Professor Richard Trask
B.Eng., MSc, PhD(Soton.)

Professor

Office 0.110
Advanced Composites Ctre for Innovation,
and Science (ACCIS), University of Bristol BS8 1TR
(See a map)

+44 (0) 117 33 15845
r.s.trask@bristol.ac.uk

Summary

Professor Trask is a member of the Bristol Composites Institutes (formly ACCIS), working in the field of Multifunctional Composites and Additive Manufacturing.

The focus of his research is directed towards the development of biologically inspired composite materials and structures, at the interface of engineering-chemistry-biological sciences, specifically targeted towards synthetic fibrous polymer composite materials in high performance applications. Nature has developed materials, objects and processes that function from the nanoscale to the macroscale. The aim of Professor Trask's work is to mimic these systems to develop innovative and ingenious methods of adding functionality to advanced fibre reinforced polymer composite materials.

Current Research:

- Additive Layer Manufacture of 4D materials and functionally graded multi-material composite systems
- Biologically inspired design features and philosophies found in nacre for advanced body armour
- Biomimicry of plantae vascules in the development of stimuli responsive self-healing composite structures.
- Development of adaptive colour change camouflage (linked to Biological Sciences)
- Hierarchical form and design strategies of Euplectella aspergillum (sea sponge) for structural efficiency and damage tolerance of airframe structures
- Morphing structures using soft polymers for active camouflage based on the anatomical structure of cuttlefish papillae.

Postgraduate research student supervisor in the EPSRC Centre for Doctoral Training in Advanced Composites for Innovation and Science (ACCIS CDT)

Biography

Professor Richard Trask is the Professor of Advanced Materials at the University of Bristol in the Bristol Composites Institute. He is also an Engineering and Physical Sciences Research Council (EPSRC) Early Career Fellow (Engineering Fellowships for Growth - June 2014 to May 2019).

Professor Trask completed a first degree in Materials Science and Engineering before commencing employment as Research Scientist in the Defence Evaluation and Research Agency (DERA) and ultimately secured the role of Technology Leader and Advisor for UK Ministry of Defence (MoD). He developed an interest in advanced composite materials for and undertook a PhD sponsored by the Royal National Lifeboat Institution at the Southampton University. After completing his PhD in 2004 he joined the Advanced Composite Centre for Innovation and Science (ACCIS) in the Department of Aerospace Engineering at University of Bristol (2004 to 2016). In 2016 he moved to the Department of Mechanical Engineering at University of Bath (2016 to 2018). In this period he was the Head of Group for Advanced Design and Manufacturing @ Bath, the Head of 'The Additive Layer Manufacturing & Multifunctional Material Design laboratory (ALM3D)' and a standing member of University Research Committee (URC). In June 2018 he returned to the University of Bristol and resides within the Bristol Composites Institute.

His research area is in the development of biologically inspired 3D and 4D multifunctional materials.

- Development of biologically inspired multifunctional composite materials and structures possessing adaptive (shape and colour), damage tolerant and self-healing/remodelling potential.
- Development of 3D printing and 4D materials "Morphogenesis Manufacturing" where the material is programmed to transform during additive manufacturing to produce the next generation of advanced metamaterials.
- Applying biomimetic principles to 'grow' architectures within an advanced manufacturing domain to maximise performance.

He is the co-founding editor for Multifunctional Materials (IoP Publishing), he is currently on the American Institute of Aeronautics & Astronautics' (AIAA's) Adaptive Structures Technical Committee, the Steering Committee for the International Conference of Self-Healing Materials, and a member of the Editorial Board of Smart Materials and Structures journal (IoP Publishing).

His field of interest is bio-inspired multifunctional materials covering the areas of damage tolerance and self-healing composite materials. Nature has developed materials, objects and processes that function from the nanocale to the macroscale. The aim of Dr Trask's work is to mimic nature to develop innovative and ingenious methods of adding functionality to advanced fibre reinforced polymer composite materials.

Keywords

- Biomimicry; Self-Healing and Remodelling; Damage tolerance; Composites; Additive manufacturing
- 3D Printing
- 4D Materials

Memberships

Organisations

Department of Aerospace Engineering

Other sites

- Aerospace

Research Groups

- Advanced Composites Collaboration for Innovation and Science (ACCIS)
- Advanced Composites Collaboration for Innovation and Science (ACCIS) - Core

CDTs

- CDT in Advanced Composites for Innovation and Science

Recent publications

- Brown, KR, Trask, R & Bacheva, D, 2019, 'The structural efficiency of the sea sponge Euplectella aspergillum skeleton: bio-inspiration for 3D printed architectures'. *Journal of the Royal Society Interface*, vol 16.
- Baker, AB, Bates, SR, Llewellyn-Jones, TM, Valori, LP, Dicker, MP & Trask, RS, 2019, '4D printing with robust thermoplastic polyurethane hydrogel-elastomer trilayers'. *Materials and Design*, vol 163.
- Bates, SR, Farrow, IR & Trask, RS, 2019, 'Compressive behaviour of 3D printed thermoplastic polyurethane honeycombs with graded densities'. *Materials and Design*, vol 162., pp. 130-142
- Baker, AB, Wass, DF & Trask, RS, 2018, 'Thermally induced reversible and reprogrammable actuation of tough hydrogels utilising ionoprinting and iron coordination chemistry'. *Sensors and Actuators B: Chemical*, vol 254., pp. 519-525
- Hazzard, M, Trask, R, Heisserer, U, Van Der Kamp, M & Hallett, S, 2018, 'Finite element modelling of Dyneema® composites: From quasi-static rates to ballistic impact'. *Composites Part A: Applied Science and Manufacturing*, vol 115., pp. 31-45
- Qamar, IP & Trask, RS, 2018, 'Development of Multi-Dimensional 3D Printed Vascular Networks for Self-Healing Materials'. in: *ASME 2017 Conference on Smart Materials, Adaptive Structures and Intelligent Systems: Volume 1: Development and Characterization of Multifunctional Materials; Mechanics and Behavior of Active Materials; Bioinspired Smart Materials and Systems; Energy Harvesting; Emerging Technologies*. American Society of Mechanical Engineers (ASME), Snowbird, Utah, USA
- Hazzard, MK, Hallett, S, Curtis, PT, Iannucci, L & Trask, RS, 2017, 'Effect of fibre orientation on the low velocity impact response of thin Dyneema® composite laminates'. *International Journal of Impact Engineering*, vol 100., pp. 35-45
- Trask, RS, Baker, AB & Llewellyn-Jones, TM, 2017, '4D additive manufacturing of structural composites with programmed stimuli-response'.
- Llewellyn-Jones, T, Drinkwater, B & Trask, R, 2017, 'Mechanical properties of additively manufactured composite materials with ultrasonically assembled reinforcement'.
- Mulakkal, MC, Trask, RS & Seddon, AM, 2017, 'Smart cellulose-hydrogel composites for 4D printing'. in: *8th Conference on Smart Structures and Materials, SMART 2017 and 6th International Conference on Smart Materials and Nanotechnology in Engineering, SMN 2017*. International Center for Numerical Methods in Engineering, pp. 511-524

View complete publications list in the University of Bristol publications system

Courses

Professor Trask currently teaches 2 courses: