Materials Theme

Fabrizio Scarpa

bristol.ac.uk/composites
Materials Academic Team

We develop novel generations of composites with a broad range of multiscale reinforcements, from nanostructures to carbon and natural fibres, involving design, modelling, manufacturing and testing.
Highlights of 2020


• EPSRC NextCOMP (6.2 M£, RST leads for UoB, IH and SJE co-PIs)

• ONR Global (Emergent Metamaterials - 270 K), RS International (Combating heavy metal pollution in water with inexpensive functional nanostructured materials – 223K), STFC (107 K)

• Institut Laue-Langevin (80K), ESPRC (24K), BBSRC (9K), RS International Scheme (6K)

• EPSRC emPOWER (in-body artificial muscles for physical augmentation, function restoration, patient empowerment and future healthcare) - 6.1 M£, FS and BS co-PIs
Highlights of 2020

Prof Steve Eichhorn awarded the Swinburne Medal by Institute of Materials, Minerals and Mining; Editorial Board Composites Part C

Prof Valeska Ting named one of the Top 50 Women in Engineering (Sustainability)

Professor Richard Trask organizer for MRS Spring 2021 Symposium and Editorial Board Composites Part C
Highlights of 2020

Prof Fabrizio Scarpa nominated Coordinator for SIG on Multifunctional & Mechanical Metamaterials of the UK EPSRC Metamaterials Network

Dr Huan Doan was awarded an EPSRC Doctoral Prize Fellowship

Dr Lui Terry was awarded the 2020 Cavendish Medal at the STEM for Britain competition at the Houses of Parliament
Highlights of 2020


Sustainable Composites Summit organized by Professor Steven Eichhorn and Cabot Institute
I P Bond – multifunctional and self-healing composites

Electro-Bonded Composites for adaptive adhesion and morphing structures

Electro-magnetic Composites
Aluminium, glass and Kevlar, infused with epoxy, for use in novel configuration, lightweight, high power density, electrical drives/actuators

Self-Healing Composites via intrinsic polymers, embedded microcapsules, and vascular networks

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S J Eichhorn – nanocellulose materials

Image (AFM, Raman and Confocal fluorescence) cellulose nanomaterials inside thermoplastic composites and relate dispersion and mixing with mechanical properties.

Outreach events before lockdown: Black mentors – Eileen Atieno (PhD student in group, far left: https://www.bristol.ac.uk/news/2020/march/stem-bme.html

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I Hamerton - Bridging Chemistry and Engineering

- Diverse research interests in composite/coatings/adhesives technology:
  - Strengths in novel synthesis and polymer formulation
  - Cure chemistry and network formation
  - Composite processing (compression moulding and RTM)
  - Probing matrix-fibre interfacial chemistry & fibre surface characterisation

- Extensive experience in epoxy resins
- ‘Exotic’ high performance polymers used in aerospace engineering:
  - Thermosets - Cyanates, BMIs, BCIs, PETIs, polybenzoxazines
  - Engineering thermoplastics - PES, PSU, PEI, PAI, PEEK, PBI.

- Nano-structured additives (POSS, CNTs, GO, and clays)

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S Rochat—microporous polymers

Microporous and nanocomposite-based polymers for hydrogen storage

GWPore: A Global Network

Zoom, September 2020: Two international workshops on porous materials research— with more to come! 🐦@GWPore

Bristol, September 2019

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F Scarpa – bio-based materials and auxetics

- Bio-based E/Flax used to design and build cockpit dashboards for E-planes and scooters within BBI SSUCHY project (UFC France)
- New classes of smart hygromorph flax/bio and fossil polymers (HIT, IRDL France)
- Secondary structures made from recycled components (flax composites, PET bottlecaps and foams) (UFSJ, Brazil)
- High stiffness auxetic open cell foams developed within EPSRC SYSDYMATS (ZJU)
- Novel classes of auxetic mechanical metamaterials for energy absorption and shape change (HAU, IC, ITU)
- Adaptive stators concepts developed within the CS2 InnoSTAT project
V Ting - Nanomaterial composites

Materials synthesis and composite fabrication

New characterization methods

Testing and engineering evaluation

Collaborators

- NTU, Nanyang Technological University, Singapore
- RMIT, Melbourne, Australia
- UNLV, University of Las Vegas, Nevada, USA

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R S Trask – Multifunctional Materials

Supporting my PhD students to developing new research directions

• Life Cycle Analysis of Sustainable composites
• 4D printing: multi-material shape change for human body
• Manufacturing Integrated Electrical Circuits In CFRP

Grand challenges in the design and manufacture of self-healing vascular networks. (credit Qamar MIT)
Summary and Outlook

- 54 papers published so far
- Theme currently composed by 7 academics and 64 members between PhD, PDRAs and Technicians.
- Truly multidisciplinary outlook
- Open to widespread national and international collaborations
- Close collaboration and alignment with industrial and NCC Core Research Programmes

University of Bristol
Bristol Composites Institute (ACCIS)
Posters

- **Robin Hartley** - In-cure Resin Modulus Characterisation
- **Callum Hill** - Modelling multifunctional composites for further aircraft electrification
- **Ali Kandemir** - Characterisation of natural fibres for sustainable composite materials delivered using HiPerDiF
- **Usman Sikander** - Surface modification of UHMWPE using Plasma and its effects on IFSS
- **Keyao Song** - Form-finding of tessellated tensegrity structures