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APPARENT BIAXIALITY ON CHOLESTERIC LYOTROPIC LIQUID CRYSTALS

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An apparent biaxial optical sign for a cholesteric lyotropic mesophase is reported. This effect was explained by the coexistence of a cholesteric helical array with a partially untwisted structure.

Liquid crystal optical signs can be determined by microscopy under polarized light.[1] Observations made on uniformly oriented thermotropic samples show that some smectic forms are optically biaxial while other classes, including nematic and cholesteric systems, have uniaxial character.[1-3] Determinations made on well-oriented lyotropic phases show that these systems are uniaxial,[4,5] although a few cases of biaxiality have been reported for some particular lyomesophases.[6,7] On the other hand, it is known that biaxial character can be induced by orientational defects like edge dislocations[8] or shear effects.[9]

In the present note, we report a case of apparent biaxiality in a cholesteric type II lyomesophase[10] with the following composition (% molar fraction): potassium laurate, 3.37; water (with 0.1% D_2O added), 94.94; 2-d-2-undecanol, 0.84; potassium hydroxide, 0.75 and cholesterol, 0.10.

Samples were contained in flat capillar cells, 0.3 mm in thickness. They were observed with a Zeiss polarizing microscope (model Universal) after orientation by a magnetic field of 1.4 T, which was applied parallel to the cell surface.

The chevron texture characteristic of type II lyotropic cholesteric mesophases[10] was obtained (Fig.1.a). In some samples, after a prolongated magnetic field action, regions with marked extinction were seen (Fig.1.b.). This pattern can be assigned to the partial helical untwisting due to localized wall effects.

Such regions were investigated under conoscopic illumination. The obtained pattern, shown in Fig. 2, is a characteristic of an off-centered acute bisectrix figure of biaxial systems.[11]

This biaxiality can be explained by the existence of two kinds of micellar arrangements: one corresponding to micelles remaining in an helical array, and another associated to micelles in a nematic arrangement, originated from the helical untwisting.

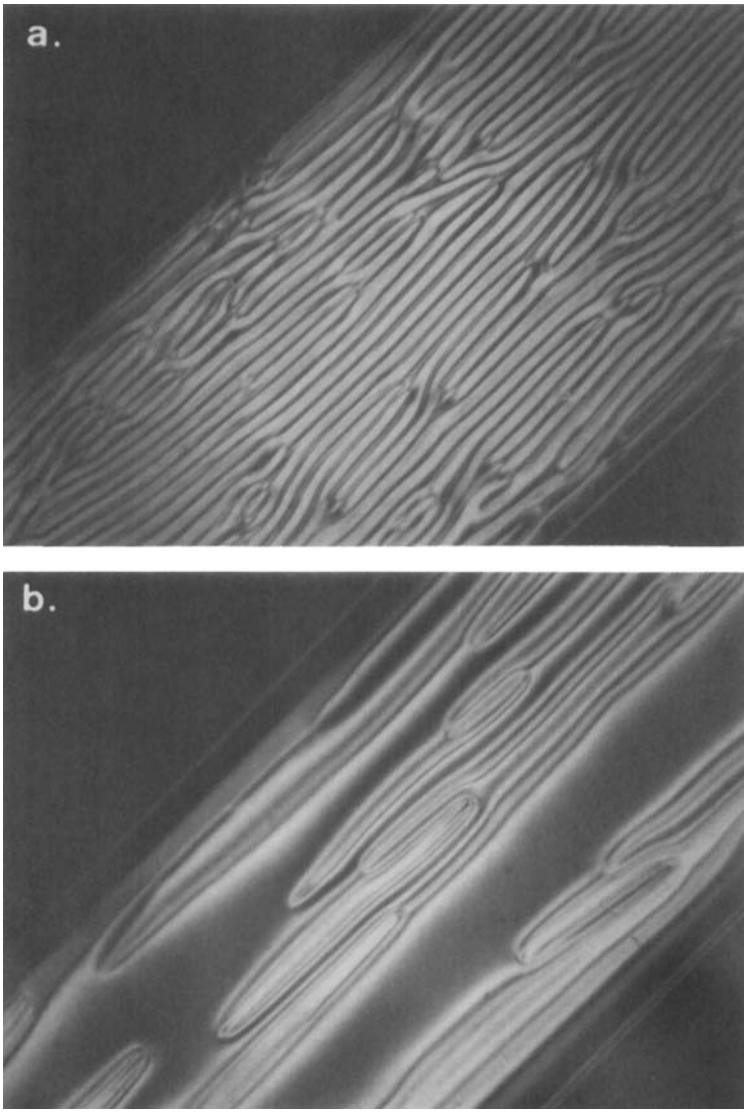

FIGURE 1. Type II cholesteric lyomesophase textures (capillar width = 6mm; crossed polarizers.) a) Magnetically oriented samples. b) Partially untwisted sample. See Color Plate I, issue 12, volume 102.

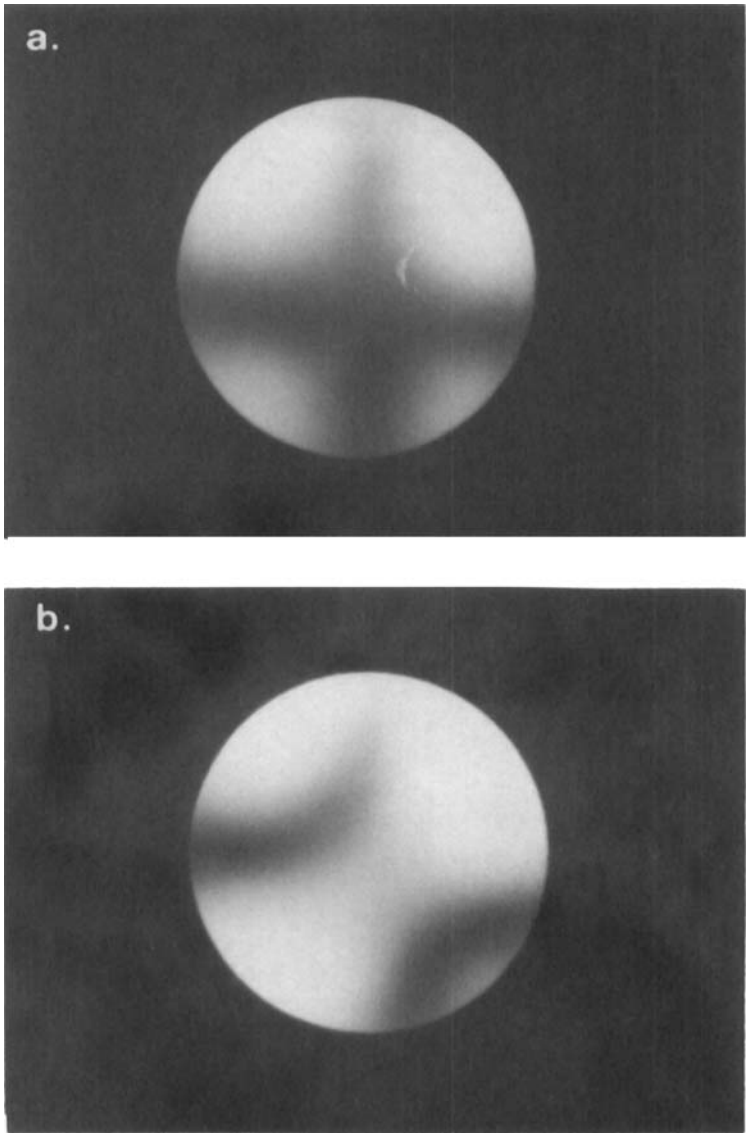

FIGURE 2. Biaxial off-centered acute bisectrix figure.
a) Extinction position. b) 45° postion. See Color Plate II, issue 12, volume 102.

The partial unwinding of the cholesteric structure led to a very special situation, in which biaxial domains were developed in the sample. Therefore, this biaxiality cannot be considered as an intrinsic characteristic of this lyotropic cholesteric mesophase, but should be regarded as an apparent effect.

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