

Information recording in photosensitive photonic cholesteric liquid crystals

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We propose a new method of information recording based on the photo controllable shift of the selective reflection wavelength in photo sensitive cholesteric liquid crystals.

We used a cholesteric mixture with photoisomerizable molecules and planarly oriented CLC layer sandwiched between two glass plates. Under UV irradiation the CLC layer changes the selective reflection wavelength. Through a mask covering the pattern, gratings in this structure were recorded. A polymer stabilizer was doped to the mixture to avoid fluidity of the CLC after preparation of the pattern.

In our experiments we used a cholesteric mixture of the nematic Zhk-440 (from NIOPIK, Moscow) and optically active dopant MLC-6248 (from Merck, Germany). Zhk-440 is an azoxy-component mixture of 2/3 p-n-butyl-p-methoxyazoxybenzene and of 1/3 p-n-butyl-p-heptoniloxazoxybenzene. It is enough transparent in the visible range of spectrum and absorbs in the UV part (Fig.1).

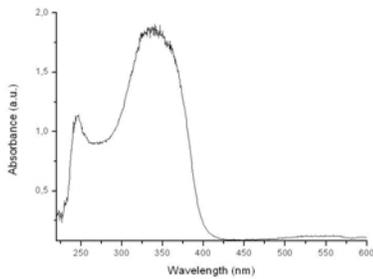


Fig.1. Absorption spectrum of Zhk-440

The used chiral dopant MLC-6248 is a transparent and non photo sensitive compound whose concentration in the CLC mixture is responsible for the selective reflection wavelength of the CLC layer. The mixture 70.7%Zhk-440 + 29.3%MLC-6248 was selected due to its most suitable photo- and thermo-optic parameters. The temperature dependence of selective reflection wavelength of this mixture near room temperature is quite weak (Fig.2).

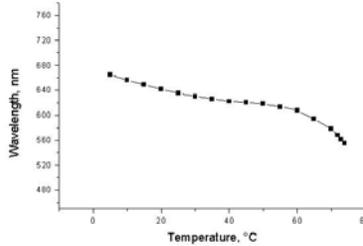


Fig.2. Temperature dependence of the selective reflection wavelength.

Exposure to UV shifts the selective reflection band (color) from red to green (Figs.3,4). The shift of reflection band depends on exposure time and thickness of the cell. A 100W Mercury lamp was used as a light source.

By means of a mask covering the pattern, gratings in these structures were recorded (Fig.5). The gratings represent interchanging color stripes. The difference between colors depends on the exposure time. In Fig.6 besides gratings the exposed and initial areas of the sample are also shown.

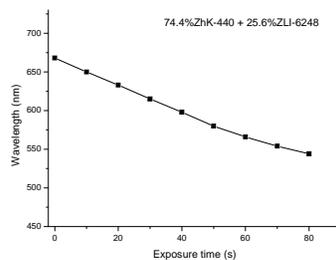


Fig.3. Dependence of the selective reflection peak on the exposure time for a 20µ-thick planarly oriented CLC layer sandwiched between two glass plates.

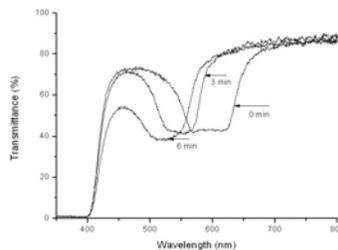


Fig.4. Shift of the selective reflection peak due to UV exposure time.



Fig.5. Gratings recorded in the CLC layer. Upper and lower parts correspond to different exposure times.

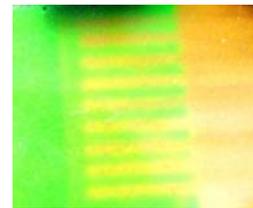


Fig.6. Gratings recorded in the CLC layer are seen in the middle of the sample. The initial (not exposed) and exposed areas (right and left parts, respectively) are also shown.