Tailoring Columnar Self-Assembly by Soft Sulfur Interactions

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Disk-shaped polycyclic aromatic compounds forming columnar mesophases display various interesting properties such as 1D charge carrier mobility, photoconductivity and self healing of defects. However, from a practical point of view mesophase ranges are often above ambient temperature and clearing transitions are in many cases close to the decomposition temperature, thus limiting potential applications [1]. We anticipated, that incorporation of sulfur groups might solve the problem, because it is known from calamitic liquid crystals that sulfur improved both mesomorphic properties and charge carrier mobilities and led to decreased HOMO-LUMO gaps [2, 3]. However, for discotic liquid crystals this issue was less explored. Therefore we initiated a case study employing triphenylene crown ethers and derivatives thereof, where we could demonstrate, that successive replacement of alkoxy side chains by thioethers not only shifted the columnar mesophase to room temperature, but also affected the redox potential in a beneficial way [4]. The influence of the sulfur units was even more pronounced as compared to the introduction of branched side chains [5], suggesting the sulfur-sulfur interactions promote columnar self-assembly.

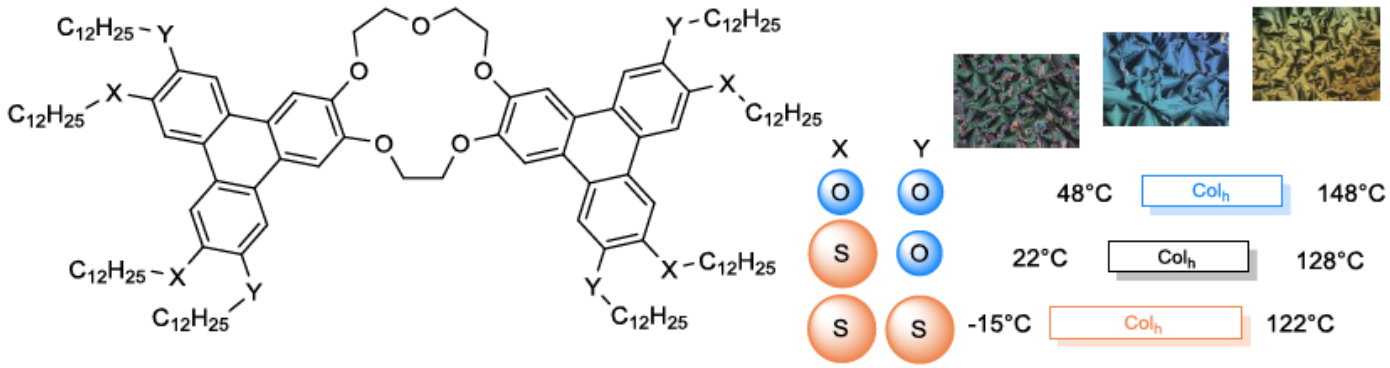

Figure 1: Effect of sulfur- vs. oxygen-containing side chains on mesophase behaviour

References

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