

Supplementary Materials

# Effect of Amorphous Crosslinker on Phase Behavior and Electro-Optic Response of Polymer-Stabilized Blue Phase Liquid Crystals

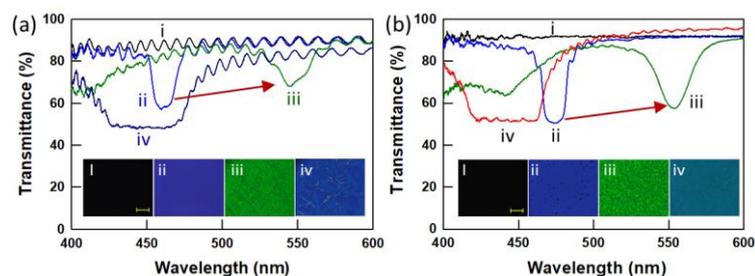
Kyung Min Lee <sup>1,2\*</sup>, Urice Tohgha <sup>1,2</sup>, Timothy J. Bunning <sup>1</sup>, Michael E. McConney <sup>1</sup> and Nicholas P. Godman <sup>1,\*</sup>

<sup>1</sup> Materials and Manufacturing Directorate, Air Force Research Laboratory, Wright-Patterson AFB, OH 45433, USA; urice.tohgha.ctr@us.af.mil (U.T.); timothy.bunning@us.af.mil (T.J.B.); Michael.McConney.1@us.af.mil (M.E.M.)

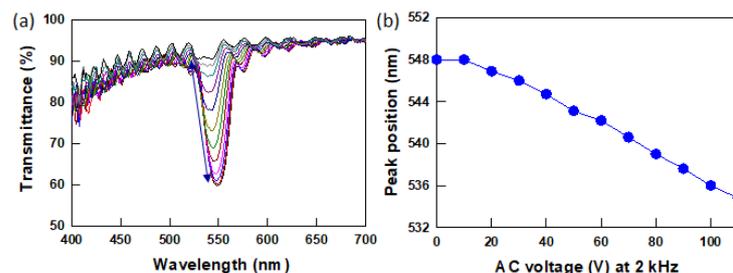
<sup>2</sup> Azimuth Corporation, Fairborn, OH 45431, USA

\* Correspondence: kyungmin.lee.3.ctr@us.af.mil (K.M.L.); nicholas.godman.2@us.af.mil (N.P.G.)

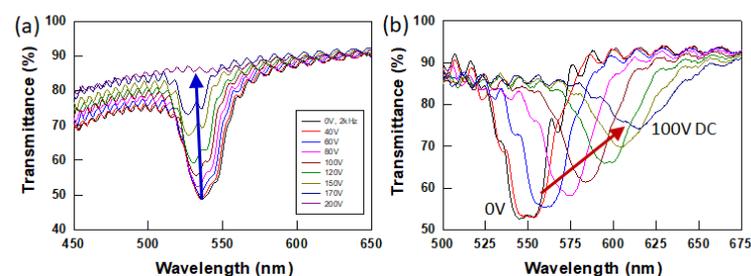
## Supplementary Materials



**Figure S1.** Transmission spectra and POM images of (a) BPLC-1 at (i) 47 °C (isotropic), (ii) 45.5 °C (BP-II), (iii) 43 °C (BP-I) and (iv) 22 °C (CLC phase) and (b) BPLC-2 at (i) 45 °C (isotropic), (ii) 42 °C (BP-II), (iii) 39 °C (BP-I) and (iv) 22 °C (CLC phase) in an aligned cell. Transmission spectra and POM images are monitored during cooling at a rate of 0.1 °C min<sup>-1</sup>. Scale bar in the POM images is 200 μm. 11.2 μm thick cells were used.

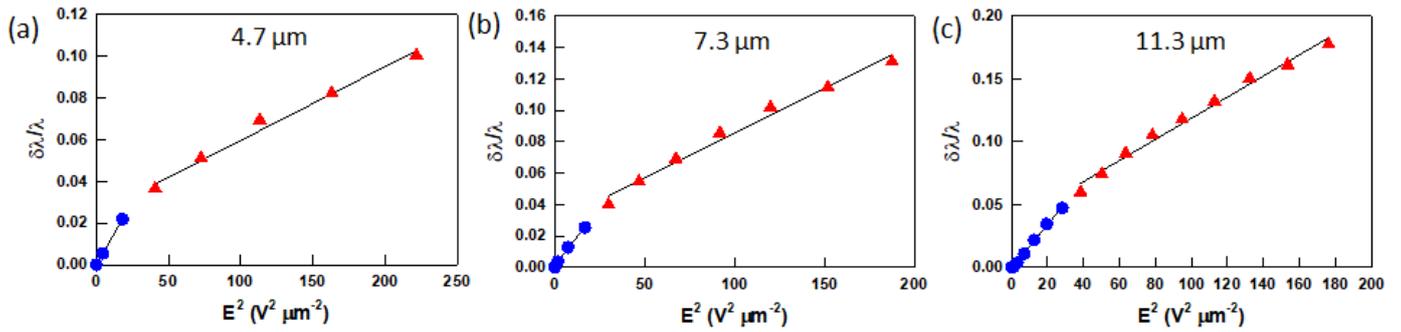


**Figure S2.** (a) Reflective to transparent switching response of 4.7 μm thick PSBPLC-3 and (b) summary of peak positions while stepping up AC voltage to 110 V at 2 kHz.

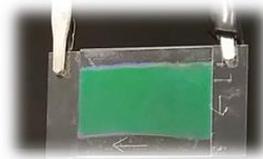


**Figure S3.** (a) AC field induced switching response between reflective and transparent states and (b) DC voltage induced redshift of the reflection band of 11.3 μm thick PSBPLC-4.

To obtain the electrostriction coefficient, the Kerr effect is neglected and only the residual lattice distortion along the field axis ( $\Delta\lambda/\lambda_0 \sim RE^2$ ) is considered, where  $R$  is the electrostriction coefficient,  $\Delta\lambda$  is the tuning range ( $\Delta\lambda = \lambda_v - \lambda_0$ ), and  $E$  is the electric field strength [1]. PSBPLC-3 with various cell thicknesses exhibits electrical strain coefficients ranging from  $1.2$  to  $1.7 \times 10^{-3} \mu\text{m}^2 \text{V}^{-2}$  at low DC voltages and  $3.6$  to  $8.4 \times 10^{-4} \mu\text{m}^2 \text{V}^{-2}$  at high DC voltages, as can be seen in Figure S4. This slope change indicates the lattice distortion and requires further study.



**Figure S4.** Fractional residual lattice distortion  $\Delta\lambda_c/\lambda_0$  as functions of electric field intensity  $E^2$  of PSBPLC-3 with various cell thicknesses (a)  $4.7 \mu\text{m}$ , (b)  $7.3 \mu\text{m}$ , and (c)  $11.3 \mu\text{m}$ .



**Video S1:** Switching response of PSBPLC-3 when an AC voltage (100 V at 2 kHz) is applied and removed.



**Video S2:** Red tuning response of PSBPLC-3 when a DC voltage increases to 150 V.

## References

1. Guo, D.-Y.; Chen, C.-W.; Li, C.-C.; Jau, H.-C.; Lin, K.-H.; Feng, T.-M.; Wang, C.-T.; Bunning, T. J.; Khoo, I. C.; Lin, T.-H. Reconfiguration of three-dimensional liquid crystalline photonic crystals by electrostriction. *Nat. Mater.* **2020**, *19*, 94–101