Shaheen SARKAR

Institution: Irish Centre for Composites Engineering (IComp), UL
Academic Mentor: Dr Emmet O'Reilly
Commercial Partner: ÉireComposites Teo
Commercial Mentor: Adrian Doyle

Shaheen Sarkar completed his PhD in synthetic chemistry at Nagasaki University Japan. He continued his research at the RIKEN Advanced Science Institute (ASI) where he was responsible for the optimisation of Suzuki-Miyaura cross-coupling reactions for pharmaceutical applications.

Shaheen's research interests include heterogeneous metal catalysed cross-coupling reactions and the development of polymeric smart materials for material science applications. He was appointed as a Senior Lecturer, Faculty of Industrial Sciences and Technology, University Malaysia Pahang, Malaysia (Sept 2013- July 2018) and has guided PhD students and secured Malaysian government funding.

His research work has been disseminated in 59 ISI ranked publications including the *Journal of the American Chemical Society* and *Angew Chem*. One of his articles is ranked in the top 1% of cited papers from 2011 (ISI Web of Science "Highly Cited"). Shaheen is highly regarded in the field of synthetic chemistry and is a regular contributor to *Synfacts*.

See case study overleaf

Dr Emmet O'Reilly

Dr Emmet O'Reilly is a PhD in polymer chemistry from Dublin City University. He was then awarded a Marie Curie post-doctoral fellowship and took up a position with the CNRS in Montpellier, France. His research interests involve the application of electroactive polymers to the fields of biomedical sensing and material science. He has extensive experience in polymer characterisation and surface functionalisation; and authored multiple scientific papers.

Adrian Doyle

Adrian Doyle is Engineering Manager at ÉireComposites, with over 15 years' experience developing and producing thermoplastic composite systems. He has led manufacturing projects in automotive, aviation and wind-energy in partnership with leading companies. He has been involved in several ESA-funded research and development programmes in advanced thermoplastic composites and has participated in two EU Framework Programmes (ALCAS 2005-2009 and DINAMIT 2004-2008).

IComp, UL

IComp was established in 2010 under the EI/IDA Technology Centres initiative and is hosted at the Bernal Institute, UL. It has over 150 PhD students and 40 postdoctoral researchers in disciplines including chemistry, physics, biochemistry and biomedical engineering.

ÉireCompisutes Teo

ÉireComposites Teo is involved in manufacturing, research and development projects in the areas of space, commercial aircraft, wind-energy, automotive and Formula 1 racing. Its focus on thermoplastic composites is driven by the possibilities these materials hold, including environmental advantages.

Shaheen's project

HEAL (Health Evaluation System for Advanced Composite Laminates)

Advanced fibre-reinforced composite laminates are finding increased applications in aviation, renewable energy (wind turbines) and automotive fields due to their excellent specific strength, light weight and resistance to environmental degradation.

Despite these advantages such materials are more susceptible to damage caused by out-of-plane indent and high-impact loads than traditional metallic materials. A common problem is that damage often occurs internally in the composite structure with little indication on the surface.

A variety of methods have been developed for assessing composite damage namely Non Destructive Techniques (NDT). However, these techniques are incapable of assessing damage deep within the composite structure.

In addition, they require the structure to be taken out of use for routine inspections to occur resulting in revenue loss as well as investment of human capital.

This project exploits the properties of conducting and piezoelectric materials currently used in the biomedical field to create the next generation of composite structures capable of "continuous health monitoring", eradicating the need for routine inspections.

Whereas previous approaches to the development of composite health monitoring systems have been discipline-specific, the HEAL project brings together a multidisciplinary team of experts in synthetic chemistry and composite engineering, taking a holistic approach to developing autonomous composite health monitoring systems.