Homeotropic to planar realignment of nematicliquid crystal cell induced by self-assembled photosensitive layer

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Photoalignment of liquid crystals (LCs) is a well known and widely used effect [1]. The usual principle of the effect is the light modification of a photosensitive layer on the LC cell substrates, which determinesa particular orientation of LC film.

In this study, we propose a simple and effective method of the liquid crystal (LC)photoalignment which does not require any preliminary treatment of the cell substrates. The main idea is using a small dopant of photosensitive compound, which is spontaneously absorbed from the LC bulk onto the substrate forming a “command surface”.

We used a typical nematic liquid crystal (E7) doped with an azobenzene carboxylic acid compound. The LC was filled into a plane-parallel glass cell. Initially, the LC has homeotropic alignment. The linearly polarized UV light illumination causes the trans-cis photoizomerization process, and the boundary conditions varied from hometropic to planar. The easy axis orientation is found to be perpendicular to the UV light polarization, which is typical for azobenzene orienting layers. The reverse transition can be caused by the blue light illumination or occur spontaneously during the thermal cis-trans relaxation.It was shown that the effect does not depend on the concentration of carboxyl azobenzene compound, when it exceeds 0.05 wt %.

This approach can be useful for the preparation of particular LC alignment in confined geometries,for instance, in capillaries and microcavities, where the direct surface treatment is hindered.

The study was supported by the Russian Science Foundation, project no. 18-72-00242.

[1] O. Yaroshchuk and Yu. Reznikov, Photoalignment of liquid crystals: basics and current trends, J. Mater. Chem. 22, 286–300 (2012).