Magnetic control of flexoelectric domains in a nematic fluid

P. Salamon, 1,* N. Éber, 1 Á. Buka, 1 T. Ostapenko, 2 S. Dölle, 2 and R. Stannarius 2

1 Institute for Solid State Physics and Optics, Wigner Research Centre for Physics, Budapest, Hungary
2 Otto-von-Guericke Universität, Magdeburg, Germany

The formation of flexoelectric stripe patterns (flexodomains [1–4]) was studied under the influence of external electric and magnetic fields in a nematic liquid crystal [5]. Experimental investigations were performed using a planar cell filled with a rod-like liquid crystal in three geometries: applying a magnetic field parallel, oblique, and perpendicular to the rubbing direction (Fig. 1).

The appearance of flexodomains was studied as the function of applied voltage at constant values of magnetic field. The critical voltage and wave vector of the pattern were determined as the function of magnetic field in all geometries. It has turned out that the magnetic field significantly influences the critical parameters. In the parallel and oblique geometries, the magnetic field dependence of the critical voltage and wave vector is monotonic, however, the behavior is different. In the perpendicular geometry, the critical parameters depend on the magnetic field non-monotonically.

Besides the experiments, the critical voltage and wave vector of flexodomains were calculated numerically as the function of the magnetic field in the parallel and perpendicular geometries. The results were obtained by the linear stability analysis of the continuum theoretical descriptions assuming elastic anisotropy. The experimental and numerical results agree quantitatively.

Fig. 1 The measurement geometries referred to as parallel, oblique, and perpendicular. The plane of the sandwich cell lies in the plane of the figure (x-y plane), the observation direction and the electric field is parallel to the z-axis.

References:

* presenting author; E-mail: salamon.peter@wigner.mta.hu