Alignment of discotic liquid crystal films for organic optoelectronics

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Liquid crystals made of disk-shaped aromatic molecules assembled into columnar stacks (1) are absorbing materials known for their outstanding optical and electronic features. These discotic materials self-assemble in large oriented domains and may be used in different devices such as solar cells or compensation layers in liquid crystal displays. To benefit from their good optoelectronic properties, the organization of columnar liquid crystals has to be controlled in oriented thin films in the thickness range of about 100 nm. Uniaxial planar anchoring (columns parallel to the interface) is needed for applications such as polarizers, whereas a homeotropic alignment (columns normal to the interface) is required for solar cells (2).

Different methods to control the orientation in open supported thin films will be presented, which make possible to achieve either homeotropic (2) or uniaxial planar alignment (3). On one hand, based on these orientation processes, a complete study of the anisotropic optical properties with the determination of the anisotropic complex optical indices as a function of the light wavelength has been performed (3). On the other hand, a uniform ultra-thin film, homeotropically oriented, has been achieved (down to thickness of about 50 nm), opening the way towards efficient solar cells based on self-organized discotic materials (4).

References:

(1) S. Saïdi-Besbes, E. Grelet, H. Bock *Angew. Chem. Int. Ed*. **2006**, *45*, 1783.
(2) E. Grelet and H. Bock *Europhys. Lett.* **2006**, *73*, 712.
(3) E. Charlet, E. Grelet *Phys. Rev. E* **2008**, *78*, 041707.
(4) E. Charlet, E. Grelet, P. Brettes, H. Bock, H. Saadaoui, L. Cisse, P. Destruel, N. Gherardi, and I. Seguy *Appl. Phys. Lett*. **2008**, *92*, 024107.

Figure: Growth of a hexagonal columnar liquid crystal in homeotropic orientation in the geometry of open supported thin film. Observation by optical microscopy (200µm x 150µm).