BioPhenom

UNIVERSITY OF BIRMINGHAM

About University of Birmingham (UoB)

The University of Birmingham is an established higher-educational institution, home to over 38,000 students and more than 8,000 staff members. It is ranked 76th globally in the QS World University Rankings (2024) and 35th in the QS World Sustainability Rankings (2024). UoB secured £197 million in research grants and contracts during the 2022/23 academic year. The university has a distinguished history of academic excellence, with 10 Nobel Prize laureates among its staff and alumni.

In the 2021 Research Excellence Framework, 96% of the reserach conducted in the School of Metallurgy and Materials was classified as “world-leading” or “internationally excellent”.

Sensors and Composites Group, School of Metallurgy and Materials

The Sensors and Composites Group is led by Professor Gerard Fernando, Chair of Polymer Engineering. He is the technical lead at UoB for the BioPhenom project. The project is funded by the European Commission (Grant Agreement No: 101135107), Innovate UK (Grant Agreement No: 1005409) and Swiss State Secretariat for Education, Research and Innovation (Grant Agreement No: 24.00212).

The Sensors and Composites Group’s primary research is focused on:

(i) manufacturing carbon fibres from biomass;

(ii) the development of optical fibre sensor systems for: (a) monitoring chemical processes (thermosets and thermoplastics); and (b) multi-measurand sensors and techniques for evaluating the structural integrity of engineering materials and structures; and

(iii) energy-efficient and environmentally friendly manufacturing of filament wound and pultruded composites.

UoB RESEARCHERS

Professor Gerard Fernando

School of Metallurgy and Materials

Professor of Polymer Engineering.

BioPhenom Project Lead at UoB.

Dr Zoe Schnepp

School of Chemistry

Associate Professor in Materials Chemistry.

Catalytic Pyrolysis of Biomass.

Professor Mayorkinos Papaelias

School of Metallurgy and Materials

Professor of NDT and Condition Monitoring.

Manufacturing.

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.
Grant Agreement No: 101135107

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Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

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UKRI Innovate UK

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Contribution to the Scientific State-of-the-Art

The BioPhenom project will contribute to the state-of-the-art in the following areas:

(i) Optimised extraction procedures for biophenols from biomass.

(ii) Synthesis and characterisation of fire retardants for recyclable thermosets and polylactic acid (PLA) thermoplastic.

(iii) Potential for replacing acrylonitrile with lignin and tannin as precursors for the production of carbonised fibres.

(iv) Techniques to improve the mechanical properties of the bio-carbon fibres will be investigated and the same applies to the possibility of lowering the graphitisation temperature of the biocarbon fibres using catalysts.

(v) New techniques for the integration of fire retardants into the recyclable thermosetting resin and PLA. The techniques that will be investigated include electro-spraying and co-axial electro-spinning.

(vi) The clean filament winding concept will be used in conjunction with the bio-carbon fibres and recyclable thermosetting resin to manufacture small tubes. This will contribute to the Safe and Sustainable by Design (SSbD) strategy.

Role of UoB in the Project

UoB leads Task 3.3, where the aim is to create fire-retarded bio-carbon fibres and thermosetting composites. This work uses the Sensors and Composites Group's patented electro-spinning and nano-fibre forming technologies to process highly aligned bio-carbon fibres. A key challenge is to improve the mechanical properties of the bio-carbon fibres. UoB will also explore the use of catalysts to lower the graphitisation temperature. A clean electro-filament winding technique will be developed to create prototype tubes consisting of the bio-carbon fibres with the recyclable bio-epoxy resins that will be developed by other partners in the project. This will lead to the production of fully bio-based, fire-retarded and recyclable fibre reinforced composites.

UoB is also participating in Task 3.4, where the focus is on fire-retarded PLA-based thermoplastics. UoB will explore techniques such as electro-spraying and co-axial electrospinning to better integrate biochar and bio-IFR into electro-spun PLA fibres.

UoB RESEARCHERS

Dr Siheng Shao

School of Metallurgy and Materials

BioPhenom Research Fellow working on nano-fibre formation using biomass.

Zi He

School of Metallurgy and Materials

Research assistant.

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