Transient Biaxial Order Reconstruction in Nematic induced by modulated electric signals

R. Hamdi, H. Ayeb, G. Lombardo, M. De Santo, R. Barberi

CNR-INFM LiCryL – Liquid Crystal Lab., Physics Dep., University of Calabria, via P. Bucci, Cubo 31/C, Rende, Italy

Recent experiments and theoretical studies on highly frustrated nematic liquid crystals cells have demonstrated the possibility to induce, inside a calamitic phase, a transient bulk biaxial order to connect topologically different nematic textures. This is, for instance, the case of a nematic π-cell, in which a strong electric field induces a splay to bend transition without any director rotation, by means of the exchange of two eigenvalues of the tensor order parameter Q of the nematic material. The electric switching between these two different nematic textures is due to the formation of a transient bulk biaxial wall,effect which is known as "nematic biaxial order reconstruction"[1-7]

This work will present experimental results and numerical investigations, based on Q-tensor description, about the possibility to control the electrically induced biaxial order reconstruction threshold inside a π-cell by modulating the electric signal. These results are relevant both from a fundamental point of view, for a better understanding of the nematic order, and for applications, as they allow to decrease the amplitude of external fields inducing nematic order reconstruction. Note that order reconstruction is, for instance, always present in all kinds of known bulk bistable devices, even when only defects are created or destroyed. This is the case, for instance, of "zenithal bistable electro-optical devices" [8] and "postaligned bistabile nematic displays" [9].

References:

(1) Martinot-Lagarde.Ph., Dreyfus-Lambez.H., Dozov.I, Phys. Rev. E. **2003**, 67, 051710.

(2) R. Barberi, F. Ciuchi, G. Durand, M. Iovane, D. Sikharulidze, A. Sonnet, and E. Virga, Eur. Phys. J. E **2004,** 13, 61.

(3) R. Barberi, F. Ciuchi, G. Lombardo, R. Bartolino, G. Durand, Phys. Rev. Lett. **2004,** 93, 137801.

(4) B. Zappone, Ph. Richetti, R. Barberi, R. Bartolino and H.T. Nguyen, Phys. Rev. E **2005,** 71, 041703.

(5) F. Ciuchi, H. Ayeb, G. Lombardo, R. Barberi, G.E. Durand, Applied Physics Letter, **2007,** 91, 244104.

(6) G.Lombardo, H.Ayeb, R. Barberi, Phys. Rev. E **2008,** 77, 05178.

(7) G. Lombardo, H. Ayeb, F. Ciuchi, M.P. De Santo, R. Barberi, R. Bartolino, E.G. Virga, G.E. Durand, Phys. Rev. E **2008,** 77, 020702(R) .

(8) G. B. Bryan-Brown, C. V. Brown, J. C. Jones, E. L. Wood, I. C. Sage, P. Breet, and J. Rudin, Proceedings of SID XXVIII, **1997** p. 37.

(9) S. Kitson and A. Geisow, Appl. Phys. Lett. **2002,** 80, 3635.