THE EFFECT OF MESOGENIC CORE ON LIQUID-CRYSTALLINE BEHAVIOUR

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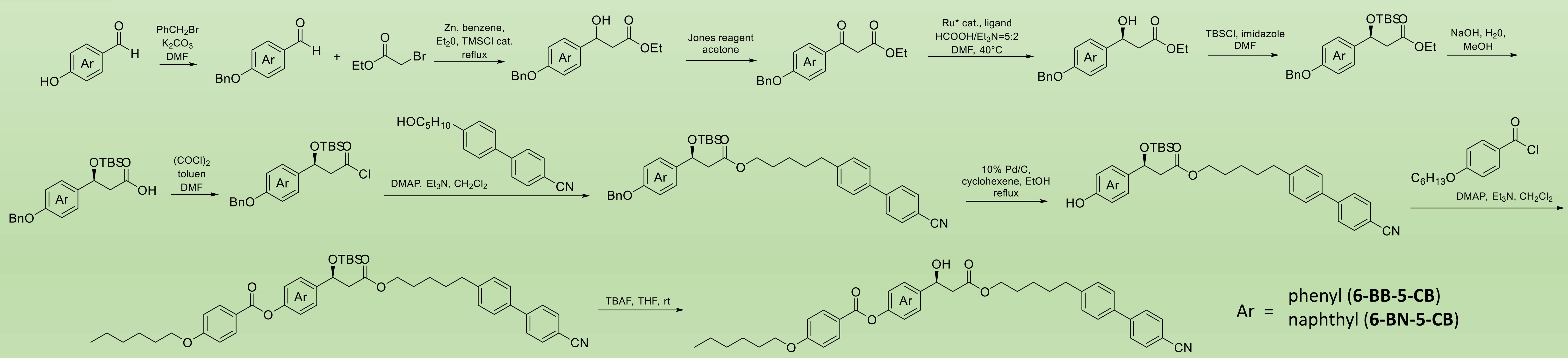
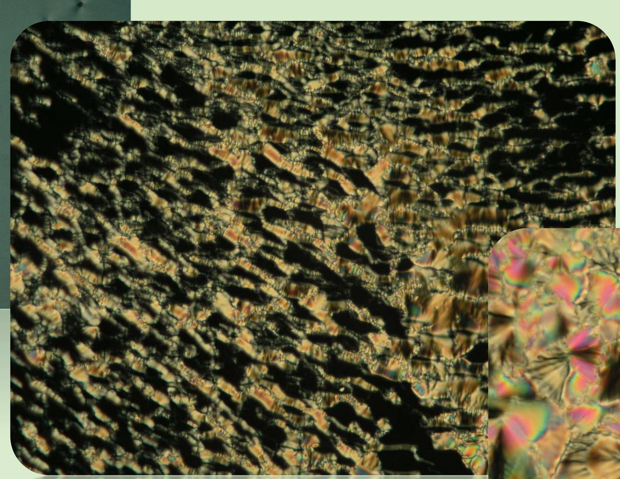
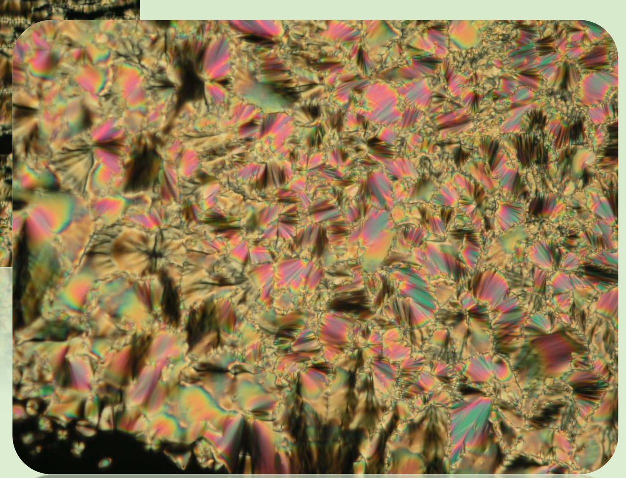
A liquid crystal (LC) is a state of matter that occurs between solid and liquid. There are many different types of liquid-crystal phases which can be distinguished by their different optical properties, such as POM (polarizing optical microscope) textures. The molecular shape influences the packing of molecules and also determines the longer-range attractive and repulsive forces responsible for the stability of liquid-crystalline phases. Changing the structure of the molecules enables investigation of structure-property relations (structure of the mesogenic units and the terminal groups, length of the spacer and the links between it and the mesogenic units). The chirality of molecules in LC has a remarkable influence on the macroscopic physical properties of these systems, including the appearance of new phases. We have synthesized LC molecules with chiral 3-aryl-3-hydroxy propanoate mesogenic core to investigate its influence on the formation of mesophases. Subtle changes in chemical structure can be used to tune the intermolecular interactions which then influence the thermal stability of the molecular arrangement.

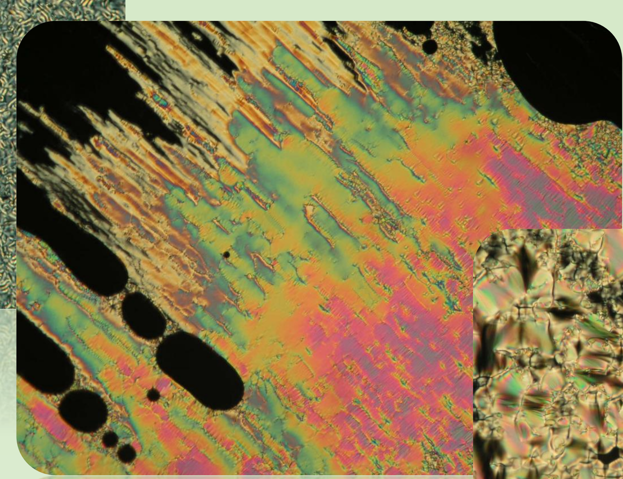
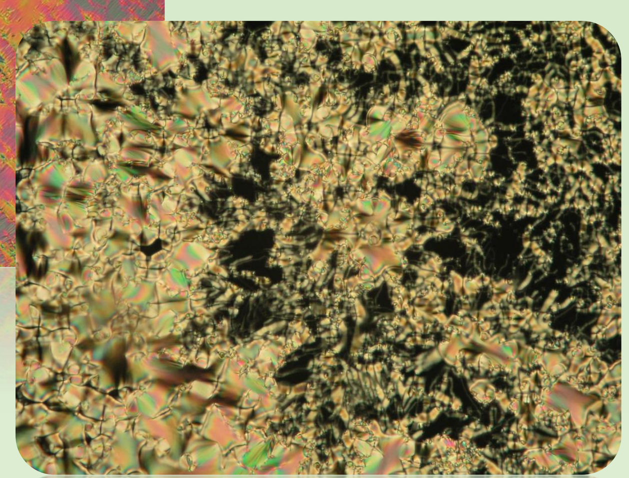
SYNTHESIS



MESOMORPHIC BEHAVIOUR

POM textures of **6-BB-5-CB** obtained on cooling: blue phase obtained in the planar cell (left); transition from blue phase to chiral smectic A phase (middle); fan-shaped texture of chiral smectic A phase (right)

POM textures of **6-BN-5-CB**: fingerprint texture of chiral nematic phase (left); oily streak texture of chiral nematic phase (middle); fan-shaped texture of chiral smectic A phase (right)

Dimer	Transition temperatures (°C) and associated enthalpies (kJ mol^{-1})
6-BB-5-CB	Cr[a] • 82 (SmA* • 40 • BP • 51) • I *40,28*[b] *2,07*[c] *0,03*[c]
6-BN-5-CB	Cr[d] • 80 (SmA* • 75) • N* • 111 • I *14,91*[e] *2,35*[c] *0,15*

Cr: crystalline phase; SmA*: chiral smectic A phase; BP: blue phase; N*: chiral nematic phase; I: isotropic liquid; (): monotropic phase; [a]: glassy state obtained on cooling at 20 °C, *Cp* = 0,17 J g^{-1} °C^{-1}, [b]: Cr – Cr transition at 72 °C in second heat run; [c]: obtained on cooling; [d]: glassy state obtained on cooling at 20 °C, *Cp* = 0,18 J g^{-1} °C^{-1}, [e]: combined enthalpies, Cr – Cr transitions at 68 °C and 80 °C

CONCLUSION

The targeted molecules **6-BB-5-CB** and **6-BN-5-CB** were synthesized using the same convergent approach.

The **6-BB-5-CB** exhibits a monotropic blue phase and fan-shaped texture characteristic for chiral smectic A phase. The exact blue phase is yet to be determined.

Fingerprint and oily streak texture of chiral nematic phase and fan-shaped texture of chiral smectic A phase were obtained from **6-BN-5-CB**.

The incorporation of a naphthyl group increases the density of polarizable π electrons and promotes interactions between mesogenic units which occurs in transition to isotropic phase at the higher temperature, stabilization of mesogenic properties and stabilization of smectic phase.

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