Liquid crystals form the base of today’s multi-billion dollar display (LCD) industry. In the past decades, they have been optimised to serve specific goals in display technology, such as high contrast, high switching rates, etc. After this successful commercial application, we are now realising that we can use the special properties of liquid crystals to other goals. In the Molecular Materials group, for example, we use liquid crystals to control the morphology of new optoelectronic materials. This project, we will develop a new application of liquid crystals: a templating medium for the growth of aligned conducting polymers.

The goal of this “master-stage” project is to demonstrate the functionality of liquid crystal templating for the growth of anisotropic conducting films. Important tools are surface functionalisation (a key issue in controlling the macroscopic properties of the liquid crystal host and thus the polymer film), polymerisation conditions and characterisation of the conducting polymer films (electrochemistry, IR, scanning probe techniques, etc.). The project uses the materials that were developed in an earlier study. If necessary, additional material will be prepared using our protocols.
Nanostructures through liquid crystal templating

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Liquid crystal templating is a new concept for nanostructuring matter. This is of particular interest for the continuing miniaturisation of technology. In the Molecular Materials group, we are interested to apply this technique towards generating metallic patterns at nanometer length scales. The versatility of liquid crystals allows not only for control at the nanometer, but also at much larger length scales, which is important for converting nanostructure to devices. Here, the surface properties play a key role.

Figure 1. Ionic liquid crystal for nanopatterning: (a) examples of metal containing ILCs; (b) reduction results in metal deposition; (c) patterning of nanoelectrodes using the liquid crystal templating effect.

The goal of this “master-stage” project is to develop new materials that allow nanostructure formation, using the concept of liquid crystal templating with metal-containing liquid crystals (metallomesogens). You will be involved in the synthesis and characterisation of new materials. Application of the materials towards nanostructures and subsequent characterisation requires you to master a variety of techniques, including electrochemistry, AFM and STM.