Welcome Message

Dear Delegate

It is a pleasure to have you as a delegate to the Seventeenth International Conference on Composite Materials. Edinburgh is Scotland's capital city and a superb location for sightseeing in its own right and as a base for touring other parts of the country. We trust you will take the opportunity while here of moving around and seeing some of the outstanding attractions on offer.

The conference is the largest ever in the series so far and will cover every aspect of the research being conducted in composite materials. Leading researchers at the forefront of technological advancement in their field from around the globe are attending and contributing their expertise to the development of the area. The contributions which composites are making to assist in the quest for “leanness and greenness” are addressed.

We are committed to making your stay a memorable experience and determined to do anything we can as the organisers of the conference to enhance your visit. Please feel free to be in touch with us if you think there is anything we can do to help.

We are extremely grateful to our Sponsors and to the many dedicated volunteers who have worked so hard to make this conference a resounding success. Particular thanks go to our Executive Committee and Session Organisers who willingly gave so much of their time and effort to ensure all the detailed arrangements were in order.

The facilities available are excellent and we are sure that you will find the venue an outstanding location in every respect.

You will appreciate that with a total of 1536 abstracts submitted from the initial call and a limit on the total number we could accommodate in the conference venue and by way of parallel sessions; some difficult decisions had to be made in relation to the overall presentation of the papers. One of these was to have “interactive sessions” fully integrated in the programme and with equal status to the “oral sessions”. We hope that these sessions will allow plenty of discussion between researchers with common interests (as is done in conferences in other fields) and may well be a forerunner for use in future composites conferences with large numbers of delegates.

Once again a warm and sincere welcome to Scotland - the home of the pipes and drums – let’s hope the weather is kind and the sun shines!

Ceud mile fàilte

Professor William M Banks                     Professor Michael R Wisnom
General Chairman                              Programme Chairman
National Committee

G Allegri University of Bristol
DP Almond University of Bath
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PWR Beaumont University of Cambridge
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S Ogion University of Surrey
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M Pavier University of Bristol
T Peijis Queen Mary University of London
HX Peng University of Bristol
ST Pinho Imperial College London
P Potluri University of Manchester
K Potter University of Bristol
P Robinson Imperial College London
C Rudd University of Nottingham
F Scarpa University of Bristol
RA Shenoi University of Southamton
S Shepherd Advanced Composites Group Ltd
G Sims National Physical Laboratory
C Smith University of Exeter
G Smith University of Warwick
C Soutis University of Sheffield
SM Spearing University of Southampton
K Stokes Prospect FS Ltd
J Summerscales University of Plymouth
M Sutcliffe University of Cambridge
J Thomason University of Strathclyde
G Turvey University of Lancaster
JFV Vincent University of Bath
N Warrior University of Nottingham
P Weaver University of Bristol
GM Wells Dstl Porton Down
R Young University of Manchester
X Zhang Cranfield University
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<th>Name</th>
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<tr>
<td>Prof H Abramovich</td>
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<td>Prof S Adali</td>
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<td>Session</td>
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</table>
| A1. Advanced Composite Materials in Construction | Toby Mottram  
Geoff Turvey  
Paul Curtis  
Peter Hopgood  
Goichi Ben  
Richard Brooks  
Yasushi Miyano  
Ajit Shenoi  
Yapa Rajapakse  
Ozden Ochoa  
Geoff Gibson  
Mark Spearing  
Felicity Guild  
Hans Lilholt  
Michael Sutcliffe  
Aldo Boccaccini  
João Mano  
Adriaan Beukers  
David Nash  
Chen-Chi Ma  
Neil McCartney  
Minoru Taya  
Chris Bowen  
Tom Hahn  
Les Lee  
James Thomas  
Ian Bond  
Ole Thybo Thomsen  
Paul Cunningham  
Yapa Rajapakse  
Chun Gon Kim  
Jinsong Leng  
Nobuo Takeda  
Alfredo Güernes  
Christophe Paget  
Shanyi Du  
Ajit Roy  
Abbas Milani  
Philippe Boisse  
Philip Harrison | University of Warwick  
Lancaster University  
Dstl  
Nihon University  
University of Nottingham  
Kanazawa Institute of Technology  
University of Southampton  
Office of Naval Research (ONR 332)  
Texas A&M University  
Newcastle University  
University of Southampton  
Imperial College London  
Rise National Laboratory, DTU  
Cambridge University Engineering Department  
Imperial College London  
University of Minho - 3B's Group  
Delft University of Technology  
University of Strathclyde  
Department of Chemical Engineering, National Tsing Hua University, Taiwan, R.O.C.  
National Physical Laboratory  
University of Washington  
University of Washington  
UCLA  
Office of Scientific Research Aerospace  
US Naval Research Laboratory  
University of Bristol  
Department of Mechanical Engineering, Aalborg University  
Loughborough University  
Office of Naval Research (ONR 332)  
KAIST  
Harbin Institute of Technology  
The University of Tokyo  
UPM  
Airbus  
Harbin Institute of Technology  
Air Force Research Laboratory  
University of British Columbia  
INSA Lyon  
University of Glasgow |
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<th>Affiliation</th>
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<tr>
<td>C2. Flow Processes in Composite Materials</td>
<td>Suresh Advani, Peter Hine, António Torres Marques, Kevin Potter, Reza Vaziri, Arthur Jones</td>
<td>University of Delaware, University of Leeds, Faculdade de Engenharia da Universidade do Porto, Portugal, University of Bristol</td>
</tr>
<tr>
<td>C3. Manufacturing Technologies</td>
<td>Alex Bogdanovich, Prasad Potluri, Julian Vincent, Lars Berglund, Hiroshi Hatta</td>
<td>The University of British Columbia, University of Nottingham, 3TEX, Inc.</td>
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<tr>
<td>C4. Residual Stresses and Processing</td>
<td>Bojan Boskovic, Jacques Lamon, Kevin Knowles, Steve Johnson, Wesley Cantwell, Sergei Mileiko</td>
<td>University of Manchester, University of Bath, KTH Fiber and Polymer Technology</td>
</tr>
<tr>
<td>D1. 3D Textiles and Composites</td>
<td>Bob Young, Frank Jones, Bela Pukanszky, Krish Chawla, Hua-Xin Peng, Alan Lau, Stephen Eichorn</td>
<td>CNRS/University of Bordeaux, University of Cambridge, Georgia Tech</td>
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<td>D3. Carbon/Carbon Composites</td>
<td>Tsu-Wei Chou, Bojan Boskovic, Byron Pipes, Michele Meo, ShaoYun Fu</td>
<td>University of Sheffield, Budapest University of Technology and Economics, Department of Physics and Material Science, University of Alabama at Birmingham</td>
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<tr>
<td>D4. Ceramic Matrix Composites</td>
<td>Fabrizio Scarpa, Suong Hoa, Alistair McIhagger, Zhong Zhang, Jingshen Wu</td>
<td>Bristol University, Hong Kong Polytechnic Univ, School of Materials and Northwest Composites Centre</td>
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<tr>
<td>D5. Fibre-metal Laminates and Hybrid Composites</td>
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<td>K.U.Leuven - Department MTM, University of Nottingham, Universita del Salento, University of Strathclyde, University of Delaware, NANOCEYL sa, Purdue University, University of Bath, Technical Institute of Physics and Chemistry, University of Bristol, Concordia University, University of Ulster, National Center for Nanoscience &amp; Tech, USTC</td>
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| E6. Polymer Nanocomposites for Structural Applications | Mahesh Hosur,  
Emile Greenhalgh,  
Yapa Rajapakse,  
Jang-Kyo Kim,  
Tina Lekakou,  
Alain Vautrin,  
Peter Davies,  
Byron Pipes,  
Jon Gosse,  
Haim Abramovich,  
Paul Weaver,  
Adrian Mourtz,  
Geoff Gibson,  
John Botsis,  
Pierre Ladaveze,  
Stephen Hallet,  
Takashi Ishikawa,  
Richard Butler,  
Costas Souts,  
Alma Hodzic,  
Kevin O'Brien,  
Paul Robinson,  
Serge Abrate,  
Lorenzo Iannucci,  
Yapa Rajapakse | Tuskegee University,  
Imperial College London,  
Office of Naval Research (ONR 332),  
Hong Kong University of Science and Technology,  
University of Surrey,  
Ecole des Mines,  
IFREMER,  
Purdue University,  
Boeing Company,  
Technion, I.I.T.,  
University of Bristol,  
RMIT University,  
Newcastle University,  
EPFL,  
ENS Cachan,  
University of Bristol |
NATURAL FIBRE COMPOSITES

Chair: A Lau

Multifunctional Structural Green Nanocomposites from Bio-oil based Thermoset Resin Systems: An Overview
M Matsa (Univ of Guwahati)

MUFANT MEMBRANE COMPOSITES

Chair: S Hua

Preparation and Mechnical Properties of CNT-FFP Hybrid Composites
J Xiong (Hong Kong Univ of Science & Technology)

Recent Developments of Structural Health Monitoring Technologies for Aircraft Composite Structures in Japan
N Takada (Univ of Tokyo)

DAMAGE TOLERANCE & IMPACT

Chair: F Albion/G Sunesma

Impact Properties of Stitched Fibre Reinforced Thermoplastic Composites
J Zhao, H Hofel, J Abraham (TU Dortmund)

New thermal analysis method to determine glass/epoxy/glassy woven composites are studied. Without validation of tensile synergy and with the robustness of heat resistance and impact properties. Our method improves impact toughness through considerably increased energy absorption. It is an interesting approach for crack bridging mechanisms during crack propagation (F7.13)

TEXTILES & COMPOSITES

Chair: M Mohamed/JWS Heath

3D Woven Preforms and Properties for Textiles
JWS Heath, X Chen (Textile Software Ltd)

3D fabrics made on commercial machine, include solid, shaped, nodal and hollow forms. Software links fabric design to weaving control. Engineering applications need modelling to realistic geometries for performance prediction. 3D fabrics in composites have been developed by some applications, but there are other approaches, including high volume-low cost applications. (F1.13)

Manufacturing and Testing of 3D Woven Natural Fibre Composites
M Swain, D Mclaren, G Redwood (Univ of Ulster)

The paper reports new developments in the design, manufacture, testing, and lasting of 3D reinforced natural fibre composites. The cross-section of the 3D woven glass fabric, used, details the WART composite processing method and testing on the unique challenges of producing structural composite materials from naturally available vegetable yarns. (F1.14)

Impact Damage to 3D Woven CFRP Composite Multi-Ply Specimen
MPT Suffin, G Zampelas, C Acs, WJ Sturgeon (Cranfield Univ of Manchester)

Two CFRP composites, an orthogonal weave and a layer-to-layer multi-ply, were impacted using a gas gun. The damage area increases roughly linearly with impact energy, while the contact force increases roughly as the square of the impact energy. Seating was oriented to lead an impact behaviour and damage (F1.15)

Three-Dimensional Braided Composites for Reinforcing Artificial Cartilage
I Abu, KJ-K Wu, J-Y Wu (National Taiwan University)

The objective of the present study was to develop new braided composite scaffolds that could be used as artificial cartilage. The bioactive glass composite scaffolds were investigated during the ultimate and mechanical properties, and under mechanical testing, using a three-dimensional endocarilage scaffold with high porosity. (F1.16)

Novel Three-Dimensional Braiding Approach and its Products
F Pla, J Egozcue, F Soria, J Gries, F Achard, J-J Menaudeau, J-J Redel, L Guinard (CTC Composites and Technologies)

The braiding approach is based on a braiding process. The principle of the new method consists in a braiding process. The principle of the new method consists also in a braiding process. (F1.17)

Moorefoot

CAUTION TO THE COMPETITION ON Belarusian, Lithuanian, Latvian and Russian markets, the new market for carbon fibre reinforced plastics is still relatively small. However, the market for carbon fibre reinforced plastics is expected to grow significantly in the near future. (F7.11)

Textile reinforcement is the predominant form of reinforcement in composites. Textile reinforcement can be achieved through a variety of methods, including woven, non-woven, and knitted fabrics. (F7.12)

3.3 DISCUSSION

The discussion section of the paper should provide a critical evaluation of the research findings, highlighting the implications of the study and suggesting areas for further investigation. The discussion should address the following key points:

3.3.1 Interpretation of Results: Interpret the results in a clear and concise manner, linking them back to the research questions and hypotheses. Discuss the significance of the findings in the context of existing literature and their potential applications.

3.3.2 Limitations: Acknowledge any limitations of the study that may have influenced the results. Discuss how these limitations might be addressed in future research.

3.3.3 Future Research: Suggest areas for future research that could build upon or extend the current findings. Include potential methodologies, theories, or technologies that could be explored.

3.3.4 Implications: Discuss the implications of the findings for theory, practice, education, or policy. Consider the broader impact of the research on specific fields or communities.

3.3.5 Conclusion: Summarize the key points of the discussion, reiterating the main research questions and highlighting the contributions of the study. Provide a final statement on the significance of the research and its implications.
**Kilsyth**

**MECHANICS OF SHORT FIBRE COMPOSITES**

**Effect of Molecular Weight on Aging Properties of Glass/Polypropylene Composites**

T. Morii (Shonan Inst of Tech) T. Yoshihara, H. Hamada (KIT)

- This study discussed effect of molecular weight of matrix PP and glass fibre into epoxy is able to generate positive synergistic effect in terms of triboological performance.
- The improved surface hardness (mainly resulting from carbon fiber), wear, and fibre has been reinforced by nano-SiO2 that act as lubricant, and rapid formation of stable transfer film take the responsibility. (F24:1)

**Deformation and Temperature Fields in Short Fibre Composites**

V. Kompas (DSII) Z. Municzko (Tech Univ in Kosice)

**Full-Field Strain Measurement of Discontinuous Carbon fibre Composites**

M. Bogdanic, K. Hapner, T. Turner, W. Hamada (Univ of Nottingham)

- A study of the mechanical properties in discontinuous carbon fibre composites is presented, using Digital Image Correlation (DIC) to monitor full-field strain distributions within experimental samples.
- The results were compared and the effect of fibre matrix properties was analyzed. (F11:14)

**Prediction of Modulus of Injection Moulded CF/LCP Thin Plates**

A. Fukui, F. Biba, N. Yamada (Mitsubishi Electric Corp)

- The modulus of the injection molded carbon fibre (CF) liquid crystal polymer (LCP) thin plate is estimated by the Cox formula and laminate theory based on the fiber orientation and distribution of the modulus of the LCP in the thickness direction. The results were compared to the prediction model suggested in this paper was valid to estimate the modulus of thin injection moulded CF/LCP plates. (F17:16)

**Strength Prediction of Short Fiber Reinforced Injection Moldings**

A. Nakai (Shinshu Univ)

- Long glass fiber reinforced polypropylene injection moldings were fabricated. By simultaneously using two kinds of AE sensors, AE measurements were performed. By assuming that the specimen possesses a lamellar structure, the strain energy density of the matrix PP and glass fibre has been reinforced by nano-SiO2 that act as lubricant, and rapid formation of stable transfer film take the responsibility. (F24:1)

**Study on Friction Performance of Carbon/Carbon Composites**

M. Cerezo, P. Plesinger (Czech Technical Univ)

- A study on material friction and wear properties were performed. By simultaneously using two kinds of AE sensors, AE measurements were performed. (F24:1)

**WEAR**

**Chairs:** MQ Zhang/HX Peng

- Synergetic Effect Revealed by Sliding Wear Performance of Hybrid Nanocomposites
- MQ Zhang (Zhejiang Univ)
  - Additives of nano-SiO2 and carbon fiber into epoxy is able to generate positive synergistic effect in terms of triboological performance. The improved surface hardness (mainly resulting from carbon fiber), wear, and fibre has been reinforced by nano-SiO2 that act as lubricant, and rapid formation of stable transfer film take the responsibility. (F24:1)

**ADVANCED COMPOSITE MATERIALS IN CONSTRUCTION**

**Chairs:** JT Mottam/GJ Turvey

- Failure of Pultruded GRP Angle-Leg Junctions in Tension
- G Turvey (Lancaster Univ) P Wang (Schlumberger)
  - Additives of nano-SiO2 and carbon fiber into epoxy is able to generate positive synergistic effect in terms of triboological performance. The improved surface hardness (mainly resulting from carbon fiber), wear, and fibre has been reinforced by nano-SiO2 that act as lubricant, and rapid formation of stable transfer film take the responsibility. (F24:1)

**DEFORMATION & FRACTURE OF COMPOSITES**

**Session Organisers:** C. Souts/A. Hozdci

- Non-Linear Properties of Coated Fabrics used in Tensile Structures
- G. Galliot (Empa) S. Avanzadd (LMFA)
  - The yarn-parallel and shear behaviour of FVC-coated polyester fabric is investigated. From biaxial tensile test results a simple material model is proposed and included as a User Input in ANSYS. It is used for the finite element analysis of Tensile structures. (A1:3)

- New Composite Poles for Electrical Lighting, Transports and Distribution
- J. Nunes (Minho Univ) J. Silva (ISEP) J. Ferreira (PoliT) A. Nakai, H. Hamada (Shinshu Univ)
  - The manufacture, mechanical and physical design of new composite poles made from glass fibre reinforced thermoplastic and thermosetting plastic composites (GRP) and were studied and evaluated in accordance with the standard relevant to the manufacturer. The composite materials have been further calculated numerically by OR iteration of the finite element method and compared. (A1:3)

**ADVANCED COMPOSITE MATERIALS IN CONSTRUCTION**

**Session Organisers:** Y. Miyano/A. Shenoi/Y. Rajapakse

- x4 Interactive Papers (IA4-1 - IA4-4)
  - see page 55 for details of titles and authors

**COMPOSITES IN FIRE**

**Session Organisers:** A.Mounted/A. Gibson

- x3 Interactive Papers (IF4-1 - IF4-3)
  - see page 55 for details of titles and authors

**MARINE COMPOSITES**

**Session Organisers:** M. Yilmaz/A. Shenoi/Y. Rajapakse

- x4 Interactive Papers (IA4-1 - IA4-4)
  - see page 55 for details of titles and authors