Light induced changes in chiral liquid crystals with variable viscosity.

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Light induced changes in liquid crystals have attracted attention of scientific community for many years due to possible applications in such areas as information recording, signal processing and, more recently, lasing \cite{1,2}. Recently, a novel class of azo dyes with chiral groups extended possible applications of azo-doped liquid crystals towards devices exploring the properties of photonic band gap structure of chiral materials. In these materials trans-cis-isomerization of azo molecules results in changes of their twisting power in liquid crystalline matrix.

In this work the synthesis of novel chiral azo dyes is presented. Liquid crystals doped with these azo-dyes display structural and spectral changes under UV light irradiation. Isomerization of dyes results in changes of twisting power that in turn translates into a wide range of structural transformations and spectral changes. These changes were found to depend not only on the structure of chiral dopants and changes of their twisting power, but also on anchoring energy, thickness, geometry and viscosity of the samples. The dependence of optical properties on viscosity was studied in detail. Chiral liquid crystalline materials with high viscosity are also viscoelastic. Their viscoelasticity leads to sensitivity of their mechanical properties to light irradiation (samples shrink or extend depending on the direction of trans-cis-isomerization). The influence of local temperature on structural changes in chiral liquid crystals is thoroughly studied. It is shown that in viscoelastic samples the increase of local temperature may account for for 30\%-40\% of the magnitude of the observed effects. The model describing structural transformations in terms of increased local temperature and trans-cis-isomerization is presented.

Finally, the behaviour of liquid crystals with varying viscosity is compared in terms of the strength of their mechanical and optical response.

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References:

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