Chiral Isotropic Liquid and Bicontinuous Cubic Phases in Achiral Polycatenar LC Molecules

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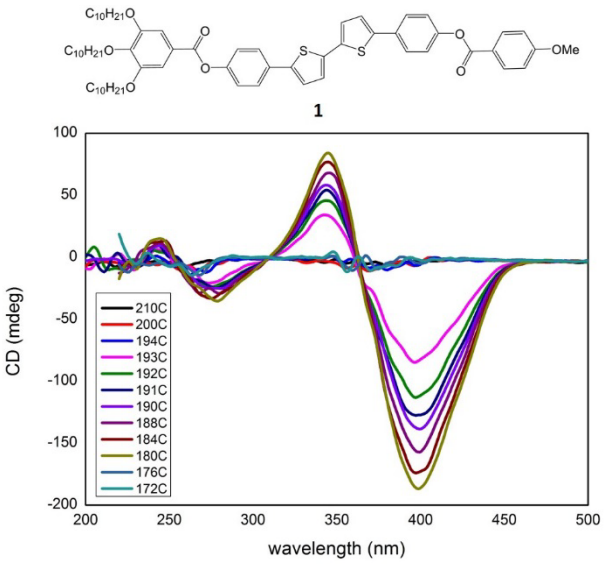
Recently, intriguing dynamic mirror symmetry breaking phenomena have been reported in the isotropic liquid[1], as well as in bicontinuous cubic phases consisting of infinite interpenetrating networks[2] formed by achiral polycatenar liquid crystalline compounds. Here we report the observation of chiral isotropic liquids formed by a series of achiral polycatenar rod-like molecules, and also the transition from chiral liquids to achiral bicontinuous $Ia\bar{3}d$ cubic phase. Compound **1** represents one of these polycatenar molecules based on a 5,5'-diphenylbithiophene core. According to small angle X-ray scattering (SAXS) results, on cooling of compound **1** from isotropic liquid, it transforms to the cubic $Ia\bar{3}d$ phase at 168 °C. Synchrotron circular dichroism (SRCD) spectra, on the other hand, show strong CD signals appear in the temperature range between 193 °C and 180 °C (see Figure), before they disappear on transition to the $Ia\bar{3}d$ phase. This indicates that a chiral isotropic phase is formed, prior to the formation of the cubic phase, from the ordinary achiral isotropic liquid phase. This is also confirmed by the presence of a DSC peak showing an exotherm at the first order liquid-liquid transition on cooling at 192 °C.



References

[1] C. Dressel *et al.*, *Nature Chem.*, **2014**, *6*, 971-977.
[2] C. Dressel *et al.*, *Angew. Chem. Int. Ed.* **2014**, *53*, 1-7.