**Materials from Nature**

*Dr Mike E Ries, Dr Peter J Hine, Prof Chris Carr and Dr Muriel Rigout (all University of Leeds)*

Processing of biopolymers with ionic liquids gives the possibility to tap into nature’s most abundant molecules, unlocking their remarkable natural properties via “green” dissolution routes. For example, all cellulose composites have excellent material characteristics due to the improved binding between matrix and fibre. As these materials are formed entirely from one biopolymer, their recyclability is greatly simplified with this being an important consideration for the product lifetime. In looking to maximize the impact of a recycling strategy for waste, this project will explore the potential for all-keratin composites formed from poultry feather waste or other keratin based animal fibres from textile waste, for example cashmere, angora and wool. In the UK there is approximately 120,000 tons of waste feather produced annually and this is either landfilled or hydrolysed down to small proteins and used as animal feed. Through initial supercritical carbon dioxide extraction at 120°C the raw feathers can be cleaned and sterilized and hence provide a substantial cheap feedstock material for producing high value materials through processing with ionic liquids.

Single component composites is a growing area of research and development in which the Leeds Soft Matter Physics group has been one of the foremost pioneers. Research to date on melt processable polymer systems has led to a number of major patents, and via a University spin-off company to commercial applications. More recent research, run in parallel to a SOFI cohort 2 student, has also led to a new patent for all-cellulose based composites.

The student will learn a wide variety of soft matter characterisation techniques including nuclear magnetic resonance, x-ray scattering, tensile testing, differential scanning calorimetry and scanning electron microscopy. The project is interdisciplinary so the student will learn how to work with colleagues from different backgrounds including Physicists, Chemists and Engineers. This project will work with industry, such as Futamura, and therefore will give the student a wider experience outside of academia. The theme of the research is sustainability which is naturally becoming of greater importance and so will be relevant to much future work. In addition, the student will learn about polymer physics and mechanical processing of materials. We have a team of people working in this area, some on patent pending material, giving the student team working skills and an insight into the workings of intellectually property.