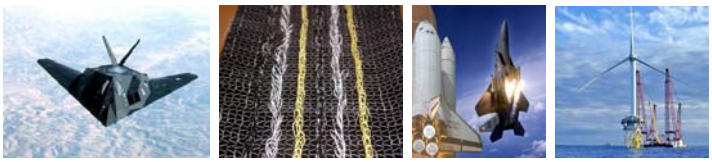
ICCM17 Edinburgh
27-31 July 2009, Edinburgh, UK



Smart Composites & Applications

Manufacturing and Flexural Testing of Composite Braided Hockey Sticks with Embedded Fiber Optic Sensors
M Selezneva, C Poon, X Gu, Z Fawaz, K Behdinan, V Kulisek (Ryerson Univ) A Nakai (Kyoto Institute of Technology)
This paper outlines the manufacturing process for braided composite hockey stick shafts with embedded fiber optic sensors. The effect of the braiding parameters on the residual strains and resultant stiffness is investigated, and the overall performance of FBGs for such applications is assessed. **(B7:1)**

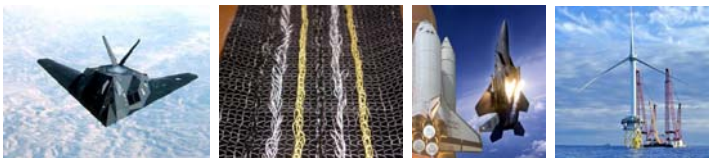
Debonding Propagation Rate in Single NiTi Shape Memory Fibre Composite
Y Payandeh, F Meraghni, E Patoor (ENSAM) A Eberhardt (ENIM)
The debonding propagation in single NiTi fibre composite was investigated. The in situ observations of the interfacial debonding during the pull-out test were carried out. It is found that the debonding rate depends on the displacement rate as well as the length change during phase transformation. **(B7:2)**

Experimental Study on Vibration Characteristics of Magnetorheological Elastomer Embedded Sandwich Beams
WJ Choi, YP Xiong, RA Shenoi (Univ of Southampton)
Dynamic behaviour of a sandwich beam with aluminum skins and magnetorheological elastomer (MRE) core is studied experimentally under different magnetic field strength. Forced vibration tests for MRE embedded sandwich beam are carried out. The magnitude of magnetic field and the boundary condition effects on the vibration characterisation of the MRE sandwich beam with simply supported and clamped are investigated. **(B7:3)**

On the Characterization of the Piezoresistivity of Embedded Carbon Fibres
A Horoschenkoff, T Mueller, A Kroell (Munich Univ)
The piezoresistivity of carbon fibres has become a key property for exploiting the electrical conductivity of carbon fibres in the development of smart composite structures. Commercially available carbon fibres (ex-PAN and ex-pitch) were electrically connected at the fibres` ends by means of a galvanic process. In order to characterize the piezoresistivity of the embedded carbon fibres, specific specimens were employed. **(B7:4)**

Development of Self Healing Resin Matrices for Composites
MS Bin Md Jamil, FR Jones (Univ of Sheffield)
An ideal self-healing matrix systems is capable of continuously sensing and responding to damage which restore the material's performance without negatively affecting the properties. A novel self-repair technique employing a solid-state repair system for a thermosetting resin that has been shown to be capable of recovering until 60% of its pre-fracture strength after healing. **(B7:5)**

Effect of Silane Treatment of E-Glass on the Cross-Linking Kinetics of an Epoxy Resin
L Wang, R Mahendran, SD Pandita, VR Machavaram, A Tomlin, E Redmore, D Harris, MA Paget, GF Fernando (Univ of Birmingham)
The primary focus of this study was to demonstrate that conventional reinforcing Eglass fibres can be used for in-situ monitoring of cross-linking reactions using evanescent wave spectroscopy. The effect of silane treatment on the cross-linking kinetics of a thermosetting resin is also presented. **(B7:6)**



Applications of Structural Health Monitoring using Fiber Optic Sensors
C-S Hong (KAIST)
Due to their many advantages, fiber optic sensors are the most promising sensors for structural health monitoring. Despite of these advantages, there were still some challenges to overcome for real applications. In this paper, some trials to enhance the strength of FBG sensors and stabilize the system, and several applied cases are introduced. **(B7:7)**

Evaluation of Residual Strain of Fibres in Matrix Resin During Cure Process by Optical Fibre Sensors
T Kosaka, K Osaka, Y Sawada (Osaka City Univ)
Strain of embedded fibres in matrix resin during cure was evaluated by optical fibre strain sensors. Several moulding patterns of temperature were employed. FE viscoelastic analyses were also conducted to calculate strain of the embedded optical fibres. These results showed that the temperature patterns strongly affected residual strain of the embedded fibres. **(B7:8)**

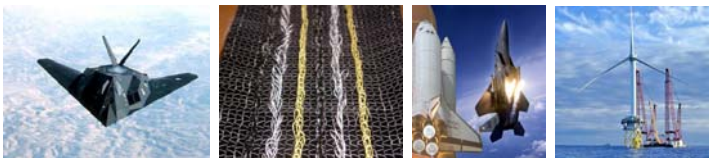
Electromechanical Properties of Carbon Nanotube Buckypapers
MD Rein*, H Bar, O Breuer, R Yoseph (Rafael - Advanced Defense Systems Ltd) HD Wagner (*& The Weizmann Institute of Science)
The electrical resistance of single and multi-walled carbon nanotubes buckypaper thin films was studied as a function of mechanical strain. The buckypaper strain sensors were encapsulated in epoxy matrices and the effect of carbon nanotube type, electrical current and degree of strain on their resistance change and sensitivity were studied. **(B7:9)**

Simultaneous Aquisition of Data on Refractive Index, Strain, Temperature and Cross-Linking Kinetics
D Harris, GF Fernando (Univ of Birmingham)
An Abbe refractometer was custom-modified to enable the simultaneous acquisition of data on the refractive index via the refractometer and strain, temperature, refractive index and cross-linking kinetics via optical fibre sensors. The experiments were carried out isothermally at 40, 50, 60 and 70 ºC using an epoxy/amine resin system. **(B7:10)**

A Novel Bistable Laminate Hybrid Composite
F Dai, B Zhang, S Du (HIT)
A bistable unsymmetric hybrid composite laminate with quite high stiffness and large shape change is presented. Rayleigh-Ritz method is used to predict the cured shape and the predited results are well agreed with the experimentals. The critical loads switching between different shapes are tested. It shows that the critical load for hybrid composite laminates increases greatly (up to 10 times) compared with the pure fiber reinforced polymer matrix composite laminates. **(B7:11)**

Simultaneous Measurement of Strain & Temperature for Structural Health Monitoring using FBG Sensors
SO Park, B Moon, BW Jang, YG Lee, CS Hong, CG Kim (KAIST)
The structural health monitoring is needed for space structures in low earth orbit (LEO) because of degradation in materials exposed to the severe environment. The graphite/epoxy composite specimens embedding FBG sensor arrays were exposed to the LEO aging cycles and the change in the reflective spectrums and the wavelengths from FBG sensors were investigated. **(B7:12)**

A New Smart Multifunctional Polymer Nanocomposites Layer for the Detection of Low Velocity Impact Damage in Composite Structures
G Carotenuto (IMCB) M Meo (Univ of Bath) E Milella (IMAST)
A variety of new smart photoluminescent polymer nanocomposites layers were developed to be used for detection of low-velocity impact damage on composite structures. These layers exhibit a unique characteristic of showing specific light emission in the visible range under UV-light excitation that could be used to visualize in a quick and effective manner barely visible impact damage. **(B7:13)**



Structural Health Monitoring Based on Strain Distributions of a Composite Train Car Body
B-W Jang, S-O Park, Y-G Lee, C-G Kim (KAIST) J-R Lee (Chonbuk National Univ)
The lightweight composite train carbody gives many advantages such as fuel reduction, reducing burden for railway systems, etc. In this study, global monitoring of composite carbody using strain data is suggested. From the acquired strain using FBG sensors, the deformation shapes can be estimated and warning will be shown in the emergency case. **(B7:14)**

A Novel Multi-Functional Sensor Design for Process Monitoring
R Mahendran, V Machavaram, L Wang, JM Burns, AKR Nair, S Kukureka, GF Fernando (Univ of Birmingham)
This paper reports on a novel fibre optic sensor that is capable of monitoring four independent parameters: strain, temperature, refractive index and the relative concentrations of specific chemical species. A unique feature of this sensor is that a conventional fibre-coupled Fourier transform infrared spectrometer is used to interrogate the sensor. **(B7:15)**

In-Situ Damage Detection in Glass Fibre Composites
SA Malik, SO Ojo, D Harris, GF Fernando (Univ of Birmingham)
A novel technique is reported where the reinforcing glass fibres are used as light-guides to enable in-situ damage detection of fibre fractures. A high-speed camera was used to record the fracture of individual reinforcing fibres during mechanical loading. Correlation was demonstrated between the fibre fractures, acoustic emission and light transmission characteristics. **(B7:16)**

Multi-Disciplinary Design Optimization of a Hybrid Composite Flywheel Rotor with Superconducting Magnetic Bearing
HH Han, JH Kim, SK Ha (Hanyang Univ) TH Sung, SC Han (Korea Electric Power Research Institute)
Multi-disciplinary design optimization is performed to minimize the cost of a composite flywheel satisfying structural safety and dynamic stability. The dynamic stability of a flywheel rotor supported by superconducting magnetic bearings is improved by the implementation of piezoelectric actuator, which optimally changes stiffness and damping coefficient of overall system along with the rotational speed. **(B7:17)**

3D Thermal Buckling Analysis of Piezoelectric Composite Plates using Finite Layer Method
G Akhras, W Li (Royal Military College of Canada)
The finite layer method is used to analyse the thermal buckling of symmetrical and anti-symmetrical angle-ply piezoelectric composite plates. The effects of material properties and structural geometry are investigated and the results are compared with available experimental or numerical ones. **(B7:18)**

A Smart Material Flapping Wing Micro Rotorcraft
S Guo (Chengdu Aircraft Design & Research Institute) D Yang, Z Huang (Cranfield University)
In this project, investigation was made into the design, analysis and experiment of a smart material flapping wing devices for micro air vehicles (MAV). Attention was mainly focused on the design of a simple, reliable and lightweight flapping mechanism to achieve two most challenging objectives. **(IB7:1)**

Click here to return to Themes