Search for new lyotropic smectic C* materials

Friederike Knecht[1], Christopher P. J. Schubert[2], Marc D. Harjung[1], Jan H. Porada[1], Robert P. Lemieux[2], and Frank Giesselmann[1]*

[1]*Instute of physical chemistry, University of Stuttgart, Stuttgart (DE)*

[2]*Department of Chemistry, University of Waterloo, Waterloo, ON (CA)*

The recent discovery of a new lyotropic liquid crystal phase, the structure and properties of which are analogous to the chiral ferroelectric smectic C-phase (SmC*) in thermotropics, was based on a tailored structure of the amphiphile **G10** (fig. 1a) in which a tilt-promoting 2-phenlypyrimidine core was linked to a chiral diol-headgroup *via* a hydrophilic ethylene glycol spacer [1]. However, so far there is only one example of this general amphiphile structure known to form the new lyotropic SmC* phase in mixtures with water and with formamide.

In an attempt to systematically elucidate the molecular requirements for the formation of lyo-SmC* phases [2] we here report three new amphiphiles leading to lyotropic SmC* phases. These amphiphiles are derived from the parent amphiphile structure by (i) an elongation of the hydrophilic ethylene glycol spacer, (ii) the inversion of the original 2-phenylpyrimidine core and (iii) its exchange by an even more tilt-promoting fluorenone core. The probably most striking effect was found in the case of the new amphiphile **G10inv** (fig. 1b), where the simple inversion of the 2-phenylpyrimidine core direction in the original **G10** structure led even in the neat **G10inv** material to a 30 K wide thermotropic SmC* phase, which is fully preserved in the lyotropic state up to formamide concentrations of at least 35 wt%.

Even though we were successful to enlarge the existing library of lyo-SmC* amphiphiles, our investigations also reveal that the formation of the lyotropic SmC* phase is highly sensitive to even minor changes in the molecular amphiphile structure.

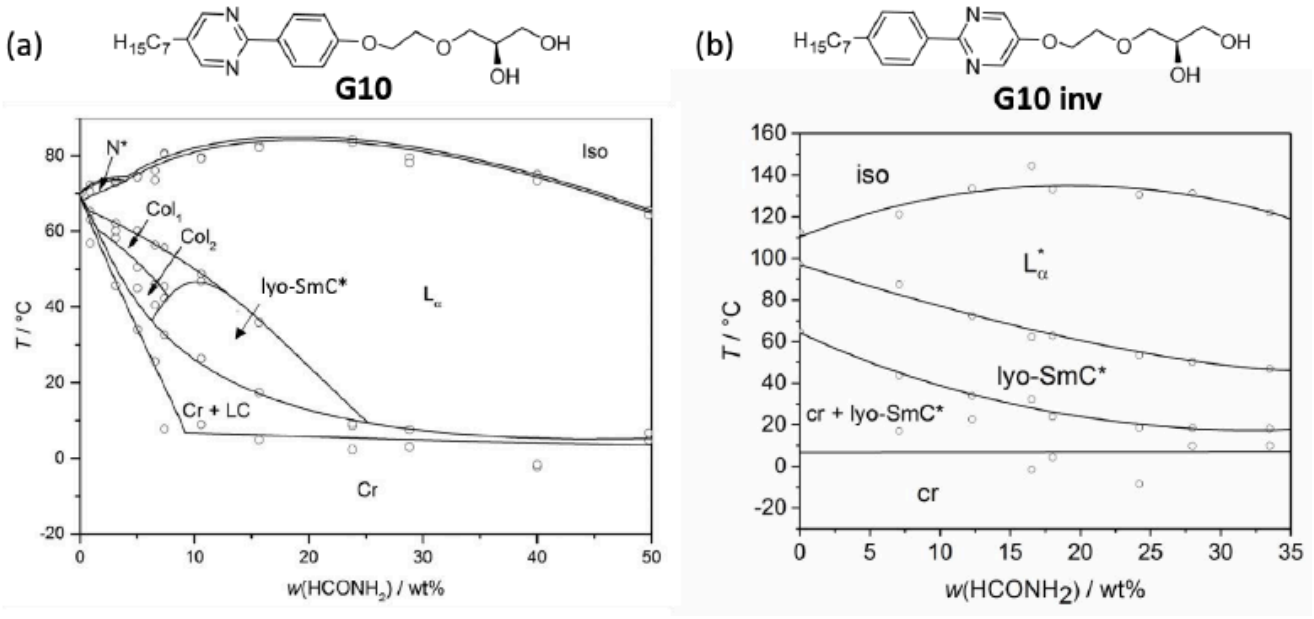

Figure 1: Phase diagrams of G10 with formamide on the left [2] and on the right the lyotropic system G10 inv with formamide. The chemical structures of G10 and G10 inv are shown above.

We thank the *Deutsche Forschungsgemeinschaft* for financial support (DFG Gi243/4).

References

[1] Johanna R. Bruckner, Jan H. Porada, Clarissa F. Dietrich, Ingo Dierking, and Frank Giesselmann Angew. Chem. Int. Ed. 52, 8934 –8937 (2013).

[2] Marc D. Harjung, Christopher P. J. Schubert, Friederike Knecht, Jan H. Porada, Robert P. Lemieux and Frank Giesselmann J. Mater. Chem. C 5, 7452-7457 (2017).

**Corresponding author e-mail: f.giesselmann@ipc.uni-stuttgart.de.*