

The design, preparation and characterisation of composite, polymer membranes.

How to apply

Applicants must email a [postgraduate application form](#) (including a 1500 word proposal) to meri@shu.ac.uk by 12 noon on Friday 24 February 2017.

Your application form should clearly indicate the project you are applying for and outline:

- a) why you are interested in doing PhD research on this topic
- b) how your skills and experience to date (including your undergraduate and/or masters dissertation, if relevant) prepare you to embark on the project
- c) any challenges that you foresee in conducting the research and how you might approach or solve them

Where English is not your first language, you must show evidence of English language ability to the following minimum level of proficiency: an overall IELTS score of 7.0 or above, with at least 6.5 in each component or an [accepted equivalent](#). Please note that your test score must be current, i.e. within the last two years.

Please view our [eligibility criteria](#) before submitting an application.

Selection process

Successful applicants will be required to attend an interview where you will be asked to talk through your research proposal.

Project details

Supervisors: Dr Francis Clegg and Professor Chris Sammon

[Polymers, Nanocomposites and Modelling Research Centre](#)

The interests of the Polymers, Composites and Spectroscopy group, which sits within this research centre, involve the study of advanced polymeric systems. Representative research areas include:

- fire retardant and barrier properties of clay polymer nanocomposites
- competitive sorption processes in nanocomposite formulations
- stimuli responsive polymers
- amphiphilic hydrogels
- transport mechanisms in polymeric and composite systems
- gelation mechanisms of polymers

From these studies the focus is often towards the production of commercial products, such as Cailar, a sustainable, flexible and biodegradable barrier packaging and CROWD, controlled release open wound dressings.

External Partner: [PIL Membranes Ltd](#)

Project Description:

The joint funded programme of research between the Polymers, Nanocomposites and Modelling Research Centre and PIL Membranes Ltd, the market leaders in developing advanced membranes for performance outerwear and other specialist membranes, offers a unique opportunity for the successful candidate to gain both academic and industrial experience in the design, preparation and characterisation of composite polymer membranes.

Polymer membranes are utilised in a wide range of industrial applications including; performance clothing, technical garments (fire-fighting/military), separation of gases, water purification and treating organic waste. Polyurethanes (PU) are of particular interest for use as the matrix within membranes because of their extensive material chemistries and forms; indeed they are already employed in many applications within numerous industrial sectors.

The project will investigate the incorporation of nanoparticle technologies into microporous and monolithic PU membranes produced by solvent casting, or coagulation, from the solvent dimethyl formamide. The primary route will be direct addition to PU formulations following polymerisation, although the addition of nanoparticles during the polymerisation reaction will also be investigated if this provides benefit at very low risk to current processes. Alongside the addition of nanoparticles to PU formulations, the chemical modification of both nanoparticle and PU will be explored since this will facilitate control over compatibility, membrane function and performance.

The generation of new formulations, forms and novel chemistries will bring new challenges and so understanding and characterising the compatibility and distribution of the nanoparticle components within the polymer matrix will be key to the development of successful membranes. Several individual or combined material benefits/enhancements are likely to result from the newly formulated membranes, and these new unique property profiles could be exploited in any of the different application fields described above.

The successful candidate will gain an in-depth and up-to-date understanding of the theoretical and practical aspects of current, state-of-the-art polymer membranes together with practical experience and skills in their preparation and characterisation using a wide range of complimentary analytical techniques available at Sheffield Hallam.

The candidate will be based at the university and will also have the opportunity to spend time and use appropriate facilities at the industrial site.

Appendix:

PIL Membranes Ltd is a Norfolk based, premium manufacturer of technical and highly specialised membranes.

The Porelle brand, offers one of the largest global ranges of membranes that have been engineered for extreme, high performance outerwear requiring maximum waterproofness, breathability, durability and protection. They have regularly supplied membrane for use in military, medical, firefighting and emergency services sectors which have demanded the highest performance in specification.

They continue to expand into new sectors requiring specialist membrane technology for use in industrial and scientific markets. This has been due to the steady growth in demand for non-garment use waterproofing, moisture control, filtration and air permeability, within a range of applications, including electronics, acoustics and conservation.

For further information, please contact Dr Francis Clegg f.clegg@shu.ac.uk

