UNIVERSITY OF Southampton

PhD studentship in Mechanical/Material Engineering – Investigation of recycling and re-manufacturing process parameters of highly-aligned long discontinuous carbon fibre composites

Malaysia has become both a heavy manufacturer and end user of aerospace-grade advanced carbon fibre-reinforced plastic composites with the escalating growth of her aerospace sector. In the many years to come, we will have to deal with substantial amounts of composite manufacturing and end-of-life waste. A long-term sustainable solution is to recycle and reuse the high performance carbon fibres from the waste. However current technological barriers impede their re-manufacture into useful products. Pyrolysis is one of the mainstream recycling processes used for reclaiming the reinforcement carbon fibres from composite waste. As the composite waste is usually fragmented into short lengths before the pyrolysis process, the reclaimed fibres generally appear in a short, entangled and 'fluffy' form, with a random 3D orientation (Figure 1). Without further treatment, they can only be used to manufacture low-quality random fibre composite recyclates suitable for low-value applications. In order to reuse them as a reinforcement in potential high performance aerospace or automotive structural applications, one needs to achieve high levels of fibre alignment and fibre content in the finished composite recyclates.

Fig. 1: Recycled carbon fibres in a typical random and fluffy form.

High performance carbon fibres can be recovered from composite waste via an optimised pyrolysis process, while the key to unlocking and realising the full potential of reusing composite recyclates for structural application is aligning the reclaimed fibres. Therefore this PhD project aims:

(i) To determine the main process parameters in the pyrolysis techniques to reclaim long carbon fibres beyond 50 mm with minimal entanglement;

(ii) To establish a novel hydrodynamic technique and to investigate key manufacturing parameters to induce high level fibre alignment for long fibres in re-manufacturing a good quality high performance composite recyclate.

(iii) To carry out mechanical testing to gauge the quality and performance of the composite recyclate.

Information for applicants

Applicants should hold a minimum of an upper-second class degree (or equivalent qualification) in Mechanical/Mechatronics/Chemical Engineering with a strong interest in advanced composite materials, and be available to start in early 2016. A relevant Master's degree and/or experience in composite materials and manufacturing will be an advantage. Successful applicants will be offered a partial funding covering tuition fees for three years with the University of Southampton. To cover their living expenses, they are encouraged to apply for the MyBrain15 (MyPhD) scholarship offered by the Ministry of Higher Education (For more information see https://biasiswa.mohe.gov.my/MyBrain15/v2/index_myphd.php). They will be based mostly in the Malaysia Campus in Nusajaya, Johor and will be required to spend a year in the UK campus. For further information, please contact Dr. Gan Khong Wui (K.W.Gan@soton.ac.uk).

The University of Southampton is the top one per cent of world universities and in the top 10 of the UK's research-intensive universities.