

Imperial College London Department of Aeronautics

PhD Studentship – Optically transparent armour reinforced with microbially-synthesized cellulose nanofibres with self-repair capability

Overview:

Microbially-synthesised cellulose nanofibres, more commonly known as bacterial cellulose (BC), is an ultra-pure form of cellulose nanofibers with mechanical performance exceeding that of single E-glass or Kevlar fibre. The tensile modulus and strength of a single BC nanofiber are estimated to be up to 160 GPa and 6 GPa, respectively (comparing to that of ~70 GPa and ~3000 MPa, respectively for single E-glass or Kevlar fibre). Thus, BC is often regarded as nano-reinforcement for the production of high performance lightweight sustainable composites. This project aims to develop the next generation polymeric transparent armour reinforced with BC by combining expertise of polymer and composite engineering and mechanics of materials to: (i) engineer the degree of hornification of BC within a polymeric matrix, (ii) optimise the interaction between BC and the polymer matrix, (iii) augment the properties of BC by binding structural protein molecules, as well as (iv) introducing self-repair capabilities into BC using synthetic biology (in conjunction with collaborators from SynBiCiTE of Imperial College London) approaches to produce lightweight optically transparent BC-reinforced polymer composite laminates that not only possess ballistic protection beyond the state-of-the-art but also self-repair capabilities. The objectives of this project reflect the novel, highly exciting nature and multidisciplinary elements of this project. This project will be co-supervised by Dr Koon-Yang Lee (Polymer and Composite Engineering) and Dr Vito Tagarielli (Mechanics of Materials). The synthetic biology aspect of the project will be performed by collaborators in SynBiCiTE of Imperial College London.

Pre-requisites:

Candidates should have, or expect to obtain, a strong undergraduate degree in a quantitative discipline, e.g. a 1st Class degree in Physics, Materials, Mechanical, Aeronautics, Civil or Chemical Engineering. Applicants should have a demonstrable interest in research, innovation and inter-disciplinary research, particularly with synthetic biologist. It is desirable for the successful applicant to demonstrate experience, knowledge, and/or interest of relevance to the project, e.g. materials science, polymer and composite engineering, mechanics of materials, composites manufacturing, quasi-static and dynamic mechanical testing of composites, with a particular focus in (nano)cellulosic structures and materials.

Apply:

To apply for the position please send a cover letter, and CV to Dr Koon-Yang Lee (koonyang.lee@imperial.ac.uk) with the subject line 'PhD Studentship – Optically transparent armour reinforced with microbially-synthesized cellulose nanofibres with self-repair capability'

Closing date for applications: Open until filled

Start Date: 1st July 2019

Funding Notes: This scholarship covers the full cost of UK/EU tuition fees and an annual stipend of £16,300.

Committed to equality and valuing diversity. We are also an Athena Bronze SWAN Award winner, a Stonewall Diversity Champion and a Two Ticks Employer.