Functional Liquid-Crystalline Polymers

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This presentation will deal with various functionalized liquid-crystalline (LC)-polymers. Their functionalization is due to (i) crosslinking and the properties of LC-elastomers, (ii) to the preparation of mesoscopic anisotropic colloids from LC-polymers and (iii) the formation of LC-phases from anisotropic inorganic nanoparticles with inherent functionality.

LC-elastomers (i) are soft solids, in which the director couples to the conformation of the polymer chains. That is why they can be used as actuators. Their use as actuators requires, however, their macroscopic orientation. This is usually achieved by a macroscopic orientation of films or fibers. We have recently succeeded in using micro-fluidics to obtain a lot of oriented micro-objects in one process, which change their shape on an external stimulus.

A second topic (ii) involves the preparation of anisotropic mesoscopic objects (anisotropic colloids) from LC-polymers and elastomers. We have developed two routes to these colloids. The first one involves dispersion polymerization of acrylate monomers in water or dimethylsiloxane as solvent. It leads to colloids of diameters in the range of 0.6 to 3 μm. Such colloids can be trapped in an optical tweezer and rotated The second route to LC-colloids starts with a miniemulsion process and yields smaller colloids of some 100 nm diameter.

At least (iii) anisotropic inorganic nanoparticles with semiconducting properties can be solubilized with a polymer coating. The highly concentrated solution thus accessible leads to the formation of lyotropic LC-phases. With this concept it gets possible to orient the semiconducting nanoparticles over macroscopic distances.