8-5 Light Scattering in Nematic-Cholesteric Mixtures at a low electric field

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The existence of an optical storage effect in nematic-cholesteric systems is well known.[1-5] It has also been evidenced that the lifetime of the optical storage effect can be adjusted to any value.[6] However the usefulness of this effect for display purposes is limited because the contrast ratios are smaller compared with dynamic scattering.

We present a preliminary investigation of another electro-optic effect in nematic-cholesteric systems doped with organic quaternary ammonium halides. This system has no storage effect but has a strong light scattering effect and a sharp and low threshold.

Concentration of cholesteric LCs in nematic LCs are varied from 0.1% to 0.6% by weight. The experimental setup is described in Fig.1.

The threshold voltage(V_{th}) of light scattering is extremely lowered with increasing the concentration of the cholesteric LC(Fig.2). V_{th} value was 5V at 0.4-0.5% by weight. In these conditions, it is recognized with microscopic observation that no "dynamic scattering" occurs but "finger-print" pattern[6] is formed(Fig.3(a)). "Dynamic scattering" follows it at a higher voltage(Fig.3(b)).

It is assumed that this effect is due to "domain scattering" intensified by the cholesteric LC. The light intensity of this new scattering mode is as strong as of "dynamic scattering", so a display device which is operated at a low voltage and has high contrast will be able to be provided.

The dependence of the scattered light intensity on a viewing angle has also been investigated. The scattering angle of this effect is similar to that of various field effect modes.

We also investigated about homeotropically oriented devices. The difference between a compound contained a cholestericLC and a compound not contained is obvious in Fig.4. It is detected that the compound not contained cholesteric LC(Fig.4(a)) scatters slightly in the low field region. On the other hand the compound contained the cholesteric(Fig.4(b)) scatters strongly in the same region.

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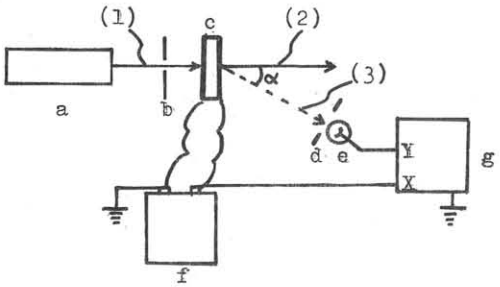


Fig.1 Experimental setup
a;He-Ne laser b;pinhole c;LC cell
d;apperture e;photocell f;functional power supply g;X-Y recorder
(1)incident light (2)direct transmissive light (3)scattered light
α:viewing angle

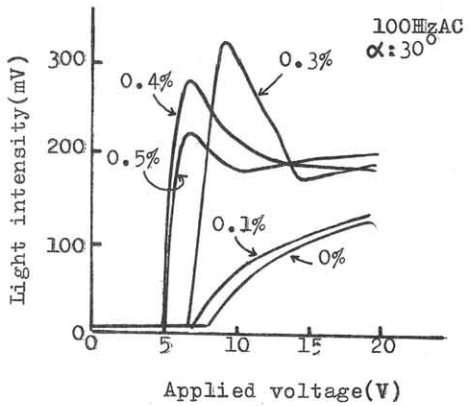
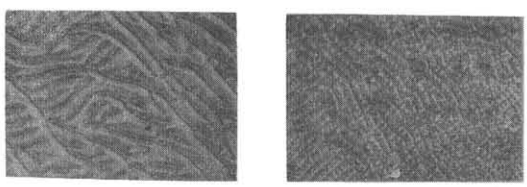


Fig.2 Relation between light intensity and applied voltage in cholesteryl nonanoate(CN) contained systems
Base:MBBA/EBBA
Parameter:CN concentration



(a) 6V applied (b)15V applied

Fig.3 Microscopic observation of a cholesteric LC contained compound at 100HzAC
MBBA/EBBA/CN(0.5%)

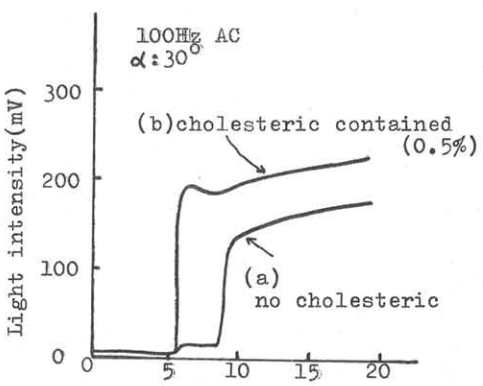


Fig.4 Relation between light intensity and applied voltage in homeotropically oriented devices
Base:MBBA/EBBA