

Imperial College London Department of Aeronautics

PhD Studentship – Reducing the physiological burden of individual protective clothing with nanocellulose

Overview:

Individual protective equipment (IPE) is used to protect personnel from the effects of chemical, biological and radiological (CBR) warfare agents. The technology used in IPE clothing provides a very high level of protection against CBR warfare agents for the military personnel. However, the physiological burden of wearing such clothing can be high in some circumstances. One major challenge is the removal of body heat, which is facilitated by the use of air-permeable fabrics as these allow water vapour derived from sweat to escape the microclimate of the suit. However, if the air-permeability is too high the levels of protection can fall significantly. Consequently, there is an interest in developing protective technologies that could provide protection without impeding the permeation of water vapour out of the suit.

Cellulosic fibres in the nanometre scale, more commonly known as nanocellulose, is a family of high-performance bio-based nanofibres with high mechanical performance. Nanocellulose possesses the combined properties of cellulose, e.g. broad chemical modification capacity and high crystallinity (up to 90% for microbially-synthesised cellulose), with the features of a nano-material, e.g. high surface energy and specific surface area. It is anticipated that the application of nanocellulose in IPE clothing will foster the development of lighter, multifunctional IPE garment with reduced physiological burden to the user by providing filtration within the outer shell textile. As nanocellulose is hydrophilic in nature it is anticipated that this will also facilitate the passage of moisture from the inner layers to the exterior of the garment, allowing for efficient body heat removal. Therefore, the aim of this proposed project is to produce nanocellulose-enhanced IPE and to demonstrate the scale of the resulting performance improvements over the state-of-the-art. This project will focus specifically on microbially-synthesised nanocellulose, e.g. bacterial cellulose (BC), as Imperial College London has a vast expertise in the design, synthesis and characterisation of these novel material.

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, Chemistry, Materials, Chemical Engineering or any other relevant engineering subjects. Applicants should have a demonstrable interest in research, innovation and inter-disciplinary research. It is desirable for the successful applicant to demonstrate experience, knowledge, and/or interest of relevance to the project, e.g. materials chemistry, 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 – Reducing the physiological burden of individual protective clothing with nanocellulose'

Closing date for applications: Open until filled. First round of interview is anticipated to be held in May 2019.

Start Date: 1st Oct 2019

Funding Notes: This scholarship covers the full cost of UK/EU tuition fees and an annual stipend of £16,777.

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