Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supplementary Information

Topological defects stabilized by soft twist-bend dimer and quantum dots lead to a wide thermal range and ultra-fast electro-optic response in a liquid crystalline amorphous blue phase

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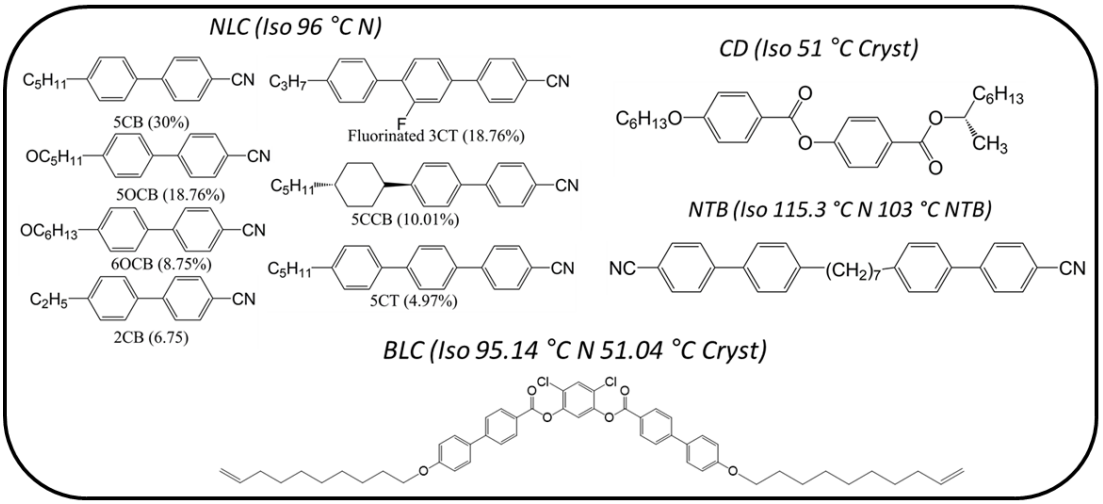
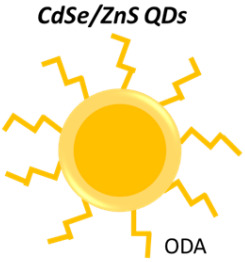
S1. Chemical structures and phase transition temperatures





Compositions:

i. 20 wt.% NTB + (45 wt.% CD in NLC) (host BPLC or BP45)

ii. 0.005 wt.% QD in BP45 (QD-BPLC)

iii. 20 wt.% BLC + (45 wt.% CD in NLC)

Phase transition temperatures:

i. host BPLC: Iso 45.3 °C BPI 25 °C Ch

ii. QD-BPLC: Iso 45 °C BPIIII 11 °C Ch

iii. 20 wt.% BLC + (45 wt.% CD in NLC): Iso 52 °C BPI 48.5 °C Ch

Figure S1. Chemical structures and phase transition temperatures of the individual compounds that constitute the BPLC mixtures. The compositions and phase transition temperatures of the mixtures are also shown.

S2. Characterization of CdSe/ ZnS core-shell quantum dots:

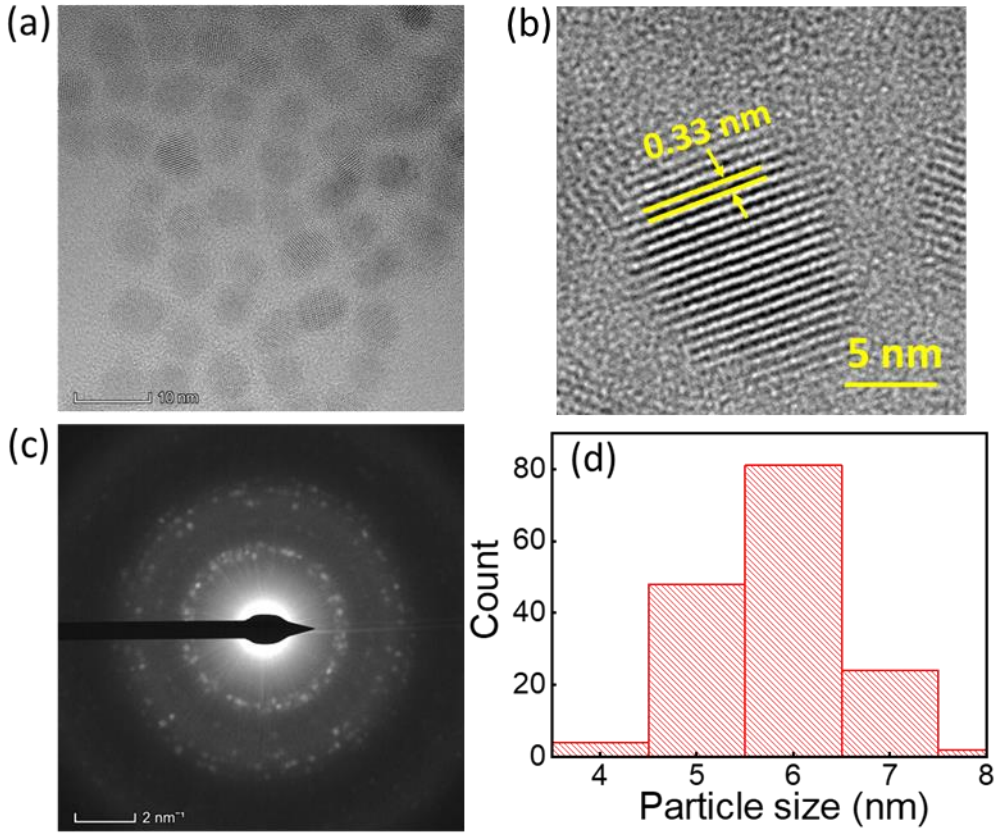


Figure S2. (a), (b) The HRTEM images, (c) SAED pattern and (d) particle size distribution of the CdSe/ZnS core-shell QDs. The average size of the QDs is 5.8 ± 0.7 nm (calculated using Image J software).

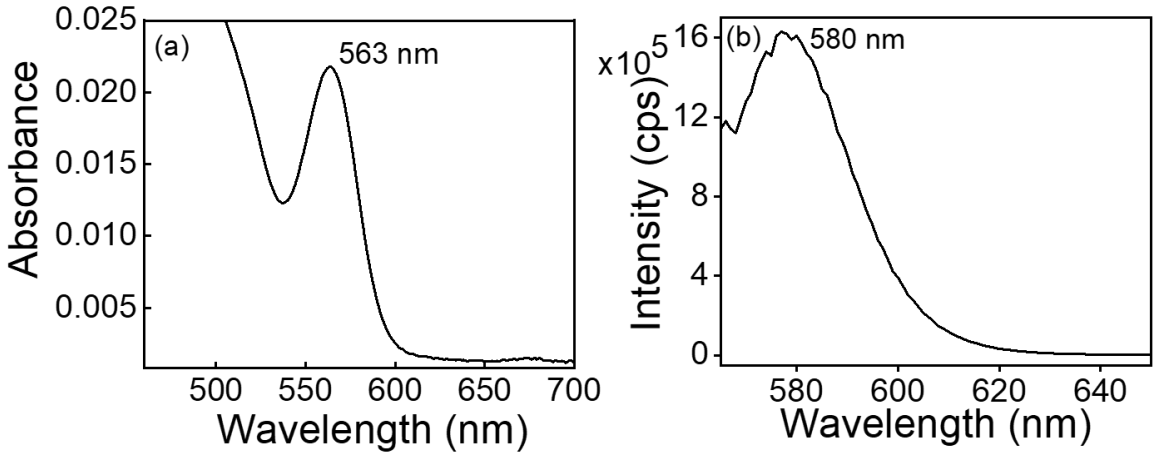


Figure S3. (a) Absorption and (b) emission spectra of CdSe/ZnS QDs dispersed in toluene.

S3. POM textures of the BPLC mixtures

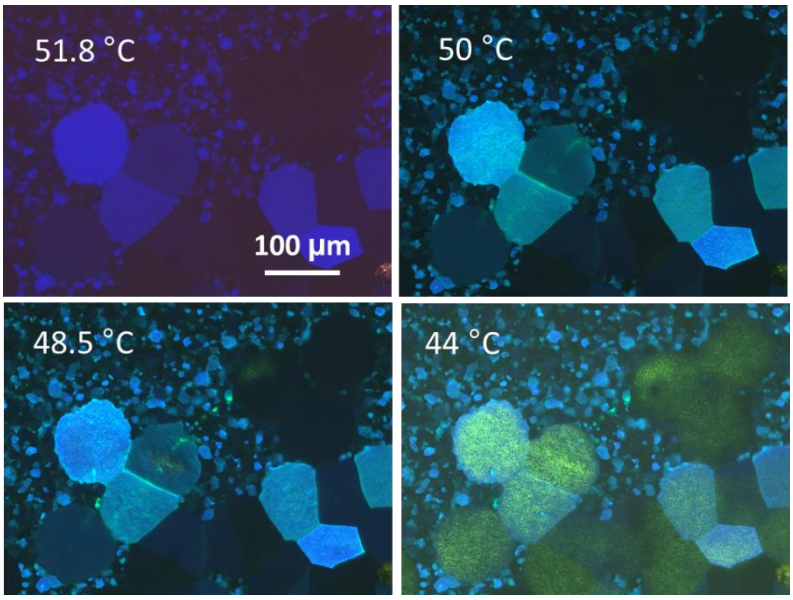


Figure S4. POM textures of 20% BLC + (45% CD in NLC) in BPI (51.8 °C and 50 °C) and Ch (44 °C). The texture at 48.5 °C corresponds to the onset to Ch.

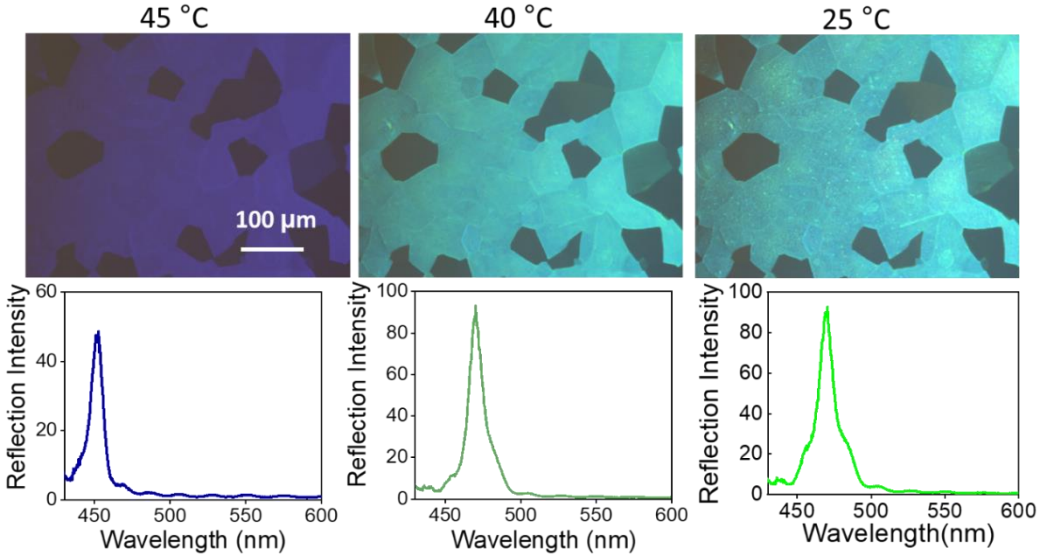


Figure S5. POM images (top row) and the corresponding selective reflection spectra (bottom row) of 20% NTB + (45% CD in NLC) mixture at different temperatures in BPI.

Table S1. Phase sequence and transition temperatures of the QD doped BPLC composites with different concentrations of CD

Wt.% of CD in NLC (with NTB fixed at 20 wt. %)	Phase sequence and phase transition temperatures	Thermal range of BPIII
30	Iso 66 °C BPIII 65 °C BPII 62.8 °C BPI 58 °C Ch	1 °C
35	Iso 58 °C BPIII 56 °C BPI 44 °C Ch	2 °C
40	Iso 48.6 °C BPI 35 °C Ch	--
45	Iso 45 °C BPIII 11 °C (remains in BP III)	34 °C

S4. POM images of QD-BPLC sample at different temperatures

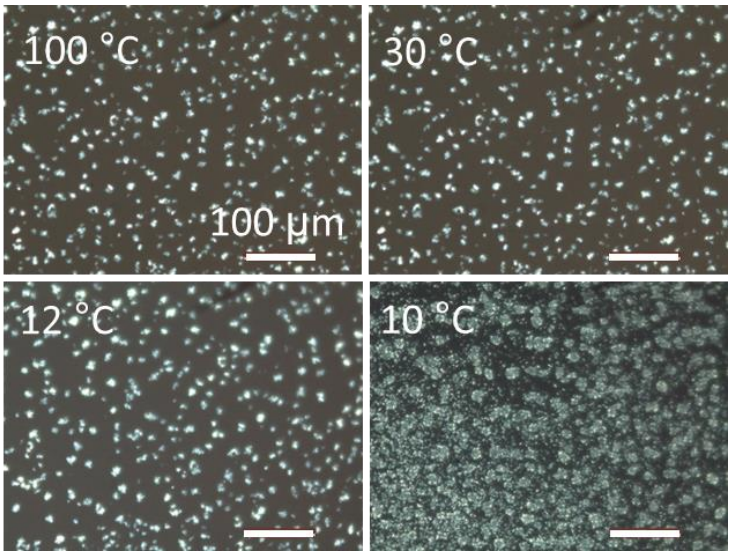


Figure S6: The POM images of QD-BPLC captured in the Iso phase (100 ^{o}C), BPIII (30 ^{o}C and 12 ^{o}C) and Ch phase (10 ^{o}C) between crossed polarizers.

S5. Determination of BPIII from Iso by optical activity

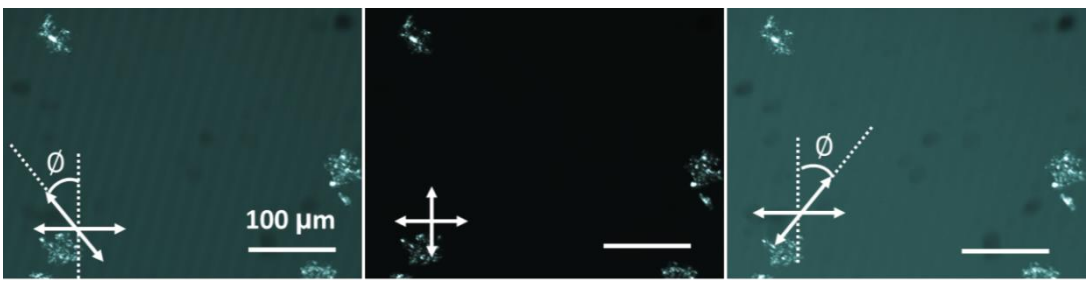


Figure S7: POM images of the QD-BPLC sample when analyzer is fixed at -10° (left), 0° (middle) and +10° (right) with respect to the polarizer.

S6. Determination of BPIII from Iso by Circular Dichroism spectroscopy

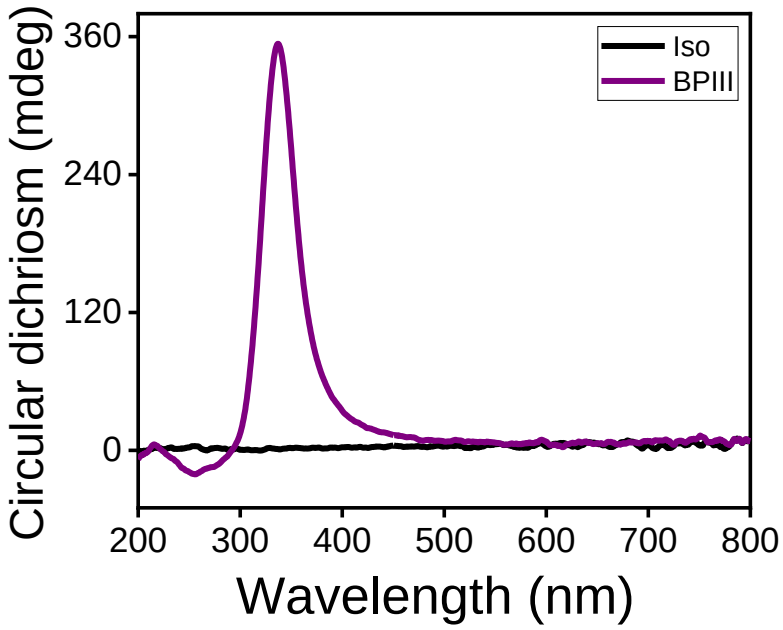


Figure S8: Circular dichroism spectra of QD-BPLC sample at Iso and BPIII phases.

S7. Determination of phase transition of QD-BPLC by DSC

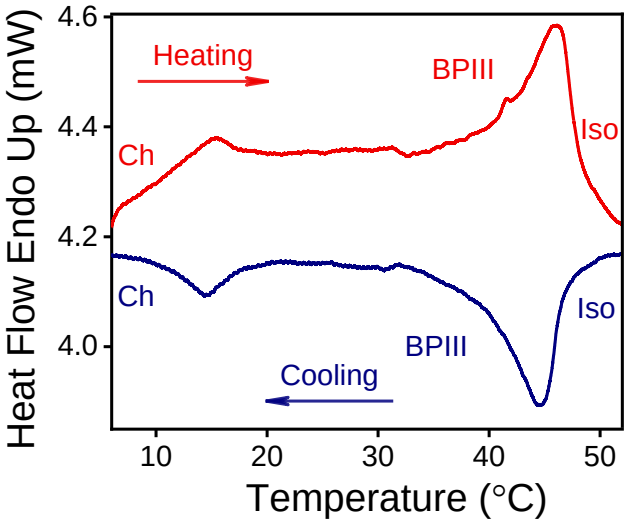


Figure S9: DSC profile for QD-BPLC sample in both heating and cooling cycles obatained at a rate of 5 °C/min.

S8. POM image with QDs concentration of 0.1%

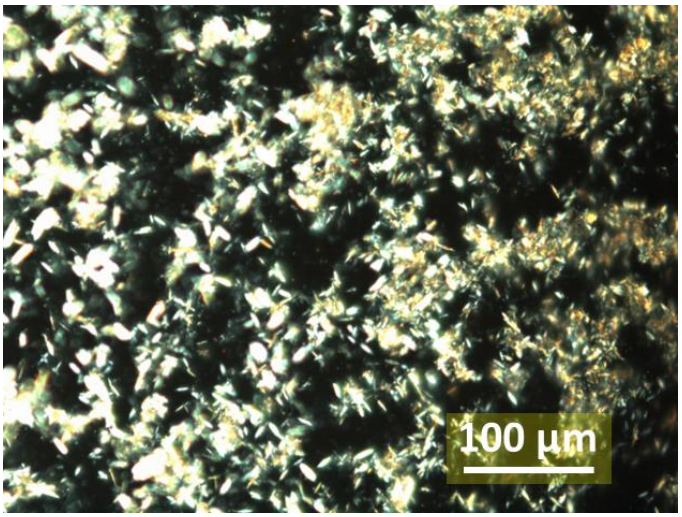


Figure S10: POM textures of 0.1% QD doped in BPLC

S9. Electro-optic switching studies of QD-BPLC:

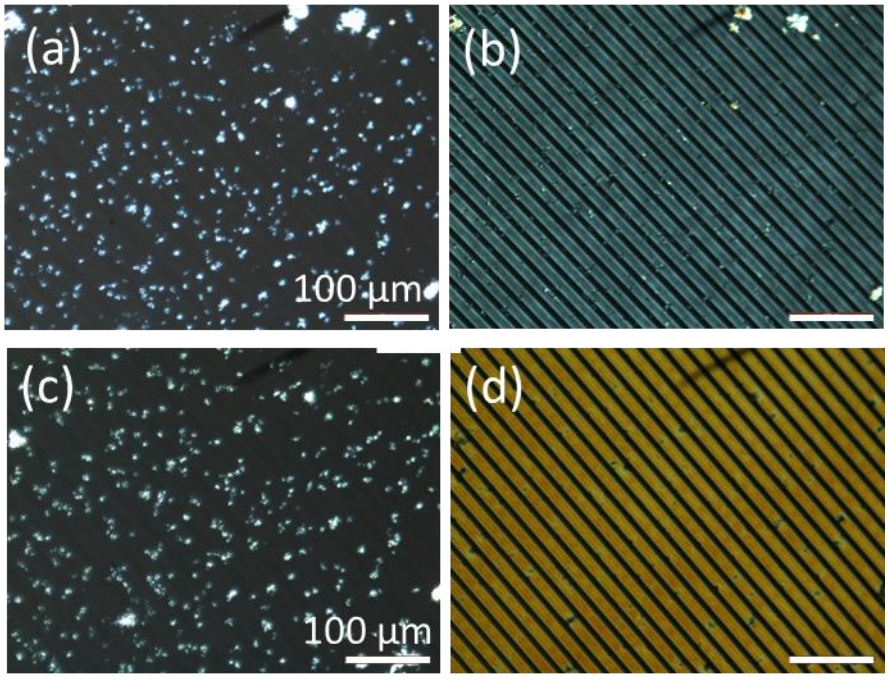


Figure S11. POM images of the QD-BPLC composite: (a), (c) without electric field, i.e., OFF-state and (b), (d) with electric field (25 V/µm), i.e., the ON-state, at 35 °C (top row) and 20 °C (bottom row), respectively. The stripes in (b) and (d) are due to the in-plane electrode pattern.

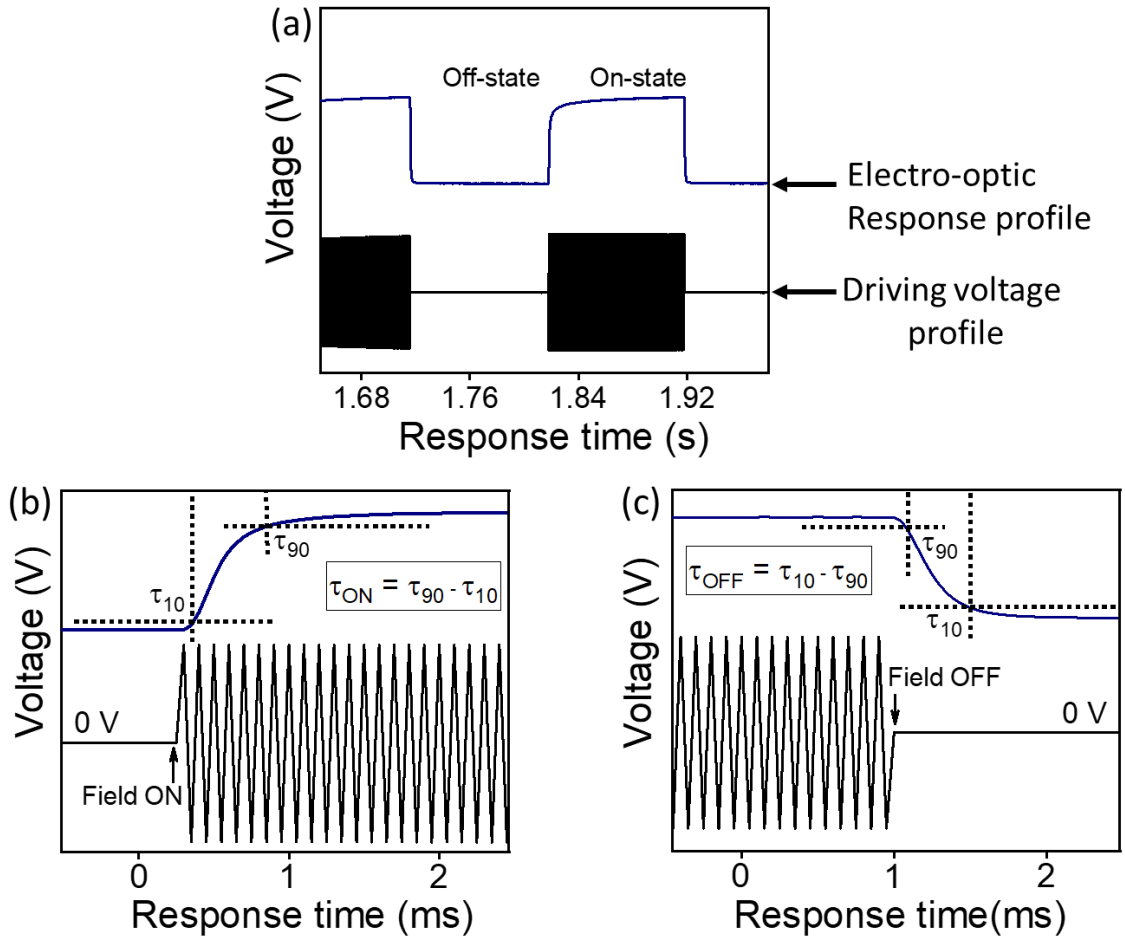


Figure S12. (a) Driving voltage and the electro-optic response profiles. Enlarged view of the (b) ON and (c) OFF states for the QD-BPLC sample. The τ_{ON} (τ_{90} - τ_{10}) and τ_{OFF} (τ_{10} - τ_{90}) are defined as the time taken for the transmitted intensity to vary from 10% to 90% and 90% to 10% of the maximum transmitted intensity, respectively, as depicted in the figure.

Movie S1. Electro-optic switching of QD-BPLC. The applied electric field is 25 V/ µm (ac, sine, 10 kHz)