Behavior on field-induced optical axis of BPIII

Sheng-Feng Lu\(^1\)*, and Hui-Yu Chen\(^2\)

\(^1\)Dept. of Photonics, Feng Chia University, Taichung, Taiwan
\(^2\)Department of Physics, National Chung Hsing University, Taichung, Taiwan

Blue phases (BPs) appear in a narrow temperature region at the isotropic phase boundary when the chirality in a liquid crystal (LC) material is strong enough. BPs are classifiable into three distinct phases: blue phase I (BPI), blue phase II (BPII), and blue phase III (BPIII) [1]. Because the temperature range of BPIII is the narrowest, only few papers discuss the electric-optic effect in BPIII [2]. By applying a vertical electric field, the reflection intensity of BPIII can change, but the reflection wavelength does not [3]. Moreover, by an in-plane-switching field, BPIII can switch from optically isotropic to anisotropic state. Although this optical isotropy/anisotropy switching is already explained by Kerr effect [4], the research on BPIII still stops on the earlier stage. In our previous experiment [5], by detecting the polarization state of the transmitting light through the BPIII cell and calculating the field-induced birefringence, we found that the induced birefringence saturates in the high voltage regime, but the transmitting intensity does not. It implies that Kerr effect can not explain the electro-optical behaviour of BPIII.

In this summary, a wide-temperature-range BPIII material (>15°C) without a polymer network is used to discuss its electric-optic behavior. When the BPIII cell is applied the electric field, the field-induced optic axis which paralleled the electric field was seen in Fig. 1. We measured the azimuth angles and the polar angles of the field-induced optic axis under application of various applied voltages in Fig. 2. From the preliminary experimental results, we suggests that the field-induced optic axis is rotated by the electric filed in three dimensions. It induced a special electro-optical phenomenon, which may be explained both by Kerr effect and flexoelectric effect.

Acknowledgement

The authors would like to thank the National Science Council of the Republic of China for financially supporting this research under Grant No. NSC 101-2112-M-035-001-MY3.

References:


* E-mail: amused8076@hotmail.com

---

Figure 1. Field-induced optic axis of BPIII.

Figure 2. (Left) The azimuth angles of optical axis for maximum and minimum light intensities. (Right) The ratio of polar angles and field-induced light intensity under varied voltages.