Ordinary and extraordinary refractive indices change of an in-plane-switching blue phase liquid crystal cell

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Abstract

We measured the variations of ordinary refractive index (δn_o) and extraordinary refractive index (δn_e) of an in-plane-switching (IPS) blue phase liquid crystal (BPLC) cell by varying the driving voltage. Theoretically, the value of $\delta n_e / \delta n_o$ should be 2.[1-2]

Experiment and Discussion

The cell parameters are listed in Table I. The polarization-microscope photograph and the transition temperatures are shown in Fig. 1. The measurement setup shown in Fig. 2 is composed of an dual-frequency laser, polarizing beam splitter, and retroreflectors.

Table.1	IPS Room	Temperature	BPLC	Cell	Data
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cell gap	7.3 μm		
electrodes' wide	8 μm		
electrodes' spacing	12 μm		
host nematic LC	LCM10 ($\Delta \epsilon \sim 3$) 78wt%		
	NYCL 22 wt% (left-		
chiral dopant	Handness chiral molecules)		



Fig.2 Dual-frequency laser measument setup.

When the driving electric field is perpendicular (parallel) to the light polarization direction, δn_o (δn_e) can be measured. The experimental result is shown in Fig. 3. It can be found that the value of $\delta n_e / \delta n_o$ is about 1.58 and is different from the theoretical value 2. This result may cause by the non-uniform fringe field.

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References

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LCM10 (Δε~3) 77.93wt% + NYCL 22.07 wt%



Fig.1 Phases transition of the IPS BPLC cell



Fig. 3 Relationship between (a) δn_o (b) δn_e and voltage.