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Evolution of light-induced anchoring in dye-doped nematics: Experiment and model

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A series of experiments was carried out to describe the evolution of light-induced anchoring in dye-doped nematic liquid crystals (LCs) at irradiation with polarized light. The experiments included cells filled with a pure pentyl-cyanobiphenyl (5CB) and containing a layer of azo dye deposited on an aligning film, as well as cells filled with azo dye doped 5CB, which allowed us to distinguish the role of "surface" and "bulk" dye molecules in the evolution of light-induced anchoring. Modifications of the spectra of spontaneously adsorbed dye molecules under illumination enabled us to assert that light-induced desorption is a mechanism responsible for producing an easy orientation axis in a dark-adsorbed layer. We found that the evolution of light-induced anchoring involves a competition between light-induced desorption and adsorption of the dye molecules on the aligning surface, and the final anchoring is determined by the total light irradiation dose. These data allowed introducing a theoretical model of light-induced anchoring of dye-doped nematic LCs that quantitatively described the experimental results and portrayed the whole evolution of the dye-doped LC cell at irradiation.

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