

The search for liquid crystals with stable ferroelectric phases

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Liquid crystals are soft-matter phases with a wide range of properties which makes them uniquely suited for many applications, e.g. in optics, lasers, robotics etc. Recently liquid crystalline phases exhibiting proper ferroelectricity have been discovered [1,2]. Spontaneous polar order was observed in the fluid nematic phase and in 1D-positionally ordered smectic phases. This new type of material exhibits electric polarization of order of several $\mu\text{C}/\text{cm}^2$, which is comparable with that of solid ferroelectrics, as well as giant values of dielectric permittivity, of order of 10^4 . Also phases exhibiting more complex molecular arrangements due to their strong polar order were described, e.g. twist-bend ferroelectric nematic phases with spontaneous heliconical structures and a pitch length comparable to visible light wavelengths [3]. On this poster I will present phase behaviour of four new mesogens belonging to the same homologue series and compare it to the behaviour six new mesogens of analogical structure. Depending on their structure the materials form various LC phases, with different degrees of positional order of molecules as well as polar order. The materials are characterized by the following methods: optical polarized microscopy, X-ray diffraction, differential scanning calorimetry, second harmonic generation, birefringence measurements, dielectric spectroscopy etc.

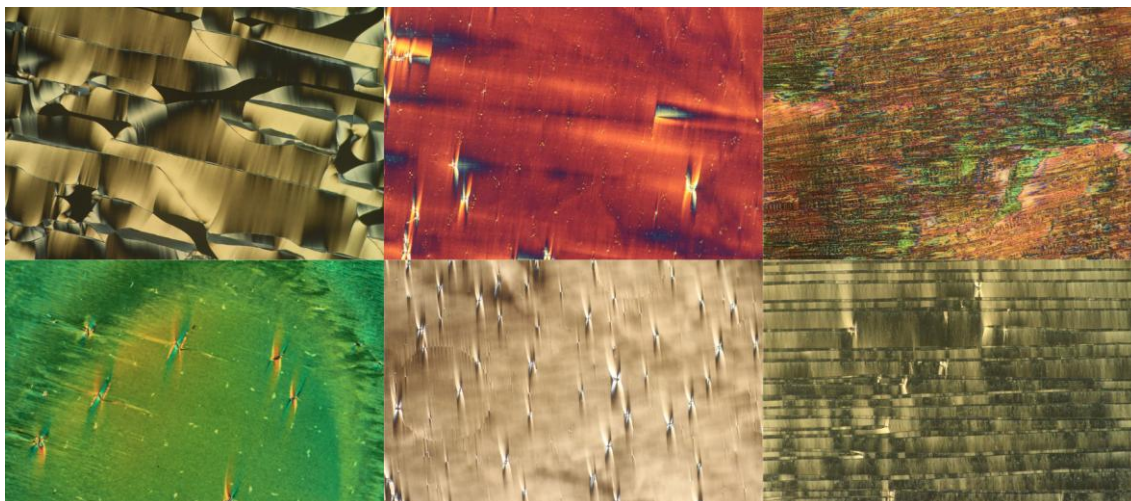


Figure 1. Examples of liquid crystal textures under the polarized optical microscope for different analysed materials.

Literature:

[1] Nishikawa H., Shiroshita K., Higgs D., et al., *Adv. Mater.* 2017, 29, 1702354.

[2] Mandle R. J., Sebastian N., Martinez-Peragón J., et al., *Nat. Commun.* 2021, 12, 4962.

[3] Karcz J., Rożycka N., Pocięcha D., et al., *Science* 2024, 384, 1096-1099.