Quasi-stable nematic liquid crystal director reorientation under the influence of focused Gaussian laser beam and electric fields

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1. Introduction

For liquid crystals with positive dielectric anisotropy a torque is generated in the liquid crystal to align the highest polarizability with the electric field, in order to get an equilibrium with minimal energy density in the system.

2. Director reorientation due to the laser beam and electric fields

We report on the generation of quasi-stable domains (Fig. 1) in nematic liquid crystal due to the combined influence of optical and electric fields. The generated domains are an order of magnitude larger than the size of the optical field profile due to a leverage mechanism. To achieve the formation of quasi-stable domains with opposite tilting with respect to the rest of the cell, the optical field needs to be applied first. The final reorientation strongly depends on the starting conditions and properties of this optical field. It reverses the pre-tilt and an additional application of the voltage amplifies it dramatically.

3. Conclusion

The resulting reorientation of the director due to the joint influence of the focused Gaussian laser light and the electric field leads to an unusual refractive index profile which itself causes lensing effects. Our experiments confirm the concept of competitive switching when simultaneously electrical and optical torques are present in a nematic liquid crystal [1].

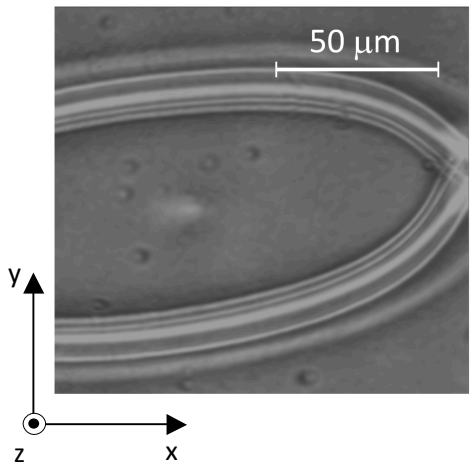

Fig. 1 Microscope transmission image of planar NLC, seconds after switching on the voltage. The preliminary present IR laser beam (inducing the spot near the middle) has inclination angle of 10°.

References

[1] J. Beeckman, K. Neyts, W. Cort, A. Madani, "Non-linear light propagation and bistability in nematic liquid crystals", Proceedings of the SPIE, Volume 7414 (2009).

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