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Photo-Responsive Lyotropic Liquid Crystals using Unconventional Solvents

Liquid crystals combine the short to medium range order of crystalline structures with the macroscopic flow properties of liquids. They are of interest because of these and other properties, including optical birefringence. The azobenzene functional group readily forms liquid crystalline phases, and is of interest because of its ability to reversibly switch between trans and cis (E/Z) conformations when irradiated with UV and blue light respectively.

A range of azobenzene molecules based on the 4 ((4 hydroxyphenyl)diazenyl)benzoic acid motif, with varied amide coupling to the benzoic acid functional group have been synthesized for lyotropic liquid crystalline systems, allowing for a facile route to induce conformational change in the azobenzene and structural change in the aggregation of the molecules in the liquid crystal.

While azobenzenes typically have poor solubility in conventional solvent systems, they display good solubility in many more unconventional solvents including DMSO and ammonium containing ionic liquids (ILs). Ionic liquids generally have near zero vapour pressure and can be non-flammable, which makes them ideal candidates for a range of commercial applications.

The phase behaviour of these photo-stimuli responsive, lyotropic LCs has been determined using characterization techniques including polarizing light microscopy, SAXS, and SANS. Further development of these systems aims to create a range of responsive optical and optoelectronic materials as smart sensors and actuators.

Topic

Soft Matter

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