High Refractive Index Polymers for AR/VR Optics Applications

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Liquid crystals blend the properties of solids and liquids, combining liquid-like fluidity with partial orientational order which manifests in anisotropic properties (e.g. birefringence). Reactive mesogens (RMs) are a special class of liquid crystalline material which can be polymerised *in situ* to give a polymer that retains the structural anisotropy of the parent liquid crystal. Currently widely exploited in display devices, it is envisaged that augmented and virtual reality (AR, VR) applications demand a new generation of liquid crystalline materials with higher performance.

Some applications, including in AR/VR, require liquid crystalline polymers with carefully selected refractive index. Existing materials in this class have a number of drawbacks, and so the focus of this project is to understand the design rationale for current materials and ultimately to design and develop a new generation of materials targeting specific AR/VR requirements. This requires existing materials to be characterised experimentally and/or computationally, structure-property trends to be understood, and in parallel to undertake the synthesis and characterisation of a newer generation of materials.

The project is ideal for a student interested in synthetic chemistry, with an interest in materials design and evaluation. This project will develop skills not only in chemical synthesis and characterisation, but also in the characterisation of liquid crystalline materials, the preparation and study of polymeric systems from reactive mesogens, and relevant physical characterisation techniques (e.g. optical microscopy, Raman spectroscopy, X-ray scattering).

This studentship will be part-funded by the company Merck, who are the world leader in liquid-crystalline materials. Merck will provide significant technical know-how and oversight. At Leeds the student will have a unique opportunity to work with scientist from chemistry, computing, physics and engineering.

This project benefits from access to modern synthetic chemical laboratories (fully automated purification systems, continuous flow platforms, electrochemical and photochemical reactors), state-of-the-art equipment for materials characterisation in the Bragg Centre, and continuous interaction with Merck as a project partner.