMINUM HYBRID VEHICLE WHEEL BY USING ADHESIVE BONDING CONSIDERING MASS PRODUCTION SH Hoo, SW Park, DS Son, KC Jung, SH Chang (Chung-Ang Univ.) In this paper, a composite-aluminum hybrid wheel composed of complex aluminum outer rim and a relatively simple shaped composite inner rim was introduced. By dividing the wheel structure into two parts, all the parts can be fabricated by the traditional mass production methods.</p>	<p>TH41-6 HIGH-TEMPERATURE INTELLIGENT COMPOSITES YH Li, SJ Kim, N Salowitz, S Roy, CC Larrosa, V Janapat, FK Chang (Stanford Univ.) We have demonstrated with our intelligent diagnostics algorithm and temperature compensation model, the newly developed high-temperature piezoelectric sensors (BS-PT) not only can survive the harsh curing conditions required for high-temperature PMCs, but also can be potentially utilized in high-temperature intelligent sensory systems to achieve SHM in a larger temperature range.</p>
18:10					<p>TH40-6 THE SIMULATION FOR THE BONE HEALING PROCESS BASED ON MECHANO-REGULATION THEORY CONSIDERED LOADING CONDITION AND COMPOSITE BONE PLATE PROPERTY HJ Kim, SW Chang, HJ Jung (Chung-Ang Univ.) By using the finite element analysis the tissue differentiation tendency and healing efficiency at the callus parts according to the plate modulus and loading conditions were evaluated and the most appropriate plate modulus under each initial loading condition was suggested.</p>	<p>TH41-7 A MICROMECHANICAL METHODOLOGY FOR FATIGUE LIFE PREDICTION OF POLYMERIC MATRIX COMPOSITES YC Huang, KK Jin, G Mustafa, SK Ha, L Xu (Hanyang Univ.), YH Han (Korea Electric Power Research Inst.) A micromechanical approach for fatigue life prediction of polymeric matrix composites was proposed. A combination of micromechanical models, constituent fatigue models, a modified Goodman formulation of constant life diagram, Basquin's equation, and Minor's rule, led satisfactory prediction compared with fatigue test data.</p>
18:30						

BANQUET

	202B	203	301	302	401	402A
16:30	<p>TH42 SANDWICH MATERIALS AND STRUCTURES Chairs: OT Tohmsen/ ZH Xie</p> <p>TH42-1 APPLICABILITY OF AN INCLUSION-BASED HOMOGENISATION APPROACH TO MODELLING OF BALS-LIKE POROUS MATERIALS O Shishikina, Y Zhu, L Gorbatikh, SV Lomov, I Verpoest(Katholieke Universiteit Leuven) In this work, we discuss the applicability of the inclusion-based methods to predict elastic properties of bals-like cellular materials and results of the micro-compression tests performed inside a SEM chamber for polymeric foams and wood.</p>	<p>TH43 NON-DESTRUCTIVE EVALUATION Chairs: DJ Yoon/ JG Kim</p> <p>TH43-1 NONDESTRUCTIVE EVALUATION OF COMPOSITE BOGIE USING INFRARED THERMOGRAPHY TECHNIQUE JG Kim, JS Kim, HJ Yoon(KRRI) In this investigation, the lock-in thermography was employed to evaluate the defects in a composite bogie. Prior to the actual application on a composite bogie, in order to assess the detectability of known flaws, the calibration reference panel was prepared with various dimensions of artificial flaws.</p>	<p>TH44 HIGH PERFORMANCE AND SUSTAINABLE COMPOSITE MATERIALS Chairs: J Takahashi/ K Uzawa</p> <p>TH44-1 VIBRATION WELDING OF LONG AND CONTINUOUS CARBON FIBER REINFORCED POLYPROPYLENE A Sasaki, T Hayashi, K Akiyama(Mitsubishi Rayon) Vibration welding of acid modified polypropylene matrix CFRTP was experimentally studied. Two types of panels were investigated, namely random chop panel and uni-directional panel. For the two panels, the effects of welding pressure, welding time, vibration amplitude, vibration direction, holding pressure and holding time on lap shear strength were investigated.</p>	<p>TH45 MICROMECHANICS OF COMPOSITES AND HETEROGENEOUS MATERIALS: MULTISCALE MODELING AND HOMOGENIZATION Chairs: I Tsukrov/ H Berger</p> <p>TH45-1 EFFECTIVE ELASTIC PARAMETERS OF CARBON/CARBON COMPOSITES WITH NON-ELLIPTICAL PORES I Tsukrov, B Drach(Univ. of New Hampshire), R Piat(Karlsruhe Institute of Technology) We present a homogenization procedure to predict the effective elastic properties of materials containing randomly distributed non-elliptical pores. Such materials can be either isotropic or anisotropic depending on the elastic symmetry of matrix material and orientational distribution of defects.</p>	<p>TH46 MANUFACTURING PROCESSES FOR COMPOSITE MATERIALS Chairs: WR Hwang/ P Kwon</p> <p>TH46-1 DEVELOPMENT OF ATL AND MATERIALS FOR LOW COST PRODUCTION RJ Crossley, PJ Schubel, NA Warrior(Univ. of Nottingham) Low cost E-glass tapes were developed for the Automated Tape Laying (ATL) process and proved problematic during lay-up. Peel tack testing and resin rheology results were used to rationalise the observed lay-up difficulties concluding that viscoelastic and surface properties of materials are key in maintaining ATL performance.</p> <p>TH46-2 DEVELOPMENT OF THE DISPLACED FOAM DISPERSION TECHNIQUE FOR THE MANUFACTURE OF MULTISCALE COMPOSITES M Mccray-dennis, OQ Okoli, CC Zeng(FAMU-FSU College of Engineering) This paper details the use of the neoteric Displaced Foam Dispersion (DFD) technique for the production of multiscale composites. The technique utilizes a polystyrene (PS) foam substrate to place carbon nanotubes within desired regions. The results indicate improvements in tensile strength and modulus of 14% and 20% respectively.</p> <p>TH46-3 DESIGN AND PROCESSING OF ADVANCED MATERIALS FOR PERSPIRABLE SKIN MG Wang, M Lempe(State Univ.), CW Chen(National Taiwan Univ.), T Wong(Alfred Univ.), PY Kwon(Michigan State Univ.) A perspirable skin design has been proposed to autonomously cool the surface. To achieve a higher capacity for self-cooling, an assembly of design shapes (called 'tiles') is designed to buckle under an expected thermal loading. These tiles had uniquely designed CTEs, which enable buckling to occur under a given loading.</p> <p>TH46-4 CONTROL OF LAMINATE QUALITY FOR PARTS MANUFACTURED USING THE RESIN INFUSION PROCESS Q Govignon, S Kazmi, C Hickey, S Bickerton(Univ. of Auckland) An experimental study is presented on the control of laminate Vt and quality, using the resin infusion process. The compaction response of three fibre reinforcements is studied, providing estimates for Vt range achievable. An instrumented panel manufacturing program is presented to verify the control of laminate Vt achieved.</p> <p>TH46-5 FIBER REINFORCEMENTS: CORRELATING PERMEABILITY AND LOCAL SPATIAL FIBROUS FEATURES S Comas-carbono, C Binetruy(Coles de Mines), S Bickerton, L Tournier, J Gar(UNiv. of Auckland), F Zhang(Ecole des Mines de Douai) The manufacturing of composite materials is influenced by variability in the constituent materials. For the Liquid Composite Moulding (LCM) family of processes, development of resin flow and tooling forces are governed by the architecture of the reinforcement. Permeability and compaction response depend on local fibre content and architecture, and significant...</p> <p>TH46-6 ANISOTROPY-INDUCED WARPAGE OF A MICRO-MOLDED PART HJ Oh, JR Youn(Seoul National Univ.), YS Song(Dankook Univ.) An analytical procedure was proposed and validated for predicting the warpage of hybrid LCP composites, where fillers are glass fiber and talc. There are two specimens, injection molded, to measure the properties of the composite and to validate the warpage of a micro-molded part.</p>	<p>TH47 PROGRESSIVE DAMAGE AND FAILURE Chairs: TE Tay/ R Talreja</p> <p>TH47-1 FASTENER AS FAIL-SAFE DISBOND/DE-LAMINATION ARREST FOR LAMINATED COMPOSITE STRUCTURES CH Cheung, P Gray, KY Lin(Univ. of Washington) This paper presents an analytical method for predicting effectiveness of fasteners as a fail-safe mechanism for disbond/delamination arrest. The mode-decomposed strain energy release rates are solved analytically. Results show that the fastener provides significant crack retardation capability in both Mode I and Mode II loading conditions.</p> <p>TH47-2 WORK OF SEPARATION OF TRUSS-LIKE MIXED MODE COHESIVE LAWS S Goutianos, BE Sørensen(Technical Univ. of Denmark) We show analytical that for cohesive laws for which the traction vector follows the separation vector, the tractions can be derived from a potential function only when the fracture resistance is independent of the phase angle of the openings. The results are verified numerically by the finite element code Abaqus.</p> <p>TH47-3 A STATISTICAL APPROACH TO EVALUATE THE EFFECT OF MANUFACTURING QUALITY ON TRANSVERSE CRACKING IN CROSS PLY LAMINATES YX Huang, R Talreja(Texas A&M Univ.), J Varna(Lulea Univ. of Technology) A study is conducted to examine the effects of manufacturing defects on the performance of composite laminates. Cross ply laminates of carbon/epoxy are manufactured under different quality controls and then subjected to monotonic tensile loading in the 0 degree direction. In particular to examine the effect of voids, several manufacturing...</p> <p>TH47-4 A COMBINED EXPERIMENTAL AND NUMERICAL APPROACH FOR SIMULATING THE DAMAGE BEHAVIOUR OF NOTCHED COMPOSITE LAMINATES N Zobeyri, A Forghani, R Vaziri, A Poursartip (Univ. of British Columbia) A new model is presented that can be used to simulate the damage behaviour of laminated composites using a sub-laminate based approach. By conducting tests on notched specimens and using full-field displacement measurement technique, the damage properties of composites are obtained leading to calibration of the damage model.</p> <p>TH47-5 PROGRESSIVE DAMAGE STRUCTURAL ANALYSIS OF CARBON/EPOXY COMPOSITE LAMINATES SG Lee, HI Cho(Korea Maritime Univ.), JH Byun(Korea Inst. of Materials Science) For the development of composite material underwater vehicle propeller superior to the radiated noise, it is necessary to carry out the researches on the diverse fiber directions and arrays and also to develop numerical simulation techniques for its optimum structural analysis with the experiments. In this study, characteristics and weight...</p>
16:50	<p>TH42-2 MORPHOLOGY EFFECTS ON CONSTITUTIVE PROPERTIES OF FOAMS JK Kim, S Hallstrom (KTH) Rigid foams were modeled as stochastic 3D Voronoi structures. The stiffness was evaluated with finite elements. Significant differences in the morphology such as the spread in cell volume were found not to affect the predicted stiffness. The relation between relative density and stiffness was found to be slightly non-linear.</p>	<p>TH43-2 SOURCE LOCATION METHOD FOR GFRP WIND TURBINE BLADE USING ACOUSTIC EMISSION SIGNAL MAPPING Bil Han, DJ Yoon(KRISST) This study describes a new concept for identification of damage sources in heterogeneous composite materials and discusses how they can be verified both to laboratory blade certification testing and to actual full scale wind turbine blade. We suggest a new algorithm for source location of damage...</p>	<p>TH44-2 INVESTIGATION ABOUT DYNAMIC FLEXURAL FRACTURE PROPERTIES OF CARBON FIBER REINFORCED THERMOPLASTICS T Matsuo, J Takahashi, K Uzawa, T Asakawa(Univ. of Tokyo), K Kiriyama(TOYOBO Co., Ltd.) The dynamic flexural behavior of the developed thermoplastic composites was examined by low and high velocity three-point bending tests. Observation using high-speed camera and verification experiments for the strain rate dependency showed some important unique characteristics of the developed CFRTP.</p>	<p>TH45-2 ELASTIC PROPERTIES OF CARBON/CARBON COMPOSITES FOR DIFFERENT FIBERS DISTRIBUTIONS G Stasiul, R Piat, S Dietrich, A Wanner, I Boethke, O Deutschmann(Karlsruhe Inst. of Technology), B Drach, I Tsukrov, T Gross(Univ. of New Hampshire), Y Lapusta, Y Lapusta(MFA, Univ.) Material parameter identification of the carbon/carbon composites was provided using semi-analytical methods. The ODF obtained from microstructural studies is used as input for homogenization schemes. The influence of the preform architecture on the material properties of carbon/carbon composites has been studied for different fibers and pores ODFs.</p>	<p>TH46-3 DESIGN AND PROCESSING OF ADVANCED MATERIALS FOR PERSPIRABLE SKIN MG Wang, M Lempe(State Univ.), CW Chen(National Taiwan Univ.), T Wong(Alfred Univ.), PY Kwon(Michigan State Univ.) A perspirable skin design has been proposed to autonomously cool the surface. To achieve a higher capacity for self-cooling, an assembly of design shapes (called 'tiles') is designed to buckle under an expected thermal loading. These tiles had uniquely designed CTEs, which enable buckling to occur under a given loading.</p>	<p>TH47-2 WORK OF SEPARATION OF TRUSS-LIKE MIXED MODE COHESIVE LAWS S Goutianos, BE Sørensen(Technical Univ. of Denmark) We show analytical that for cohesive laws for which the traction vector follows the separation vector, the tractions can be derived from a potential function only when the fracture resistance is independent of the phase angle of the openings. The results are verified numerically by the finite element code Abaqus.</p>
17:10	<p>TH42-3 DEICING SILICONE COATING BASED ON BIDIRECTIONAL MIGRATION EFFECT OF ALKANE MOLECULES L Guan, H Zhang, Y Yang, CY Xu, Z Zhang, C Zhang(National Center for Nanoscience and Technology) Among various deicing methods, deicing coating is a convenient and effective one in preventing ice accumulation on the protected surfaces [1, 2]. In this study, we demonstrated a novel deicing coating based on the bidirectional migration effect of alkane molecules added to the silicone coating.</p>	<p>TH43-3 NONDESTRUCTIVE TESTING OF MULTI-LAYER COMPOSITES MADE OF CARBON FIBRE BY IR THERMOGRAPHY METHODS W Swidenski(Military Inst. of Armament Technology) Multi-layered composites are frequently used in many military applications and one of them is fabrication of light-weight ballistic covers. An interest in these covers results from threats to which troops participating in stabilisation missions are exposed. Usually these troops are equipped with motor vehicles exposed to small-arms fire and mine...</p>	<p>TH44-3 LIFE CYCLE ASSESSMENT OF CFRP IN APPLICATION OF AUTOMOBILE X Zhang, M Yamashita, J Takahashi(Univ. of Tokyo) This research applied Life Cycle Assessment (LCA) as a tool to evaluate potential and improving direction of CFRP in application of automobile.</p>	<p>TH45-3 MICROSTRUCTURAL ANALYSIS OF CRYSTALLINE TECHNOLOGY BY NANOSSEM - FEI NOVA 200 S Bohus, R Drochytka(Brno Univ. of Technology) The paper focus on microstructural behavior of new types waterproofing materials with secondary crystallization ability. Aim has been on issue - how secondary crystallization is developing in concrete pore system during critical 12 days period after application. Is it enough for Xypex Concentrate waterproofing ability?</p>	<p>TH46-4 CONTROL OF LAMINATE QUALITY FOR PARTS MANUFACTURED USING THE RESIN INFUSION PROCESS Q Govignon, S Kazmi, C Hickey, S Bickerton(Univ. of Auckland) An experimental study is presented on the control of laminate Vt and quality, using the resin infusion process. The compaction response of three fibre reinforcements is studied, providing estimates for Vt range achievable. An instrumented panel manufacturing program is presented to verify the control of laminate Vt achieved.</p>	<p>TH47-3 A STATISTICAL APPROACH TO EVALUATE THE EFFECT OF MANUFACTURING QUALITY ON TRANSVERSE CRACKING IN CROSS PLY LAMINATES YX Huang, R Talreja(Texas A&M Univ.), J Varna(Lulea Univ. of Technology) A study is conducted to examine the effects of manufacturing defects on the performance of composite laminates. Cross ply laminates of carbon/epoxy are manufactured under different quality controls and then subjected to monotonic tensile loading in the 0 degree direction. In particular to examine the effect of voids, several manufacturing...</p>
17:30	<p>TH42-4 THE DEVELOPMENT OF A MULTIFUNCTIONAL EMBEDDED COMPOSITE SMART SKIN ANTENNA STRUCTURE Z Xie, W Zhao, L Li, P Zhang (Northwestern Polytechnical Univ.) A Multifunctional Embedded Composite Smart Skin Antenna (MECSA) Structure with load-bearing, shape maintaining and microwave communication capabilities was designed, manufactured and tested in this work. Through the study we found that adhesive is the significant factor of affecting the electrical performance of MECSA structure.</p>	<p>TH43-4 NEW EXPERIMENTAL INVESTIGATIONS OF ADHESIVE BONDS WITH ULTRASONIC SH GUIDED WAVES P Peres, D Barnoncel(ASTRUM Space Transportation), K Balasubramanian(Indian Inst. of Technology of Madras), M Castaigne(Univ. of Bordeaux) One of the problems when using adhesives is the occasional occurrence of 'kissing bonds'. Ultrasonic guided waves such as Lamb waves offer a high potential of diagnosis of adhesive bond. This paper reports the experimental work performed with EMAT sensors in combination with simulation to detect defects in adhesive joint.</p>	<p>TH44-4 INVESTIGATION ABOUT JOINT STRENGTH OF WELDING AND SHEAR PROPERTY OF CFRTP K Uzawa, J Takahashi, T Matsuo, Y Orto, H Murayama, K Nagata, I Ohsawa, J Asakawa, A Kanai(Univ. of Tokyo), K Kageyama, I Demachi(Chiyoda Corp.) In this paper, the authors examined fundamental mechanical properties of CFRTP and strength of the welding joint by tensile test. We evaluated the CFRTP, by G2-PP with 2.0 wt% of the maleic anhydride and by Normal-PP. It was found that the joint strength is proportional to interfacial shear strength.</p>	<p>TH45-4 AN EXTENDED NUMERICAL HOMOGENIZATION APPROACH FOR COMPOSITES WITH RHOMBIC FIBER ARRANGEMENTS H Berger, M Wuerkner, U Gabbert(Univ. of Magdeburg) An extension to common numerical homogenization procedures is introduced to handle composites with rhombic fiber arrangements. The calculated effective coefficients are compared with available results from literature. Further investigations show that with such types of composites an excellent orthotropic behavior in the transverse plane can be achieved.</p>	<p>TH46-5 FIBER REINFORCEMENTS: CORRELATING PERMEABILITY AND LOCAL SPATIAL FIBROUS FEATURES S Comas-carbono, C Binetruy(Coles de Mines), S Bickerton, L Tournier, J Gar(UNiv. of Auckland), F Zhang(Ecole des Mines de Douai) The manufacturing of composite materials is influenced by variability in the constituent materials. For the Liquid Composite Moulding (LCM) family of processes, development of resin flow and tooling forces are governed by the architecture of the reinforcement. Permeability and compaction response depend on local fibre content and architecture, and significant...</p>	<p>TH47-4 A COMBINED EXPERIMENTAL AND NUMERICAL APPROACH FOR SIMULATING THE DAMAGE BEHAVIOUR OF NOTCHED COMPOSITE LAMINATES N Zobeyri, A Forghani, R Vaziri, A Poursartip (Univ. of British Columbia) A new model is presented that can be used to simulate the damage behaviour of laminated composites using a sub-laminate based approach. By conducting tests on notched specimens and using full-field displacement measurement technique, the damage properties of composites are obtained leading to calibration of the damage model.</p>
17:50	<p>TH42-5 MECHANICAL CHARACTERIZATION OF PVC FOAM USING DIGITAL IMAGE CORRELATION AND NONLINEAR FE ANALYSIS ST Taher, OT Thomsen(Aalborg Univ.), J Barton(Univ. of Southampton) The mechanical properties of polymer foam materials degrade significantly with elevated temperatures. A modified Arcan fixture (MAF) has been developed to characterize polymer foam materials tensile, compressive, shear and bidirectional mechanical properties at various temperatures. The measurements include the elastic constants and the complete stress-strain response upto failure.</p>	<p>TH43-5 FREQUENCY SHIFTING SIGNAL DETECTION AND ANALYSIS OF BOILER TUBE LEAKS GJ Jung, YS Cho, YC Kim, SH Baek(KEPRI), JH Sung(Korea Western Power Co., Ltd.) Frequency shifting has happened above 50kHz in pressure leak. Therefore, monitoring frequency band above 50kHz is essential to decide boiler tube leaks. Providing frequency figure can improve detection ability than monitoring noise intensity(dB) only. With checking out frequency shifting bands and RMS signals, we can confirm tube leaks effectively.</p>	<p>TH44-5 RESEARCH ON STRUCTURAL INTEGRITY OF CFRTP AFTER THUNDER ATTACK Y Murakami, A Morita, J Takahashi, K Uzawa(Univ. of Tokyo) The purpose of this research is to examine the thunder resistance of carbon fiber reinforced thermoplastics (CFRTP) in order to apply them to mass produced automobiles. Damage area when spark occurs are measured first for several combinations of fiber volume fractions and thermoplastics.</p>	<p>TH45-5 MULTI-SCALE MODELLING OF POLYMER COMPOSITE MATERIALS UNDER BLAST LOADING M Lidgert, R Brooks, N Warrior, K Brown(Univ. of Nottingham), N Martindale(BAC Systems), A Wright, M French(QinetiQ) This paper presents the multi-scale modelling of hybrid S2 glass / carbon epoxy non crimp fabric polymer composite materials under high strain rate loading. Analysis takes place at the micro, meso and macro scale. A blast and ballistic event is simulated at the macro scale utilising micro/meso results.</p>	<p>TH46-6 ANISOTROPY-INDUCED WARPAGE OF A MICRO-MOLDED PART HJ Oh, JR Youn(Seoul National Univ.), YS Song(Dankook Univ.) An analytical procedure was proposed and validated for predicting the warpage of hybrid LCP composites, where fillers are glass fiber and talc. There are two specimens, injection molded, to measure the properties of the composite and to validate the warpage of a micro-molded part.</p>	<p>TH47-5 PROGRESSIVE DAMAGE STRUCTURAL ANALYSIS OF CARBON/EPOXY COMPOSITE LAMINATES SG Lee, HI Cho(Korea Maritime Univ.), JH Byun(Korea Inst. of Materials Science) For the development of composite material underwater vehicle propeller superior to the radiated noise, it is necessary to carry out the researches on the diverse fiber directions and arrays and also to develop numerical simulation techniques for its optimum structural analysis with the experiments. In this study, characteristics and weight...</p>
18:10		<p>TH43-6 DEVELOPMENT OF ACTIVE SENSING-BASED REAL-TIME CONCRETE STRENGTH ESTIMATION MODEL DJ Kim, CG Lee, SH Park(Sungkyunkwan Univ.) This study proposed the real-time concrete strength estimation model based of active sensing analysis. The electromechanical impedance and guided wave signal were varied according to strength of host concrete structure during curing process. Therefore the strength of concrete can be estimated by measuring active sensig signals.</p>	<p>TH44-6 DEVELOPMENT OF ACTIVE SENSING-BASED REAL-TIME CONCRETE STRENGTH ESTIMATION MODEL DJ Kim, CG Lee, SH Park(Sungkyunkwan Univ.) This study proposed the real-time concrete strength estimation model based of active sensing analysis. The electromechanical impedance and guided wave signal were varied according to strength of host concrete structure during curing process. Therefore the strength of concrete can be estimated by measuring active sensig signals.</p>	<p>TH45-5 ESTIMATION OF MECHANICAL BEHAVIOR OF BRAIDED COMPOSITES BASED ON MESH SUPERPOSITION METHOD D Ohyama, K Tetsusei, W Yuki, Z Masaru(Osaka Univ.) In this research, an individual modeling method of fiber bundle parts and resin for the FE analysis of braided composite is proposed based on the mesh superposition method. The accuracy of the method when tetrahedral elements are superimposed is discussed to apply complex fiber bundle architecture.</p>	<p>TH46-7 FORMING OF ADVANCED COMPONENTS OUT OF PRE-STACKED CROSSPLIED UD PREPREG M Akermog(KTH), YR Larberg, P Hallander(AAB Aerostructures) The presented work focuses on forming of cross-plied prepreg using sheet forming technique. The paper summarises results from experimental tests performed to pin-point deformation modes, measure corresponding changes in fibre angles and deformation resistance (load). Further, material models are developed enabling predicting in-plane deformation of multi-layer prepreg with encouraging results.</p>	
18:30						

	Halla A	Halla B	Samda A	Samda B	201A	202A
08:30	PL17: APPLICATIONS AND KEY ISSUES OF THE COMPOSITE MATERIALS IN THE AUTOMOTIVE INDUSTRY Jong-Dae Lim (Hyundai Motor Group) (Chair: WR Yu)		PL18: POLYMER NANOCOMPOSITE: TO BRIDGE THE GAP BETWEEN CERAMICS AND POLYMERS Zhong Zhang (National Center for Nanoscience and Technology) (Chair: K Friedrich)			
09:00	Break					
09:15	F1 OTHERS Chair : Y Chen/ US Kim	F2 MANUFACTURING PROCESSES FOR COMPOSITE MATERIALS Chair : OT Thomsen/ J Barton	F3 SIMULATION-BASED DESIGN AND OPTIMIZATION Chair : S Shevtsov/ C Kim	F4 COMPOSITE JOINTS Chair : J Xu/ SH Ahn	F5 FATIGUE AND LIFE PREDICTION OF COMPOSITES Chairs : S Tsampas/ M Kawai	F6 KASSAT (KOREAN AERO-VEHICLE SMART SKIN ANTENNA TECHNOLOGY) & FMAV (FLAPPING MICRO AIR VEHICLE) chair : SM Jun/ CH Yoon
	F1-1 METALLIZATION OF FIBER-REINFORCED EPOXY COMPOSITES - EFFECT OF SURFACE STRUCTURE ON THE PEEL STRENGTH E Njuhovic, A Witt, M Kempf(Univ. of Bayreuth, Germany), V Altschädel(Luberg Elektronik GmbH & Co. Rothfischer KG) This study focuses on the effect of the surface structure, generated with a mechanical pretreatment method, on the peel strength of copper electroplated fiber-reinforced epoxy composites. The topography of the composite is heavily dependent on the selected pretreatment process and its parameters.	F2-1 THE EFFECT OF THERMAL HISTORY ON MECHANICAL PROPERTIES OF WOVEN BASALT FABRIC REINFORCED POLY(BUTYLENE TEREPHTHALATE) COMPOSITES K Hao(Harbin Engineering Univ.) H Cao, Z Fan(Shenzhen Academy of Aerospace Technology), J Teng, L Zhou(The Hong Kong Polytechnic Univ.) Woven basalt fabric reinforced pCBT composites have been fabricated via in-situ polymerization. The higher temperature processed, the better mechanical properties achieved because of better impregnation. Once the processing temperature is too high, the mechanical properties declined sharply due to the depolymerization taken place and the high crystalline.	F3-1 A PSEUDO STRENGTH FUNCTION FOR THE GENERATION OF LOCAL LAMINATE REINFORCEMENT DOUBLERS B Schlaepfer, G Kressl(TH Zurich) A global pseudo strain function that unifies the failure indices of a laminate is proposed. Subsequently, the gradient field that expresses the influence of a layer thickness change to the strength can be calculated. Based on that, local laminate reinforcement doublers are generated. The obtained solutions have superior strength-to-mass ratios.	F4-1 ENHANCEMENT OF FRACTURE TOUGHNESS OF COMPOSITE/ADHESIVE INTERFACE BY IN-MOLD PREPARATION USING NANOIMPRINT LITHOGRAPHY Y Hikosaka, R Matsuzaki, A Todoroki, Y Mizutani(Tokyo Inst. of Technology) In order to improve interfacial properties of bonded composites joint, in-mold surface preparation using nanoimprint lithography is proposed, which method can give us an adherent surface of CFRP without any conventional surface treatment. In this presentation, an effect of the in-mold preparation on mode I fracture toughness is investigated experimentally.	F5-1 DEGRADATION BEHAVIOUR OF TEXTILE-REINFORCED POLYPROPYLENE UNDER FATIGUE LOADING M Gude, WA Hufenbach, L Koch(TU Dresden) In this study multi-layered flat bed weft-knitted glass fibre/polypropylene composites based on hybrid yarns has been tested under tension and shear fatigue loading. Besides the elaboration of S-N-curves for different material configurations under tension-tension fatigue loading the influence of shear loading with different stress ratios has been investigated.	F6-1 FAILURE ANALYSIS OF ADHESIVELY BONDED JOINTS CONSISTING OF BI-LAYER COMPOSITES MS Kim, CY Park, SM Jun(Agency for Defense Development) One of stealth technologies is conformal load bearing antenna structure(CLAS). CLAS is made of multi-layered composites. The interfaces of these layers are connected using adhesively bonded joints. To find out the failure mechanism of CLAS, Double Cantilever Beam(DCB) test and numerical calculation is performed. Cohesive zone modeling is implemented.
09:35	F1-2 MACHINING QUALITY OF CARBON FIBER REINFORCED PLASTICS WITH DIFFERENT DRILLS Y Chen, Y Fu, J Xu (Nanjing Univ. of Aeronautics and Astronautics) The diameter tolerance of hole with the brazed core drill is bigger than that of twist drill. At entrance the delamination factor used twist drill was bigger than that used brazed diamond core drill. The roughness value used twist drill was smaller than that used brazed diamond core drill.	F2-2 MODELING AND SIMULATION OF NON-ISOTHERMAL REACTIVE RESIN FLOW IN LIQUID COMPOSITE MOLDING P Simasak, SC Advani(Univ. of Delaware) This paper analyzes the various possibilities to simulate the flow of reacting resins in dual scale fabrics addressing isothermal and non-isothermal situations. It describes the possibility to incorporate post-filling and pre-filling analysis into the "flow" simulation directly. Examples are provided, and the computational efficiency.	F3-2 A COMPARISON OF IMPLICIT AND EXPLICIT FINITE ELEMENT METHODS FOR THE MESO-LEVEL SIMULATION OF DRY WOVEN FABRIC COMPOSITES P Simasak, AS Miliutin(Univ. of British Columbia) The aim of this work is to conduct a thorough study on the advantages and disadvantages of different modified finite element methods with different integrators in modeling of a plain woven fabric unit cell. It concerns the computational cost, reliability of convergence, and accuracy of the models.	F4-2 A HYBRID JOINING SCHEME FOR HIGH STRENGTH MULTI-MATERIAL JOINTS DP Graham, A Rezaei, D Baker(BAE Systems), PA Smith, JF Watts (Univ. of Surrey) An advanced method for joining fibre reinforced polymers to metallic substrates has been investigated. By combining interlocking metallic surface features, with adhesive bonding, the solution was shown to offer improvements in strength, toughness and damage tolerance under a range of test conditions.	F5-2 DESIGN AND MANUFACTURING OF AN IMPACT FATIGUE TESTING MACHINE FOR FIBRE REINFORCED PLASTICS S Kato, S Ujihashi, N Tonioke(Tokyo Inst. Of technology), CG Irvine, CN Barrington, RA Hosick(Univ. of Strathclyde) An impact fatigue testing machine for fibre reinforced plastics was developed to perform high-cycle impact fatigue tests. The operational test was conducted, and some parameters are measured during the test. The results indicated that the machine is capable of evaluating the fatigue durability of CFRP specimens subject to high-cycle impact.	F6-2 LAP SHEAR STRENGTH OF ADHESIVELY BONDED COMPOSITES C Yoo, S Gil, J Yoon, M Kim(Agency for Defense Development) The Conformal Load-bearing Antenna Structure (CLAS) enhances the new technology for aircraft antenna. This approach can reduce weight, drag and enhance electromagnetic performance, damage resistance and structural efficiency. However the technology is required to solve structural design difficulty, manufacturing complexity and limited electromagnetic performance.
09:55	F1-3 FLUTTER SPEED ESTIMATION FOR FOLDING WING SYSTEM YY Jung, JH Kim(Seoul National Univ.) Recently, morphing aircrafts with multiple mission capabilities are developed by several projects such as NASA or Defense Advanced Research Projects Agency. One of the morphing concepts is the folding wing system with out-of-plane motion. It can adjust flight performance from a cruise configuration to a high speed configuration. A typical...	F2-3 FIBER BRAGG GRATING, ETCHED AND FRESNEL WING SYSTEM G Bektas, T Boz, M Yildiz, C Ozturk, YZ Menciloglu(Sabancı Univ.), C Keulen and Al Suleman(Univ. of Victoria) In this study, in situ process monitoring of resin transfer molded glass fiber reinforced polymer composites using fiber Bragg grating, and etched bare fiber optic sensors is conducted. The results have shown that both the FBG and etched sensors can be used efficiently for process monitoring in the RTM process.	F3-3 OPTIMIZATION OF THE COMPOSITE CURE PROCESS ON THE BASIS OF THERMO-KINETIC MODEL SN Shevtsov, IV Zhilyayev, AN Soloviev(South Center of Russian Academy), VV Dubrov(Rostvertol helicopters), IA Parinov(South Federal Univ.) The model of spatially distributed curing process of epoxy-based matrix polymeric composite was presented. The geometry of modeled process was converted from CAD to FEM representation. We formulate and solve minimization problem with objective as the maximum spreading of conversion gradient inside the cured spar to optimize the heating control...	F4-3 MODE I FRACTURE BEHAVIOR OF THE CFRP ADHESIVE BONDED JOINT UNDER CRYOGENIC TEMPERATURE M Takemoto, S Ogihara, T Takaki(Tokyo Univ. of Science), A Yoshimura, T Ogasawara(Japan Aerospace Exploration Agency) In this study, mode I fracture toughness was obtained using DCB test with three types of bonded specimens, CFRP/Adhesive/CFRP, Alumi-num/Adhesive/Aluminum and CFRP/Adhesive/Aluminum specimens. DCB test was performed at various temperatures, room temperature, -50 °C and cryogenic temperature (-196 °C). It is necessary to consider the effect of residual thermal stresses...	F5-3 DAMAGE CHARACTERISATION AND THE ROLE OF VOIDS IN THE FATIGUE OF WIND TURBINE BLADE MATERIALS JW Lambert, A Chambers, I Sinclair, Mark Spearing(Univ. of Southampton) The damage micromechanisms in tension-compression fatigue loading of wind turbine blade GRFP were investigated using micro-focus Computed Tomography (µCT). µCT provided detailed, 3-dimensional imaging of matrix cracking, delamination, and an overall understanding of the material's damage accumulation throughout life, including a quantitative investigation into the role of voids.	F6-3 STRUCTURAL DESIGN OF CONFORMAL LOAD BEARING ANTENNA STRUCTURE(CLAS)(PART I) J Kim, SR Ha, GH Ryu(LIG Nex1), MS Kim(Agency for Defense Development) In this design and analysis, structural integrity verification for proposed CLAS (Conformal Load Bearing Antenna Structure) was performed. Through the verification, it was confirmed that the final design has sufficient strength and stiffness for stress, buckling and resonance.
10:15	F1-4 COLORATIVE MECHANISM STUDY OF CELADON GLAZE BY MOSSBAUER SPECTROSCOPY JY Kim, HG No, AV Jeon, US Kim, WS Cho, KI Kim(Korea Inst. of Ceramic Engineering and Technology), KM Kim, CS Kim(Kookmin Univ.) The color of Goryeo celadon is developed through the formation of glassy and crystalline phases, which are generated by the physical and chemical reactions between glaze and clay based body during the reduction firing process at high temperature. The color and gloss of celadon are significantly influenced by the Fe...	F2-4 INFLUENCE OF THE BINDING SYSTEM IN THE COMPACTION BEHAVIOUR OF NCF CARBON FIBRE REINFORCEMENTS S Aranda, F Klunker, G Ziegmann(Clausthal Univ. of Technology) The compaction behaviour of textile reinforcements must be considered for the design and optimisation of closed mould manufacturing processes. Using powder binder or fleece between layers modifies the textile compaction response. In this work, compaction-relaxation-release tests were performed at preforming temperature for three NCF lay-ups with two binding systems.	F3-4 STOCHASTIC MODELLING OF UNIDIRECTIONAL AND 2D WOVEN COMPOSITE RESPONSE MB Whiteside, ST Pinho(Imperial College London) Experimental characterisation of composite materials reveals large variability of material properties. Parallelised Quasi-Monte Carlo simulation of deterministic failure criteria is used to propagate the apparent uni-axial variability into the bi-axial domain for UD and 2D woven composites. A global variance based sensitivity analysis is performed to decompose the results.	F4-4 A DETAILED FINITE ELEMENT INVESTIGATION OF COMPOSITE BOLTED JOINTS WITH COUNTER-SUNK FASTENERS C Stocchi, P Robinson, ST Pinho(Imperial College London) This paper presents a very detailed FEM model of a single lap shear composite bolted joint, with countersunk fasteners, under static tensile load. Parametric studies have been performed to study the influence of clamping force, coefficient of friction and clearance on the joint behaviour.	F5-4 PRINCIPAL MASTER DIAGRAMS APPROACH TO FATIGUE LIFE PREDICTION OF COMPOSITE LAMINATES M Kawai, T Teramuna(Univ. of Tsukuba) A new fatigue model for predicting the S-N relationships for orthotropic fiber composites for any fiber orientations is developed. It is formulated by combining a fatigue strength function approach with a constant fatigue life diagram approach to life prediction of composites. It is verified by comparison with experimental results.	F6-4 DESIGN OF COMPACT, LIGHT WEIGHTED, MULTI-BAND CONFORMAL LOAD-BEARING ANTENNA WITH MAGNETO-DIELECTRIC MATERIAL KH Bae, HS Tae(Samsung Thales), MS Kim, CY Park(Agency for Defense Development) In this paper, the novel antenna technology is proposed for the conformal load-bearing antenna. For fabricating a compact, light weighted and multi-band antenna, magneto-dielectric concept is developed to the Conformal Load-bearing Antenna Structure (CLAS) in this study.
10:35	F1-5 RESIN TRANSFER MOLDING OF SELF-HEALING COMPOSITE MATERIALS RV Grainger, S Hayes (Univ. of Sheffield) This paper reports on initial rheometric analysis and compact tension results of new formulations of a Modified Matrix resin. The viscosity of this method has largely been due to the high viscosity imparted to the system by the inclusion of a very high molecular weight healing agent.	F2-5 EFFECT OF EPOXY CURING ON TILTED FIBER BRAGG GRATINGS TRANSMISSION SPECTRUM D Kinet, C Caucheteur, M Wuilpart, P Megret(Univ. of Mons), D Garray(Sirris), F Narbonneau(Multitel) We present the spectral evolution of a tilted fiber Bragg grating during the curing of an epoxy used in the composite materials fabrication. A differential shift of the cladding modes is associated to a surrounding refractive index modification, which can be used as an indicator of the epoxy polymerization state.	F3-5 MULTISCALE MODELING OF CARBON NANOTUBE BUNDLE REINFORCED POLYMER COMPOSITES SC Chowdhury, S Chowdhury, MF Haider(BUET), BA Gama(Univ. of Delaware) A finite element model is developed to investigate the effects of CNT bundle morphology on the elastic moduli of CNT bundle reinforced nanocomposites where the properties of interface element have been derived from nonlinear cohesive law which deals with the atomistic level interaction.		F5-5 A NEW FATIGUE LIFE PREDICTION MODEL FOR NOTCHED CFRP LAMINATES M Kawai, A Uchiyama(Univ. of Tsukuba) An engineering method for efficiently predicting the fatigue lives of notched CFRP laminates for any notch size and stress ratio is developed. The accuracy of prediction of the S-N curves for notched specimens of CFRP laminates using the proposed method is evaluated by comparing predicted and experimental results.	F6-5 ANNOVA AIRCRAFT ANTENNA STRUCTURE USING COMPOSITE MATERIAL SC Yeo, HS Tae(Samsung Thales), MS Kim, CY Park(Agency for Defense Development) Recently, according to development of antenna techniques, the aircraft antenna of new form has been researched. The electronics and the structure were combined, Conformal Load-bearing Antenna Structure (CLAS) technique is representative. CLAS technique improves an electrical and structural efficiency of antenna.
10:55	F1-6 EVALUATION OF A MODIFIED MATRIX AND THE SYNTHESIS OF THERMALLY REVERSIBLE SELF-HEALING MATRIX POLYMERS EJ Fleet, MSBM Jamil, S Hayes, Simon Jones(Univ. of Sheffield) A modified epoxy matrix (with dissolved linear polymer) has been evaluated for thermal healing performance. The dissolved polymer healing agent is thought to dissolve through a matrix to a fracture surface at 140 °C, this has been visualized with scanning electron microscopy (SEM).	F2-6 ANALYSIS OF FIBER PREFORMING FOR IMPROVED MANUFACTURING OF CURVED PARTS WITH FLEXIBLE INJECTION D Gausse, E Ruiz, F Trochu(Ecole Polytechnique de Montreal) This paper addresses the issue of strongly curved part manufacturing with a new LCM technique called Flexible Injection. By using experimental procedures and numerical modeling it is shown that appropriate preforming of the fiber bed is a key stage to ensure a successful manufacturing of angled shapes with the process.			F5-6 COMPARISON OF MODELS FOR THE SIMULATION OF FATIGUE-DRIVEN DELAMINATION USING COHESIVE ELEMENTS K Kleiber, P Robinson, S Pinho(Imperial College London) Two formulations for introducing fatigue damage into cohesive elements have been examined to determine their mesh sensitivity and numerical stability in mode I, using a non-FEM model. For small element and cycle increments both models predict the fatigue crack growth rate accurately for various applied loads	F6-6 AN INSTRUMENTED FLIGHT TEST OF FLAPPING MICRO AIR VEHICLE USING A TRACKING SYSTEM JH Kim, CY Park, SM Jun(Agency for Defense Development), G Parker(Air Force Research Laboratory), KJ Yoon(Kunkuk Univ.), DK Chung(Hanwha Corp. R&D Center) Instrumented flight test of flapping micro vehicles using a tracking system is performed for numerical performance analysis and the assessment of the flight. Practical test procedures and methods are employed to obtain reasonable data. The test metrics attempted is applicable to test and evaluation of flapping MAVs.
11:15	Break					

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08:30						
09:00	Break					
09:15	F07 SANDWICH MATERIALS AND STRUCTURES Chair : OT Thomsen/ J Barton	F08 NON-DESTRUCTIVE EVALUATION Chair : DJ Yoon/ QQ Ni	F09 CARBON AND CERAMIC MATRIX COMPOSITES Chair : HG Kim/ S Amini	F10 MULTI-SCALE MODELING II Chair : A Poursartip/ V Harmandaris	F11 ANALYSIS OF DENTAL COMPOSITE RESTORATION Chair : NS Choi/ K Arakawa	F12 METAL MATRIX COMPOSITES Chair : D Zhang/ G Sasaki
	F7-1 FACESHEET DENT FORMATION AND RELAXATION ON INDENTED FOAM-CORE SANDWICH BEAMS S Minakuchi, T Uezono, J Siivola, N Takeda(The Univ. of Tokyo) This study investigated static indentation loading-unloading behavior of foam core sandwich beams. It was shown that reaction force from the core to the facesheet controls the residual facesheet dent formation, and that relaxation behavior of the dent can be predicted by considering the stress relaxation of the crushed core.	F8-1 RELIABILITY ANALYSIS OF ADHESIVE BONDED STEPPED LAP COMPOSITE JOINTS BASED ON DIFFERENT FAILURE CRITERIA A Kimjae, E Lund, OT Thomsen, JD Sørensen (Aalborg Univ.) In this paper a probabilistic model for the reliability analysis of a stepped lap adhesive composite joint subjected to external loading relevant for wind turbine blades is presented using 3D FEA modelling. After validation of the FEA model, sensitivity analyses are carried out with respect to the influence of various...	F9-1 FULL-FIELD STRAIN MAPPING OF C-SIC COMPOSITES FOR HYPERSONIC APPLICATIONS S Amini, FW Zok(Univ. of California) The principal objective of the present study is to implement a 3D strain mapping system for probing the mechanical response of a woven 3-layer angle interlock C-SIC composite at different length scales ranging from length scales as small as the characteristic fiber tow dimensions.	F10-1 AUTOMATED GENERATION OF EQUATION-BASED BOUNDARY CONDITIONS FOR MULTISCALE MODELLING OF UNIT CELLS LFC Jeanmairet(The Univ. of Nottingham) The paper presents an application developed in Python for ABAQUS that handles the automated generation of geometry and boundary-condition (BC) set-up for typical unit-cell geometries such as uni-directional square, UD-hexagonal and simple cubic packing (SCP). The need for equation based BC is discussed and requirements for further development are expressed.	F11-1 FRACTURE ENERGY EVALUATION OF A DENTAL COMPOSITE K Arakawa, T Mada(Kyushu Univ.) Single-edge-cracked specimens were fabricated by packing dental composite between two rectangular plates of PMMA. To study the dynamic effect of fracture and the nonelastic effect of the material, the specimens were pin-loaded with a special jig so that they could split and fly apart in the loading direction after fracture.	F12-1 DESIGN, FABRICATION AND MECHANICAL PROPERTIES OF IN SITU SYNTHESIZED TITANIUM MATRIX COMPOSITES Wu Lu, XL Guo, D Zhang, JN Qing(Shanghai Jiaotong Univ.) Titanium matrix composites are in situ synthesized by common casting and hot working technology. TiB, TiC and rare earth oxides are chosen to strengthen titanium matrix composites. The orientation relationships between reinforcements and matrix are examined. Microstructures and mechanical properties of the TMCs are studied.
09:35	F7-2 INFLUENCE OF MATERIAL NONLINEARITY ON THE THERMOMECHANICAL RESPONSE OF FOAM CORED SANDWICH STRUCTURES? FE MODELLING AND PRELIMINARY EXPERIMENTAL RESULTS HNK Pallek, OT Thomsen(Aalborg Univ.), RK Fruehmann, JM Dullemeier(Univ. of Southampton) This paper deals with comparison of FE modelling and experiments where interaction between mechanical and thermal loads may lead to an unsafe response with loss of stability and structural integrity, especially for polymer foam cored sandwich structures whose mechanical properties reduce as the temperature raises within the operational range.	F8-2 FATIGUE AND FRACTURE BEHAVIOUR OF AL-SIC MMC NDE BY IR DETECTION DP Myrrouis, ST Hasan(Sheffield Hallam Univ.) In this study the fatigue and fracture toughness behaviour of Aluminium reinforced with SiC particles is examined. The Al/SiC composites were subjected to heat treatments. The microstructure is tailored by introducing strengthening mechanisms such as precipitates. Infrared thermography (IR) was used to monitor the fatigue crack growth and the fracture behaviour.	F9-2 PARAMETER STUDY OF SHORT CARBON FIBER REINFORCED CARBON D Heim, S Zaremba, K Drechsler(Technical Univ. of Munich), C Klotz(SGL CARBON GmbH) In this work the impact of several material parameters (e.g. fiber length, fiber surface) of short carbon fiber reinforced carbon on the flexural strength and Young's modulus are studied via four point bending tests. Furthermore, the values of greenbody state and final carbon-carbon state are correlated.	F10-2 ON THE ROLE OF MATRIX NONLINEARITY IN MECHANICAL MODELING OF LONG-FIBER REINFORCED COMPOSITES M Hirsekorn, G Grail(ONERA) The cure cycle of a thermosetting matrix strongly influences its mechanical properties, in particular nonlinear effects. While macro-scale specimens usually exhibit elastic brittle behavior, at the micro-scale considerable plastic deformation occurs before failure under compression and shear. In this contribution, we analyze the influence of matrix nonlinearity on macro-scale failure.	F11-2 LIGHT INTENSITY EFFECT ON POLYMERIZATION SHRINKAGE OF A DENTAL COMPOSITE S Setoima, T Watanuki, K Arakawa(Kyushu Univ.), M Uchino (Fukuoka Prefecture) Dental composites, light-cured composite resins, are widely used in dental restoration because of their ease in handling, esthetic appearance, and minimal invasion of healthy tooth tissue. The wide use of composite resin has been prompted by the introduction of new resin products with good physical and mechanical properties, and new...	F12-2 THE EFFECT OF ZINC ON THE MORPHOLOGY AND WEAR RESISTANCE OF MG/SI-REINFORCED MAGNESIUM MATRIX COMPOSITES N Maleki, M Meratban, M Panjeour, A Forozmehr(Islamic Univ. of Technology) The modification effect of zinc on microstructure and wear resistance were investigated. Using a simple cast route, Mg composite reinforced Mg/Si particles was prepared. The results reveal that by addition of 0.1 wt. % Zn the morphology changes to polyhedral shapes. The wear test disclosed that modified morphology enhanced wear property of the composite.
09:55	F7-3 APPLICATION OF SANDWICH STRUCTURES TO AUTOMOTIVE RIMS A Romeo, DP Boso, U Galvanetto(Univ. of Padua) In spite of their high specific stiffness, fiber-reinforced plastics (FRP) are not widely used in automotive wheel design due to high costs. In this paper we analyze the possibility of increasing the stiffness of a car wheel by means of a sandwich structure, possibly coupled with FRP.	F8-3 ULTRASONICS INSPECTIONS AND CONFOCAL MICROSCOPY TO EVALUATE FATIGUE DAMAGE IN FIBER REINFORCED POLYMER COMPOSITES YG Garcia, J Sala, L Crispi, JM Cabrerá(Fundacio CTM Centre Tecnològic), A Isturiz, A Saez, M Millan, C Comes(Mapros Sistemas de Ensayo S.A.), D Trias(Univ. of Girona) Rectangular bars of plain weave glass fiber/phenolic resin composite and bars of a specific sequence of carbon fiber/epoxy resin composite were subjected to four-point bending fatigue tests until reaching 20,000 cycles, but stopping every 2,000 for ultrasound inspection. Under certain conditions a confocal microscope proved useful to evaluate surface damage.	F9-3 MANUFACTURE AND OXIDATION BEHAVIOR OF C/SIC COMPOSITES MODIFIED WITH B-RICH SiBC COATING XZ Zuo, LT Zhang, YS Liu, LF Cheng(Northwestern Polytechnical Univ.) 2D C/SiC composite was modified with self-healing B-rich SiBC coating by CVD. Results of oxidation in static air at 700°C, 1000°C and 1200°C, show that borosilicate glass produced easier by oxidation B-rich SiBC coating above 1000°C, can seal the cracks and protect C/SiC composites at 1000°C effectively.	F10-3 DETERMINATION OF THE SIZE OF REPRESENTATIVE VOLUME ELEMENTS FOR DISCONTINUOUS FIBRE COMPOSITES C Olan, L Harper, T Turner, SG Li, N Warrior(The Univ. of Nottingham) A method is presented for generating planar distributions of random discontinuous carbon fibre bundles. An embedded element approach is used to simplify mesh generation for the matrix phase. Periodic boundary conditions are adopted, applying St Venant's principle to provide an approximation of the effective material properties within an inner RVE region.	F11-3 STATISTICAL ANALYSIS OF ACOUSTIC EMISSIONS DURING SHRINKAGE OF RESTORATION IN DENTAL SUBSTRATE JJJ Gu, NS Choi(Hanyang Univ.) Acoustic emission (AE) signals are detected during the polymerization shrinkage of composite resin restoration in artificial dental ring according to various interfacial treatment conditions. AE amplitudes and the number of AE hit events were compared through the non-parametric statistics of Mann-Whitney method and Kruskal-Wallis method.	F12-3 FABRICATION PROCESS AND MICROSTRUCTURE OF VGCNFS/AL COMPOSITES BY SPARK SINTERING G Sasaki, ZF Xu, YB Choi, K Matsugi(Hiroshima Univ.) The spark sintering process was used to fabricate VGCNFS/Al composites in order to control the dispersion of reinforcements in matrix because of no segregation of component during PM process.
10:15	F7-4 DEBOND DAMAGE ASSESSMENT IN FOAM / COMPOSITE SANDWICH STRUCTURES RK Fruehmann, JM Dullemeier, W Wang(Univ. of Southampton) Thermoelastic stress analysis (TSA) is used to study the stress field in the face sheet of a composite sandwich structure with seeded damage in the form of a debond between the face sheet and the core.	F8-4 ELECTROMAGNETIC SHIELDING PROPERTY OF CFRP COMPOSITE LAMINATES QQ Liu, M Inoue, L Zhang(Shinshu Univ.) The EMI property of CFRP laminates is measured and an obvious carbon fiber direction dependency is found. A new NDE technology based on the EMI SE measurement was proposed to evaluate the SE anisotropic characteristics in CFRP composites.	F9-4 ULTRASOUND ASSISTED ANODIC OXIDATION TREATMENT OF CARBON/CARBON COMPOSITES AND DEPOSITION OF STRONG BONDING CALCIUM PHOSPHATE COATINGS ON THE TREATED SUBSTRATE XN Zhao, HJ Li, MD Chen, KZ Li, B Wang, ZW Xu, S Cao, JH Lu, LL Zhang(Northwestern Polytechnical Univ.) High content of O-containing and some amount of P-containing groups were grafted onto C/C by USAT. Surface energy of USAT-C/C-50 (93.31 mJ/m ²) was much higher than that of UT-C/C (10.43 mJ/m ²). Shear strength of CaP coatings on USAT-C/C-50 was about two times of that of coatings on UT-C/C...	F10-4 MACRO-SCALE MODELLING OF DISCONTINUOUS FIBRE COMPOSITES R Luchko, LT Harper, M Bond, N Warrior(The Univ. of Nottingham), A Dodworth(Bentley Motors Ltd) A numerical model has been developed, offering the ability to produce representative meso-scale discontinuous fibre architectures for downstream modelling of mechanical results. A variety of numerical algorithms have been integrated to provide a globally optimised distribution of non-interacting fibers, randomly distributed and smoothly interpolated in 3D space.	F11-4 EFFECT OF LAYERING METHODS, COMPOSITE TYPE, AND FLOWABLE LINER ON THE POLYMERIZATION SHRINKAGE STRESS OF LIGHT CURED DENTAL COMPOSITES YC Kwon, JB Lee(Seoul National Univ.) The aim of this study was to determine the effect of composite layering, flowable composite lining and use of low shrinking silorane-based composites on the polymerization shrinkage stress of light cured dental composites.	F12-4 EFFECT OF CU/MG RATIO ON MECHANICAL PROPERTIES AND FRACTURE BEHAVIOR OF SiCp/AL-CU-MG COMPOSITES Q Zhang, QZ Wang, BL Xiao, ZY Ma(Chinese Academy of Sciences) 20wt.%SiCp/Al-Cu-Mg composites were fabricated with different Cu/Mg ratios. Yield strength (YS) of the T6 samples were enhanced by increasing the Cu/Mg ratio, however, this was not the case for the T4 samples. The ultimate tensile strength (UTS) of both T4 and T6 samples were independent of the Cu/Mg ratio.
10:35	F7-5 NUMERICAL MODELING OF LOW VELOCITY IMPACT RESPONSE ON METAL FOAM CORED SANDWICH PANELS: EFFECT OF VARIOUS FACESHEET MATERIALS R Anantharaju, S Rajendran, I Sridhar(Nanyang Technological Univ.) In this paper the impact responses of aluminum foams with face sheets, whose behavior represent purely elastic (CFRP), elastic-perfectly plastic (aluminum alloy 1100) and elastic-plastic strain hardening (stainless steel 314), were investigated experimentally. The tests were carried out using hemispherical indenters made of stiff tool steel on the blocks of...	F8-5 IMAGING IMPACT DAMAGE IN HIGH ASPECT RATIO COMPOSITE PLATES J Rouse, R Bradley, PJ Withers(Univ. of Manchester) Three-dimensional X-Ray computed tomography (CT) is an excellent method for investigating the internal damage in engineering components. The method provides a non-destructive way to visualise and quantify damage areas, such as delaminations in fibre reinforced composite plates [1][2]. The types of failure, and residual properties due to impact events have...	F9-5 ACCURATE QUANTITATIVE EVALUATION OF OXIDATION RATE OF SiC UNDER ELEVATED TEMPERATURES Y Kubota(Graduate Univ. for Advanced Studies), T Yoshinaka, H Hattai(Japan Aerospace Exploration Agency), Y Kogo(Tokyo Univ. of Science), T Goto, T Rong(Tohoku Univ.) It was found that even if the input partial pressure of oxygen to apparatus is the same, the oxygen partial pressure on the SiC surface varies widely. Therefore, active oxidation rates and the transition conditions of active-to-passive oxidation should be evaluated by the oxygen partial pressure on the SiC surface.	F10-5 MULTI-SCALE SIMULATIONS OF FLUID/SOLID HYBRID COMPOSITE SYSTEMS K Johnston(Max Planck Inst. for Polymer Research), VA Harmandaris(Univ. of Crete) Hybrid fluid/solid materials are encountered in many technologies involving adhesives, coatings, lubricants, and composite materials. In such systems the interaction between the adsorbed molecules and the solid surfaces control the overall performance of the multiphase. Here we present a hierarchical multi-scale approach in order to study complex multi-phase materials.		F12-5 FABRICATION OF CNTS/AL COMPOSITE WITH ENHANCED DISPERSION PRE-TREATMENT ZY Liu, BL Xiao, ZY Ma(Chinese Academy of Sciences) An enhanced pre-treatment combined with Sodium dodecyl benzene sulfonate (SDBS) treatment and Natural rubber (NR) treatment was used to disperse CNTs. The 0.5 wt.% pre-treated CNTs reinforced 2009Al was fabricated in powder metallurgy route. The strength was enhanced about 20%, which implied good load transfer efficiency of the CNTs.
10:55	F7-6 ON EFFECTIVE THERMAL CONDUCTIVITY OF SUPERALLOY HONEYCOMB CORE IN SANDWICH STRUCTURES J Zhao, Z Xie, LI, W, L, J Tian(Northwestern Polytechnical Univ.) In this paper, experimental and numerical studies were both conducted to obtain the effective thermal conductivities of super alloy honeycomb cores. Comparison between the results from experiment and numerical model shows good conformity. Based on the semi-empirical model, parametric studies were also conducted.	F8-6 LONG DISTANCE LASER ULTRASONIC PROPAGATION IMAGING SYSTEM WITH DAMAGE VISUALIZATION TECHNIQUES D Dhital, JR Lee, HJ Shin(Chonbuk National Univ.) This study proposes a portable long distance laser ultrasonic propagation imaging (LUPI) system with associated damage visualization algorithms based on anomalous wave propagation imaging (AWPI) methods with adjacent wave subtraction, reference wave subtraction, reference image subtraction, and the variable time window amplitude mapping (VTWAM) for a robust SHM solution.	F9-6 A STUDY ON THE CHANGE BETWEEN TENSILE LOADING AND NATURAL FREQUENCY OF CARBON-CARBON COMPOSITE MATERIALS B Soru, HG Kim, LK Kwac, SG Oh, TH Kim, HJ Shin(Jeonju Univ.) In this study, an accelerometer is applied for evaluating the vibration modes of carbon-carbon composite under various tensile loadings by using a tensile testing machine. Its natural frequency is accurately measured after applying various tensile loadings on material to observe the strength of the carbon-carbon composite material.	F10-6 COUPLED ANALYSIS OF THIN-WALLED COMPOSITE BEAMS BASED ON MULTISCALE ASYMPTOTIC FOUNDATION JS Kim(Kumoh National Inst. of Technology), HS Kim(Dongguk Univ.) The objective of this paper is to present the procedure how to construct the Timoshenko-Vlasov-like model via the mixed variational theorem. The independent strain field is obtained from the asymptotic expansion method, whereas the displacement field is built upon the engineering beam theory.	F12-6 FABRICATION AND WELDING OF ALUMINUM MATRIX COMPOSITE REINFORCED WITH WC AND B4C PARTICLES YZ Li, QZ Wang, BL Xiao, ZY Ma(Chinese Academy of Sciences) High content of B4C and WC hybrid reinforced Al matrix composite plate with combined shielding of neutron and gamma radiation was fabricated using powder metallurgy (PM) method. The composite exhibited good hot workability for being forged and rolled. In addition, the composite was successfully friction stir welded (FSW).	
11:15						

Break

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11:30	<p>F13 OTHERS Chair : J Renart</p> <p>F13-1 DETAILED INVESTIGATION OF BONDED JOINTS FOR COMPOSITE REPAIRS J Costa, J Renart, Y Batista(Univ. of Girona), S Mahdi(AIRBUS France), A Rodriguez-bellido(AIRBUS Espana) This work presents an investigation on the fracture toughness and fractography of bonded joints for composite repairs (DCB specimens), trying to identify the failure modes. The adhesive films produce tougher joints than laminating resins and that the failure modes and bond strength are different in both interfaces.</p>	<p>F14 MODELING AND SIMULATION OF COMPOSITES MANUFACTURING PROCESSES Chair : F Chinesta/ P Boisse</p> <p>F14-1 HYPERELASTIC APPROACH FOR THE SIMULATION OF WOVEN REINFORCEMENTS AT MESOSCALE A Charmetant, E Vidal-salle, P Boisse(Univ. de Lyon) A hyperelastic constitutive law is proposed to model the mechanical behaviour of glass-fabric yarns in dry fabric-reinforced composites. Four deformation modes of the yarn are highlighted which allows a physically motivated description of its behaviour. Simulations of the fabric unit cell are performed at mesoscale and compared to experimental results.</p>	<p>F15 INVESTIGATION ON ADVANCED REINFORCEMENT FIBRES AND MATRICE Chair : E Mäder</p> <p>F15-1 FIBRE REINFORCED CONCRETE: PULL-OUT TESTS UNDER QUASI-STATIC AND HIGH-SPEED LOADING C Schreffler, E Mäder(Leibniz Inst. of Polymer Research Dresden) Many concrete structures are subjected to high-speed loads. The highest fracture energies at high strain rates are expected for multi-scale plastic deformation of the specimen before ultimate failure. In this work the mechanism of the interphase failure at different strain rates is evaluated by dynamic single fibre pull-out tests.</p>	<p>F16 MULTI-SCALE MODELING/MULTISCALE MODELING OF COMPOSITES Chair : SH Yang/ O Ochoa</p> <p>F16-1 EFFECTIVE PROPERTIES OF CNT/POLYMER COMPOSITES USING A MODIFIED MSM METHOD COMBINED WITH A COHESIVE LAW FOR INTERFACES X Liu, Y Qingsheng(Beijing Univ. of Technology), H Xiaoqiao(Univ. of Hong Kong) Effective nonlinear stress-strain relations of the CNT/polymer composites are derived by combining the continuum model to a modified molecular structure mechanics. The present method are useful to study the effect of van der Waals interactions in the interfaces between CNTs and polymer on the effective properties of the CNT/polymer composites.</p>	<p>F17 FATIGUE AND LIFE PREDICTION OF COMPOSITES Chair : M Kawai/ T Aoki</p> <p>F17-1 FATIGUE DAMAGE ASSESSMENT OF UD CFRP COMPOSITE LAMINATES UNDER SPECTRUM LOADING USING ACOUSTIC EMISSION M Bourchak(King Abdulaziz Univ.) I.r. Farrow(Univ. of Bristol) Notched UD CFRP laminates were subjected to tension-tension fatigue loading under variable amplitude loading (VAL). Acoustic Emission was used to detect damage under each block. Results indicated mainly linear accumulation of damage but only when the peak stress is less than 50% UTS where mainly matrix damage dominates.</p>	<p>F18 KASSAT (KOREAN AERO-VEHICLE SMART SKIN ANTENNA TECHNOLOGY) & FMAV (FLAPPING MICRO AIR VEHICLE) Chair : SM Jun/ CH Yoon</p> <p>F18-1 AUTONOMOUS FLIGHT TEST OF FLAPPING MICRO AIR VEHICLE J.S Hong, CY Park(Agency for Defense Development), SJ Kim, IH Paik(Hanwha Coporation R&D Center) In this paper, autonomous flight test is described. Because the light weight FMAV platform is required an embedded system to implement the closed-loop control method, tiny flight control computer is introduced. As a result, the altitude can be kept within desirable range by the fully autonomous flight.</p>
11:50	<p>F13-2 MILLING OF CARBON FIBER-REINFORCED PLASTICS: ANALYSIS OF CUTTING FORCES AND SURFACE ROUGHNESS L Sorrentino, S Turchetta(Univ. of Cassino) The ability to predict the cutting forces is essential for selecting process parameters that would result in minimum machining damage. The aim of this work has been to investigate the relationship among the cutting force and surface roughness with the relevant cutting parameters.</p>	<p>F14-2 COMPOSITE REINFORCEMENT FORMING SIMULATION: CONTINUOUS AND MESOSCOPIC APPROACHES P Boisse, N Hamila, P Wang, S Gatouillat, S Bel, A Charmetant (INSA Lyon) Continuous and discrete approaches are possible for the forming simulations of composite textile reinforcements because of their multi-scale structure. In this paper a hyper-elastic continuous modelling, a mesoscopic approach and the semi-discrete approach are presented. The advantages and drawbacks of the different approaches are discussed.</p>	<p>F15-2 BIODEGRADABLE CONTINUOUS FIBRE REINFORCED COMPOSITES BASED ON HYBRID YARNS T Lehtonen, J Tuominen(Vivoxid Ltd.), J Rausch, E Mäder(Leibniz Institut für Polymerforschung Dresden eV) The successful spinning of bioglass/PLA hybrid yarns and the high mechanical properties of the thereof prepared unidirectional composites demonstrate the potential of this technology. The use of different sizing systems shows significantly improved adhesion strength of the glass fibre/PLA-systems being evidenced by both micromechanical adhesion characterization and mechanical testing...</p>	<p>F16-2 COMPRESSION AND FLOWBACK IN POLYDISPERSE COMPOSITE GRANULAR PACKS M Kulkarni, OO Ochoa(Texas A&M Univ.) Composite proppant pack is analyzed under confined compression and flowback load conditions using explicit dynamic finite element method. Polydisperse particle mixture with 15% soft walnut and 85% ceramic particles is studied under confined compression. The influence of friction, pack composition and compressive load is studied from the flowback models.</p>	<p>F17-2 FATIGUE LIFE ASSESSMENT FOR COMPOSITE MATERIALS YG Nikishkov, A Makeev(Georgia Inst. of Technology) Recent advances in the technologies which enable accurate assessment of useful life for composite aircraft fatigue-critical components are presented: (1) Nondestructive subsurface measurement shift to accurate three-dimensional measurement of material structure; (2) Material characterization to generate material allowables at minimum time/cost; (3) Fatigue structural analysis captures multiple damage modes/interaction.</p>	<p>F18-2 DEVELOPMENT OF 50CM FLAPPING MICRO AIR VEHICLE AND AUTONOMOUS FLIGHT SYSTEM IH Paik, DK Chung, GS Seo, YH Kim(Hanwha Coporation R&D Center) 50cm flapping micro air vehicle and autonomous flight control system were developed. Wing structure and flapping motion mechanism were designed. Flight performance was measured at AFRL's indoor flight facility. And CFD aerodynamic analysis was tried for an aerodynamic simulation. Regarding autonomous flight system, FCS, GDT and GCSW were developed.</p>
12:10	<p>F13-3 TEMPERATURE COMPENSATED FBG STRAIN SENSORS FOR MONITORING OF WIND TURBINE BLADE KS Choi, GJ Kim, CY Kim, IB Kwon, DJ Yoon(Korea Research Inst. of Standards and Science) Big wind turbine blades may experience harsh environment as gust wind, bird strike, and lightning etc that make some damages on the blades. Therefore, a temperature compensated FBG sensor is developed and applied to monitor the blade.</p>	<p>F14-3 PARAMETRIC MODELING OF COMPOSITE LAMINATES C Ghnatios, A Laygue, F Chinesta, A Poitou(Ecole Centrale de Nantes) Many models in polymer processing and composites manufacturing are defined in degenerated three-dimensional domains. In this work we propose the application of the model reduction method known as Proper Generalized Decomposition - PGD- to simulate 3D thermal models defined in plate laminates.</p>	<p>F15-3 PERFORMANCE OF MODIFIED BASALT FIBRES T Foerster, E Maeder(Leibniz Inst. of Polymer Research Dresden) In this work the influence of chemical composition of basalt fibre properties like mechanical performance and alkali resistance was investigated. Therefore, model basalt fibres were manufactured and evaluated by single fibre tensile tests and ageing tests in strong alkaline media. The tensile test results were evaluated by Weibull probability analysis.</p>		<p>F17-3 DURABILITY OF TRI-AXIALLY WOVEN FABRIC COMPOSITES FOR SPACE APPLICATIONS T Aoki, Y Kosugi(Univ. of Tokyo), A Watanabe(Sakase Adtech Co. Ltd.), T Murakami(Industrial Technology Center of Fukui Prefecture) Fatigue behavior of TWF composite and its damage accumulation mechanism is experimentally investigated. Two types of TWF composites with different filament thickness are employed. S-N curves for these composites are constructed and the ratcheting behavior under cyclic loading is studied. Tow debonding is also observed using X-ray CT scan.</p>	
12:30	Lunch					

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11:30	<p>F19 SANDWICH MATERIALS AND STRUCTURES Chair : OT Thomsen/ K Yoshida</p>	<p>F20 ENERGY TECHNOLOGY APPLICATIONS Chair : D Tai/ KW Kang</p>		<p>F21 MULTI-SCALE MODELING Chair : C Lee/ J Thomas</p>		<p>F22 METAL MATRIX COMPOSITES Chair : S Mileiko</p>
	<p>F19-1 STUDY ON THE OUT-OF-PLANE SHEAR PROPERTIES OF SUPERALLOY HONEYCOMB CORES ZH Xie, W Li, JA Zhao, JA Tian(Northwestern Polytechnical Univ.) The out-of-plane shear moduli and elastic buckling strengths of metal honeycomb cores was analyzed, and these properties of superalloy honeycomb cores were obtained from shear tests. By carefully study the failure pattern of cell walls of honeycomb cores, a yield stress model was proposed to predict the out-of-plane shear strengths.</p>	<p>F20-1 ESTIMATION OF RESIDUAL STRENGTH DISTRIBUTION OF COMPOSITE STRUCTURE WITH IMPACT-INDUCED DAMAGE KW Kang(Kunsan National Univ.) An approach was developed to predict the statistical distribution of residual strength of composites with impact damage. The model was formulated as a function of the Weibull parameters for original strength and residual strength of impacted structures. The model was verified by using an experimental test program for sandwich structure.</p>		<p>F21-1 HOMOGENIZATION AND DE-HOMOGENIZATION OF FIBER REINFORCED COMPOSITE LAMINA AJ Ritchey, RB Pipes(Purdue Univ.) The goal of the current work is to determine the validity of the micromechanical enhancement method in composite laminates containing large gradients of strain, such as those developed at the free-edge of dissimilar lamina. This is achieved through the addition of bending curvatures and is applied to a Pagano-Rybicki problem.</p>		<p>F22-1 STUDY ON IN SITU REACTION-PROCESSED AL(ZN,CU)-AL₂O₃(ZNO,CUO) PARTICULATE COMPOSITES M Sanavej, M Meratian(Isfahan Univ. of Technology) In this study, In-situ particle-reinforced aluminum based cast composites have been synthesized by dispersion of externally added Zinc Oxide particles into molten aluminum at different processing temperatures.X-ray diffraction and scanning electron microscopy have been used to study the various reaction mechanisms and transformations.</p>
11:50	<p>F19-2 A STUDY ON DESIGN PROCEDURE OF FOAM CORE SANDWICH PANEL JOINT BASED ON FRACTURE MECHANICS K Yoshida, Y Hirose, Y Mori(Kanazawa Inst. of Technology) In the application of co-cured CFRP face/ foam core sandwich panels to aircraft structure, a panel joint is an inevitable structural element. In this study, how to design a butt type joint between two sandwich panels is discussed through the numerical investigations based on fracture mechanics.</p>	<p>F20-2 THE PROSPECT OF ALTERNATIVE ENERGY RESOURCE BY SUPPORTED ELECTRICAL SYSTEM BASED ON MICROBIAL FUEL CELL TECHNOLOGY OF SMALL INDUSTRIES IN INDONESIA PC Mawarda, MIA Mutajin, S Sari, R Triana(Bogor Agricultural Univ.) Indonesia has small industries which 80% of them have not applied waste treatment. It could be solved by MFC technology which will produced electrical energy that provided by catching ion H⁺ from microbe. The result showed 150 mV liquid waste from shrimp paste can produced 1 A electrical energy.</p>		<p>F21-2 CHARACTERIZING LOAD TRANSFER EFFICIENCY IN CARBON NANOTUBES NANOCOMPOSITES USING MULTISCALE SIMULATION TC Lu, JL Tsai(National Chiao Tung Univ.) The atomistic interaction of adjacent graphite layers in DWCNTs was characterized using MD simulation. It was found that the load transfer efficiency increases with the increment of CNTs length. In addition, the DWCNTs with covalent bonds exhibit superior load transfer efficiency than those with only vdW interactions.</p>		<p>F22-2 EVALUATION OF PARTICLE SPATIAL DISTRIBUTION IN PARTICLE DISPERSED COMPOSITES K Sugio, G Sasaki, O Yanagisawa(Hiroshima Univ.) We have suggested the quantitative method to evaluate the spatial distribution of second phase particles using the relative frequency distributions of 3-dimensional local number, LN3D, and 2-dimensional local number, LN2D. In the present work, we applied this method to second phase particles in Al-SiC composites.</p>
12:10						<p>F22-3 TRIBOLOGICAL BEHAVIOR OF DIAMOND-REINFORCED FE-CO COMPOSITE BY TAGUCHI METHOD KE Oksuz, M Simsir(Cumburiyet Univ. in Sivas), Y Sahin(Gazi Univ in Ankara) Tribological behavior of Diamond-reinforced Fe-Co composites was studied. SN ratio and ANOVA were employed to investigate the influence of parameters like, abrasive size, load, distance and hardness. The load factor was the major parameter, followed by abrasive size. The percent contributions are abrasive size (32.17 %), hardness (11.30 %).</p>
12:30	Lunch					

	Halla A	Halla B	Samda A	Samda B	201A	202A
14 : 15	<p>F23 PROCESSING, PROPERTY AND ANALYSIS OF CARBON NANOTUBE/POLYMER COMPOSITES Chair : Y Shimamura/ N Hu</p> <p>F23-1 TENSILE PROPERTIES OF CARBON NANOTUBES GRAFTED HIGH STRENGTH PAN-BASED CARBON FIBERS K Naito(National Inst. for Materials Science), JM Yang(Univ. of California), Y Inoue, H Fukuda(Tokyo Univ. of Science), Y Kagawa(The Univ. of Tokyo) The tensile strength and Weibull modulus of carbon nanotubes (CNTs) grown on high tensile strength PAN-based carbon fibers at gauge length of 1~25 mm have been investigated. The results clearly show that the grafting of CNTs improves the average tensile strength and the Weibull modulus at longer gauge length.</p>	<p>F24 MODELING AND SIMULATION OF COMPOSITES MANUFACTURING PROCESSES Chair : F Chinesta/ WR Hwang</p> <p>F24-1 SIMULTANEOUS IDENTIFICATION OF PREFORM PERMEABILITY AND COMPRESSIBILITY T Ouahbi, CH Park, J Breard(Univ. of Le Havre), P Ouagne(Polytech' Orens) The identification of the transverse properties of fabrics is becoming an important topic, as the transverse flow is significant in advanced liquid composite moulding processes such as resin film infusion (RFI), vacuum assisted resin transfer moulding (VARTM) process and compression resin transfer moulding (CRTM) process.</p>	<p>F25 SIMULATION-BASED DESIGN AND OPTIMIZATION Chair : WJ Song/ N Hamila</p> <p>F25-1 SIMULATION OF TEXTILE COMPOSITE REINFORCEMENT USING ROTATION FREE SHELL FINITE ELEMENT P Wang, N Hamila, P Boisse(Univ. de Lyon) Numerical optimization of products and production processes becomes increasingly important in the design phase of composite structures. Numerical simulations of the composite forming processes are an essential part of these optimization tools. They permit to determine the conditions of the feasibility of a process without defect (wrinkling, fracture of yarns...)</p>	<p>F26 CARBON NANOFIBERS Chair : WR Yu/ T Webster</p> <p>F26-1 CONDUCTIVITY AND CARDIOMYOCYTE COMPATIBILITY OF POLY LACTIC-CO-GLYCOLIC ACID CARBON NANOFIBER COMPOSITES DA Stout, J Yoo, TJ Webster(Brown Univ.) In recent years, various techniques have been developed to promote cardiomyocyte cell growth around dead tissue due to a myocardial infarction. This study created carbon nanotube materials which can regenerate damaged heart tissue to more effectively return natural function to the heart. Carbon nanotube injectable and patch materials were created.</p>	<p>F27 FATIGUE AND LIFE PREDICTION OF COMPOSITES Chair : M Kawai/ M Quaresimin</p> <p>F27-1 FATIGUE BEHAVIOUR OF CARBON FIBRE/ EPOXY COMPOSITE MANUFACTURED BY VACUUM ASSISTED COMPRESSION RESIN TRANSFER MOULDING L Aretxabalaeta, J Aurrekoetxea, M Iragi, G Aretxaga, M Sarrionandia(Mondragon Unibertsitatea), S Lomov(K.U. Leuven) Carbon fibre reinforced epoxy composites were successfully manufactured by a new vacuum assisted compression resin transfer moulding process (VACRTM). Fatigue tests and repeated impact tests were performed to characterise the fatigue behaviour and residual properties of the composite plates.</p>	<p>F28 RECYCLING Chair : S Thumsorn/ ML Dinis</p> <p>F28-1 DEVELOPMENT OF BLENDING SEQUENCE ON CaCO₃ REINFORCED RECYCLED PET/RECYCLED PP BLEND S Thumsorn(Rajamangala University of Technology), K Yamada, H Hamada(Kyoto Inst. of Technology), YW Leong(Inst. of Materials Research and Engineering) This research studies the effect of blending sequence on properties of recycled PET and recycled PP blend filled with CaCO₃, which was prepared by extrusion process. The results show that blending sequence influence on final morphology of the blends, which effect on impact properties and thermal stability of the blends.</p>
14 : 35	<p>F23-2 INVESTIGATION ON INTERFACIAL PROPERTIES OF CNT/ALUMINA NANOCOMPOSITES USING PULL-OUT SIMULATION BASED ON MOLECULAR MECHANICS S Liu, N Hu(Chiba Univ.) The pull-out of a carbon nanotube (CNT) from an alumina matrix was investigated using molecular mechanics simulations to study the interfacial properties. The pull-out force of the CNT was found to be proportional to its diameter, but independent of its length. A theory was proposed to predict the pull-out force.</p>	<p>F24-2 BUBBLE SHAPE AND TRANSPORT DURING LCM PROCESSES: EXPERIMENTAL MODELING IN A T-JUNCTION TUBE MAB Abdelwahed, Y Wielhorski, L Bizet, J Breard(Univ. du Havre) During Liquid Composite Molding (LCM), voids were created because of an advance delay effect of the liquid flowing between the fibers and the tows. The present work is an attempt to study bubbles formation and transport through a cylindrical T-junction device modeling two convergent pores.</p>	<p>F25-2 NUMERICAL SIMULATION OF THERMAL EXPANSION PROCESS FOR THERMOSET COMPOSITE LAMINATES USING SILICONE RUBBER TOOLS J Sun, YX Li, YZ Gu, M Li, ZG Zhang(Beihang Univ.) A two-dimensional finite element model was developed to simulate the thermal expansion process for thermoset composite materials using silicone rubber tools. Simulations and experiments were both performed for the process. The results are valuable for optimizing the thermal expansion molding and can guide the design of silicone rubber tools.</p>	<p>F26-2 MECHANICAL AND STRUCTURAL CHARACTERIZATIONS OF PAN-DERIVED HOLLOW CARBON NANOFIBERS BS Lee, KM Park, KH Oh, WR Yu(Seoul National Univ.), IS Choi(Korea Inst. of Science and Technology) This study was aimed to measure the tensile strength and elastic modulus of hollow CNFs, which have been manufactured using co-axial electrospinning, and to investigate the effect of turbostratic carbon structure in HCNFs on their strength according to the manufacturing conditions.</p>	<p>F27-2 MONITORING OF FATIGUE CRACK PROPAGATION OF ENGINEERING STRUCTURES USING TIME REVERSAL METHOD MY Lu, LM Zhou, ZQg Su, L Cheng(The Hong Kong Polytechnic Univ.), Lin Ye, D Wang(The Univ. of Sydney) In this study, a technology based on ultrasonic guided waves for monitoring fatigue crack in metallic structures is demonstrated in which two different sensor networks including eight and six piezoceramic (PZT) transducers are employed respectively for exciting and acquiring guided wave signals.</p>	<p>F28-2 ESTABLISHMENT OF CFRP RECYCLING METHOD PROCESSABLE UNDER ATMOSPHERIC PRESSURE M Sakuma, M Koyama, H Fukuda(Tokyo Univ. of Science) Various methods for recycling of thermoset composites were studied but these methods have a shortcoming that the fiber length becomes short by the crush processing. In this study, a trial of collecting continuous fibers from used CFRPs is carried out where depolymerization of thermoset matrix is conducted under atmospheric pressure.</p>
14 : 55	<p>F23-3 MECHANICAL PROPERTIES OF UNIDIRECTIONAL MWNT SHEET/EPOXY COMPOSITES N Morisawa, Y Shimamura, K Tohgo, T Fujii, Y Inoue(Shizuoka Univ.) Carbon nanotubes are expected to exceed the mechanical properties of carbon fibers. Recently, unidirectional MWNT sheets have been developed. In this study, thermoset composites are made by using the unidirectional MWNT sheets, and then tensile tests were conducted to investigate the mechanical properties.</p>	<p>F24-3 ORIENTATION PREDICTION OF CARBON NANOTUBES IN DUAL-SCALE POROUS MEDIA DURING RESIN INFUSION WR Hwang(Gyeongsang National Univ.), SG Advani(Univ. of Delaware) In this work, we introduce a simple constitutive model for the stress and orientation prediction of the carbon nanotube (CNT) suspensions and apply it to predict the orientation prediction of such a suspension during the resin infusion process (with either RTM or VARTM) through dual-scale porous media.</p>	<p>F25-3 FINITE ELEMENT MODELLING OF CFRP PLATES UNDER CRUSHING HA Israr, Samuel Rivalent(Universite de Toulouse) This paper presents a numerical modelling of CFRP laminate plates under crushing. The model is based on a mesoscale model of the composite, to represent phenomenon at a scale which enables prediction of the damages in a crushing loading.</p>	<p>F26-3 FABRICATION AND MECHANICAL PROPERTIES OF CARBON NANOTUBE FIBER NANOCOMPOSITE SW Ryu, JW Hwang, SH Hong(Korea Advanced Inst. of Science and Technology) A simple combustion method was used to prepared Li[Co_{0.1}Ni_{0.25}Li_{0.2}Mn_{0.35}]O₂ and Li[Co_{0.1}Ni_{0.15}Li_{0.2}Mn_{0.35}]S_{0.189}O_{2.97}. Surface coating was carried out using the sol-gel method with Li[Co_{0.1}Ni_{0.15}Li_{0.2}Mn_{0.35}]O₂, Li[Co_{0.1}Ni_{0.15}Li_{0.2}Mn_{0.35}]S_{0.189}O_{2.97} and LiNiPO₄. The rate capability and cycle performance of the Li[Co_{0.1}Ni_{0.15}Li_{0.2}Mn_{0.35}]O₂ were enhanced.</p>	<p>F27-3 INVESTIGATION OF THE FATIGUE FAILURE MECHANISMS FOR STITCHED AND UNSTITCHED UNIDIRECTIONAL COMPOSITES C Zhang, M Jarnshidi, S Barnes, J Rouse, R Bradley, P Withers, P Hogg(Univ. of Manchester), S Cauchi-savona(Univ. of London) The purpose of this study is to investigate the failure mechanisms of composite materials with through-thickness stitches. According to the observations of DIC and thermography, although stitching area looks more likely to fail under fatigue load, but the results of x-ray tomography indicate Kevlar stitches do not generate delaminations.</p>	<p>F28-3 MEASUREMENT OF SURFACE ENERGY OF RECYCLED CARBON FIBRES USING A CAPILLARY INTRUSION METHOD GZ Jiang, SJ Pickering(The Univ. of Nottingham) A capillary intrusion method was developed to measure the surface energy of recycled carbon fibres by first transforming into a random mat using wet-laid process and then clamped between two metal plates for sorption experiments in several probing liquid.</p>
15 : 15	<p>F23-4 MECHANICAL PROPERTY OF CARBON NANOTUBE COMPOSITE USING SPUN YARN REINFORCEMENT M Ishihara, Y Shimamura, K Tohgo, T Fujii, Y Inoue, J Muramatsu(Shizuoka Univ.) Tensile tests of CNT spun yarn were conducted to investigate the mechanical behavior of CNT spun yarn. Fracture mechanism of CNT spun yarn was discussed from SEM observation of fracture portions. Then, composite specimens using CNT spun yarns were fabricated, and tensile tests were conducted.</p>	<p>F24-4 NUMERICAL SIMULATIONS OF VISCOELASTIC FLOWS IN FIBROUS POROUS MEDIA HL Liu, WR Hwang(Gyeongsang National Univ.) We present a numerical simulation of various viscoelastic fluids in fibrous porous media to investigate effects of elasticity and shear-thinning on the flow resistance. We employ the DEVSS/DG finite element scheme combined with the mortar-element method for the bi-periodic boundary condition and the fictitious domain method for fibers in a...</p>	<p>F25-4 A MULTI-SCALE MODEL FOR THE COMPUTER-AIDED DESIGN OF POLYMER COMPOSITES Namin Jeong, DW Rosen(Georgia Inst. of Technology) We proposed a new multiscale geometric and materials modeling method to efficiently capture internal and boundary information. This approach enables integration of structure-property relationships for materials design. The surfacelet transform is defined, which consists of the Radon and wavelet transforms, in order to develop structure-property relationships.</p>	<p>F26-4 EVALUATION OF DAMAGE MECHANISM OF ±45° FLAT BRAIDED CFRP COMPOSITES CONTAINING CARBON NANOFIBERS UNDER TENSILE LOADING WITH ASSISTANCE OF FLUID TECHNIQUE MS Aly-Hasan, Y Takai, A Nakai, H Hamada(Kyoto Inst. of Technology), Y Shinyama(Toyohashi Univ. of Technology) The aim of this study is to provide an adequate understanding for the damage mechanism of ±45° flat braided CFRP composites containing Vapor Grown Carbon Nano-Fibers (VGCF) under off-axis tensile loading based on in situ macroscopic surface observations of the in-plane cracking behavior and off-line measurements via Superconducting Quantum Interference Device...</p>	<p>F27-4 FATIGUE LIFE ESTIMATION OF ALUMINIUM ALLOY REINFORCED WITH SiC PARTICULATES IN ANNEALED CONDITIONS DP Myrionis, ST Hasan(Sheffield Hallam Univ.) The scope of the present study, involved the application of two different heat treatment protocols on stripes of Al/SiC, 20% specimens with the aim of tailoring the fatigue properties of the composite.</p>	<p>F28-4 REUSABILITY ASSESSMENT OF THERMOSET POLYMERIC COMPOSITE WASTES AS REINFORCEMENT AND FILLER REPLACEMENT FOR POLYMER CONCRETE MATERIALS MCS Ribeiro, ML Dinis, AA Fuzza(FEUP-Faculty of Engineering of Univ. of Porto), ACM Castro, FIG Silva, JP Meixedo, C Costa, F Ferreira, MR Alvim(ISEP-School of Engineering, Polytechnic of Porto) In this study the effect of incorporation of recycled GRFP waste materials, obtained by means of milling processes, on mechanical behavior of polyester polymer mortars was assessed. Different contents of recycled GRFP waste materials, with distinct size grading, were incorporated into polyester polymer mortars as sand aggregates and filler replacements.</p>
15 : 35	<p>F23-5 INTERFACIAL SHEAR STRENGTH OF MWNT / EPOXY COMPOSITES AND COMPARISON WITH MOLECULAR DYNAMICS SIMULATION T Terumasa, T Nobuo(The Univ. of Tokyo), O Toshio(JAXA) In this study, two kinds of MWNT/thermosetting epoxy polymer composites were evaluated using the nano-pullout method. The experimental results were compared and discussed with that of molecular dynamics calculation. It can be said that Van der Waals force plays an important role at the interface.</p>	<p>F24-5 CHARACTERISATION OF NON-CRIMP FABRIC DEFORMATION MECHANISMS DURING PREFORMING S Bel, N Hamila, P Boisse(Univ. de Lyon) Thanks to the absence of crimp and to the through thickness stitching, non-crimp fabrics have interesting properties that lead to promising composite parts. Here we investigate on the deformability of dry non-crimp fabrics during preforming in order to model the behaviour of the composite reinforcement.</p>	<p>F25-5 NUMERICAL EVALUATION OF THERMAL WARPAGE ON FLIP CHIP PACKAGE WITH RESPECT TO LAYER RESIDUAL RATE WJ Song, YS Byun, TW Ku, J Kim, BS Kang(Pusan National Univ.), MS Kim, HS Kang(Samsung Electro-Mechanics Co., Ltd.) The thermal warpage of FC package is evaluated using finite element analysis with respect to the variation of Cu and SR film residual rates in bare PCB. It is noted that the coplanarity of FC package can be enhanced with about 30% as only adjusting the residual rates.</p>		<p>F27-5 FATIGUE DAMAGE EVOLUTION IN [0₂/90₂/0₂] COMPOSITE TUBES UNDER MULTIAXIAL LOADING M Quaresimin, P Carraro(Univ. of Padova), R Talreja(Texas A&M Univ.) The fatigue behaviour of thin walled [0F/90U/3/0F] glass-epoxy tubes under combined tension-torsion loading at different biaxiality ratios was investigated. A strong detrimental effect of the shear stress was observed on both crack nucleation and propagation. Damage modes and fracture surface morphology were also seen to depend on the biaxiality ratio...</p>	<p>F28-5 INTERFACE OPTIMISATION OF RECYCLED CARBON FIBRE COMPOSITES J Howarth, FR Jones, SA Hayes(Univ. of Sheffield) Carbon fibre recycled form bulk composite was made into workable material in a process akin to paper making. The fibres were plasma treated under various conditions before being wet-laid into panels, cured and tested in tension. Tensile strength was improved in the plasma treated samples.</p>
15 : 55	<p>F23-6 CHARACTERIZATION OF INTERLAMINAR FRACTURE TOUGHNESS OF CFRP LAMINATES TOUGHENED BY CNT-DISPERSED RESIN INTERLAYERS K Yoshida, T Yokozaki(The Univ. of Tokyo) The main goal is to improve interlaminar fracture toughness of CFRP laminates by using resin interlayers with and without CNTs between preregs. In order to evaluate the toughness, DCB and ENF tests were performed. The effect of resin interlayers, CNTs in interlayers, and the length of CNTs are discussed.</p>					<p>F28-6 SYNTHESIS OF MCM-41 FROM COAL FLY ASH KH Hui, JY Lee, QX Xia(Pusan National Univ.), SK Lee(Korea Inst. of Energy Research), KS Hui(City Univ. of Hong Kong) This study reported a novel, green and fast method to produce pure and long-range ordered nano-porous MCM-41 material from coal fly ash. Performance evaluation of the produced MCM-41 material in wastewater treatment was investigated.</p>
16 : 15	Break					

	202B	203	301	302	401	402A	
14:15	<p>F29 ENERGY TECHNOLOGY APPLICATIONS Chair : HJ Yang</p> <p>F29-1 PREPARATION AND ELECTROCHEMICAL PERFORMANCE OF TUBULAR $Li_1Ti_3O_{12}$/CARBON COMPOSITE ANODE HS Choi, JH Im, CR Park (Seoul National Univ.) $Li_1Ti_3O_{12}$/Carbon hybrid composite nanotube was successfully synthesized via electrospinning, hydrothermal reaction followed by heat treatment for the negative electrode in hybrid capacitor. 1D-shaped tubular structure and LTO/C hybridization of the composite, which were characterized with various analytic tools, improved the high rate capability of 82 mAh/g at 2000 mA/g.</p>		<p>F30 CARBON AND CERAMIC MATRIX COMPOSITES Chair : HG Kim/ YI Wang</p> <p>F30-1 TENSILE FRACTURE BEHAVIOR OF CARBON/CARBON COMPOSITE HEAT DISTRIBUTION ANALYSIS TH Kim, HG Kim, LK Kwac, HJ Shin, B Sorn, SG Oh, HJ Hong (Jeonju Univ.) Carbon/carbon composites are utilized in many fields. However, the structure of C/C composites is so complex that the defects from the manufacturing process may affect their mechanical properties. C/C composite heat distribution of the fracture in the tensile test was observed using an infrared camera to analysis correlation between stress and temperature.</p>	<p>F31 STRENGTH & LIFE PREDICTION FOR COMPOSITES Chair : SK Ha/ JD Melo</p> <p>F31-1 EFFECT OF SHEAR STRESS ON FATIGUE LIFE OF COMPOSITE LAMINATES G Mustafa, SK Ha, Y Huang, K Jin (AE Design) The complex stress state is not properly taken into account for determining the fatigue life of structures made of composite materials. This is due to lack of theoretical models. A micromechanics based fatigue life prediction of laminates under multi-axial loading is developed that can take care of complex stress state.</p>		<p>F32 APPLICATIONS OF COMPOSITES Chair : G Muthuraman</p> <p>F32-1 WEIGHT REDUCTION OF AUTOMOBILE USING ADVANCED POLYPROPYLENE COMPOSITES BK Nam, SR Ko, SH Kim and DW Lee (Daedook Research Inst.) One of the alternative methods to reduce energy consumption is weight reduction of automotive parts. To achieve this goal, we have developed advanced polypropylene (PP) composites for automotive parts: 1) TPO composites with high melt flow rate 2) PP/Nanoclay composites 3) Long glass fiber reinforced PP composites.</p>	<p>F33 METAL MATRIX COMPOSITES Chair : S Mileiko</p> <p>F33-1 SYNTHESIS OF TITANIUM ALUMINIDES BASED INTERMETALLIC MATRIX COMPOSITES BY MECHANICAL ALLOYING AND THEIR CONSOLIDATION BY HOT PRESSING DD Mishra, V Agarwala, RC Agarwala (Indian Inst. of Technology Roorkee Roorkee) TiAl intermetallics matrix composites have been produced using mechanical alloying technique. A composition of Ti-Al-2Nb-2Cr at% powders was mechanically alloyed for various durations of 20,40,60,80 and 100 hours.</p>
14:35	<p>F29-2 DESIGN AND FABRICATION OF HYBRID COMPOSITE FLYWHEEL ROTOR JD Kwon, SJ Kim, SK Ha (Hanyang Univ.), SC Han (Korea Electric Power Research Inst.) An advanced composite flywheel rotor consisting of intra and inter hybrid rims was designed to optimally increase the energy capacity, and was manufactured using filament winding with in-situ curing.</p>		<p>F30-2 INTERLAYER CONTROL OF SICF/SIC COMPOSITE PREPARED BY SIC SLURRY INFILTRATION AND HOT PRESSING PROCESS JY Park, MH Jeong, WJ Kim (Korea Atomic Energy Research Inst.) SIC/SIC composites were prepared by the slurry impregnation and hot pressing process. Due to the interlayer degradation, the specimens with thin PyC interlayer showed the brittle fracture mode in spite of a high density. By applying SIC coating on the PyC layers, however, most of the interlayers were remained.</p>	<p>F31-2 HYBRID COMPOSITE RING WITH MODIFIED RESIN FOR A ULTRA HIGH SPEED ROTOR CZ Joo, SJ Kim, YC Huang, SK Ha (Hanyang Univ.), YC Bae (Korea Electric Power Research) In this paper, the effects of rubber particles on the static and fatigue behavior of resin systems are firstly investigated. The influences of the hoop directional e-glass reinforcement on the mechanical behaviors of composites used for high speed rotors are also presented.</p>		<p>F32-2 DESIGN, FABRICATION AND TESTING OF A HYBRID COMPOSITE FLYWHEEL ROTOR & HUB K Haya, SJ Kim, YH Lee, JD Kwon, KT Kim, D Hockney, J Arsenaux, SK Ha (Hanyang Univ.), SY Jung (Korea Electric Power Research Inst.) This paper describes the design, fabrication and testing of a hybrid composite flywheel rotor and hub having 50 kWh energy storage capacity at 17,000 rpm.</p>	<p>F33-2 METAL-MATRIX HEAT-RESISTANT FIBROUS COMPOSITES ST Mileiko (Solid State Physics Inst. of RAS) A far-reaching way to enhance temperature in various gas turbines and other machines is to replace superalloys and homogeneous ceramics with fibrous composites. This idea is now rather obvious; however, ways of the realisation are complicated and despite the composite community has been going along these ways for about 40...</p>
14:55	<p>F29-3 LOW-COST SYNTHESIS OF P-CUALO NANOPARTICLES AND STUDY OF SIZE-DEPENDENT OPTICAL PROPERTIES FOR TRANSPARENT NANO-ELECTRONIC APPLICATIONS AN Banerjee, SW Joo (Yeungnam Univ.), KK Chattopadhyay (Jadavpur Univ.) Cost-effective fabrication of CuAlO₂ nanoparticles and size-dependant optical properties are presented. Nanoparticle sizes varied from 15nm to 25nm by changing the deposition time. Optical transmission spectra showed 75% to 95% transmittance with direct-bandgap varied from 3.70eV to 3.93eV for a decrease in particle size consistent with size quantization of nanocrystals.</p>		<p>F30-3 EFFECT OF DEPOSITION POSITION ON MICROSTRUCTURE OF HFC COATING FABRICATED BY LOW PRESSURE CHEMICAL VAPOR DEPOSITION YI Wang, HJ Li, QG Fu, HL Li (Northwestern Polytechnical Univ.) Using HfCl₄-C₂H₄-H₂-Ar system, HFC coating was prepared on the surface of C/C composites by LPCVD. With the increase of the distance from inlet, more C appeared in the coating, HFC grains size decreased gradually and the coating became rougher. Meanwhile, the deposition rate also decreased.</p>	<p>F31-3 THE HYBRID APPROACH OF A 3D TEXTILE COMPOSITE FINITE ELEMENT MODELLING TECHNIQUE AT MESO-SCALE LEVEL CA Young, A McIlhagger, J Quinn, S Buchanan (Univ. of Ulster), AJ Mcmillan (Univ. of Bristol), E Ravey, J Verdicchio (Rolls-Royce) This paper presents a detailed FE modelling approach to simulate 3D textile composites behaviour from stiffness through to failure using commercially available software and existing computational capabilities. In this approach the composite constituents including the fibre, interface and resin regions are modelled with Tetrahedral, Pyramid and Hexahedral finite elements respectively.</p>		<p>F32-3 MICELLAR COMPOSITE SOLUTION FOR MEDIATED ELECTROCHEMICAL REDUCTION OF PCE: AN ELECTROCHEMICAL INVESTIGATION M Govindan, MH Pyo, IS Moon (Suncheon National Univ.) In this study, CTAB micellar composite solution was successfully utilized to stabilize and solubilized the both [Co(I)(phen)]³⁺ and PCE. Reversibility of [Co(I)(phen)]^{3+/2+}-CV studies evidence the CTAB micellar composites formation. Mediated catalytic reduction of PCE in micellar stabilized [Co(I)(phen)]³⁺ aqueous solution confirms the solubilization of PCE in CTAB micellar solution.</p>	
15:15			<p>F30-4 ELECTRICAL NDE METHOD USING IMPEDANCE MEASUREMENT FOR C/C COMPOSITES M Koyama, H Fukuda, M Takezawa (Tokyo university of science), H Saito (Graduate school of Tokyo university of science), H Hatta (Japan Aerospace Exploration Agency) C/C composites are expected to be applied to high temperature structures in the aerospace field. However, C/Cs has low reliability, because of incipient defects and non-uniform defects. To establish the interfacial condition of C/C, NDE by means of electrical method was proposed and verified in this study.</p>				
15:35			<p>F30-5 THE ANALYSIS BETWEEN TENSILE LOADING AND VIBRATION MODE OF CARBON-CARBON COMPOSITE MATERIAL SG Oh, HG Kim, LK Kwac, TH Kim, HJ Shin, B Sorn, KS Kim (Jeonju Univ.) This research is focused on the influence of vibration of carbon-carbon composite material by using accelerometer with impact hammer excitation, and the change of vibration mode will be known by applying tensile loading test.</p>				
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