Electronic Supplementary Information

Stable soft cubic superstructure enabled by hydrogen-bond complex functionalized polymer / liquid crystal system

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The texture and reflection spectra of sample A

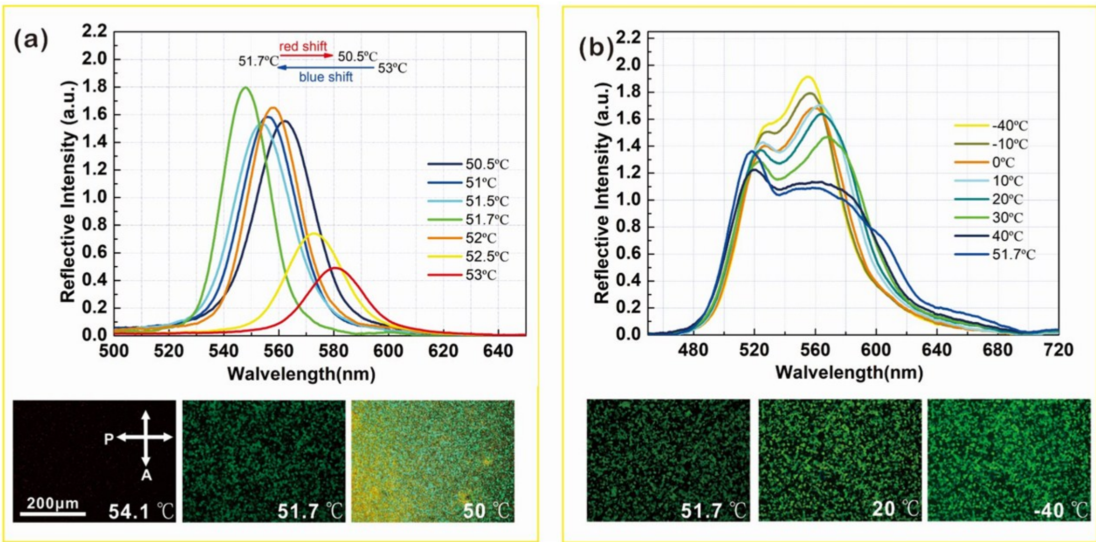

Fig. S1 (a) The reflection spectra and the optical texture of the sample before UV exposure. The spectrum exhibits a blue-shift during the cooling from 53 °C to 51.7 °C, and followed by a red-shift in a further cooling process until to the phase transition temperature, 50.5 °C; an obvious phase transition from BP to N* phase occurs at 50 °C determined by the corresponding texture. (b) The reflection spectra and the optical texture of the sample after UV exposure. The reflection peak of spectra is almost invariable during the whole cooling process, however the reflectance increases significantly due to the gradually increased orderliness of LCs in BP lattice. The micrographs shows the typical BP texture with green coloured platelets. Herein, the scale bar of the micrographs is 200 μm.

HTP determined through Cano wedge cell

Cano wedge cell is a common and believable method to determine and calculate the helical pitch length of a N*LC. Similar as the common LC cell, such wedge LC cell is composed by two flat glass substrates with planar alignment, however the two substrates are not parallel to each other, but with a very small angle θ. In such situation, the typical optical texture, presenting a series of dark straight disclination lines, of a N*LC is generally observed caused by the coupling effect of a twisted free energy of LCs and the surface anchoring of two substrates. As illustrate in Fig. S2, the helical pitch, *P*, can be calculated by the distance between two adjacent disclination lines, *R*, and the angle between two substrates, θ as Eq. S1,

$$P = 2R\tan\theta \qquad \text{(S1)}$$

Herein, the tangent of the angle between two substrates is 0.018. The HTP of chiral dopant can be calculated conveniently through Eq. S2 in the case of a low content of chiral dopant,

$$HTP = \frac{1}{P \cdot C} \qquad \text{(S2)}$$

in which, C is the content of chiral dopant.

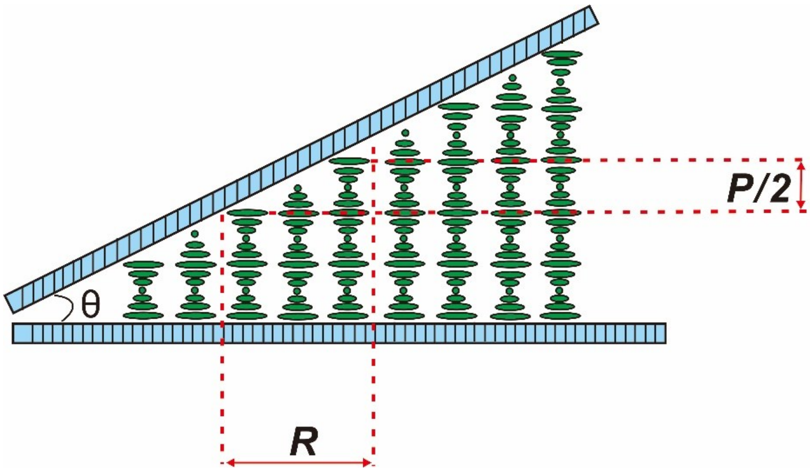

Fig. S2 A illustration to demonstrate the testing of helical pitch through Cano wedge cell. The straight disclination lines are generated at the interface between two N* phase domains with a difference of 180^{o} on twisted angle of LCs, *i.e.*, *P*/2. The distance between two adjacent disclination lines is *R*.

The texture of C1 and C2 after exposure

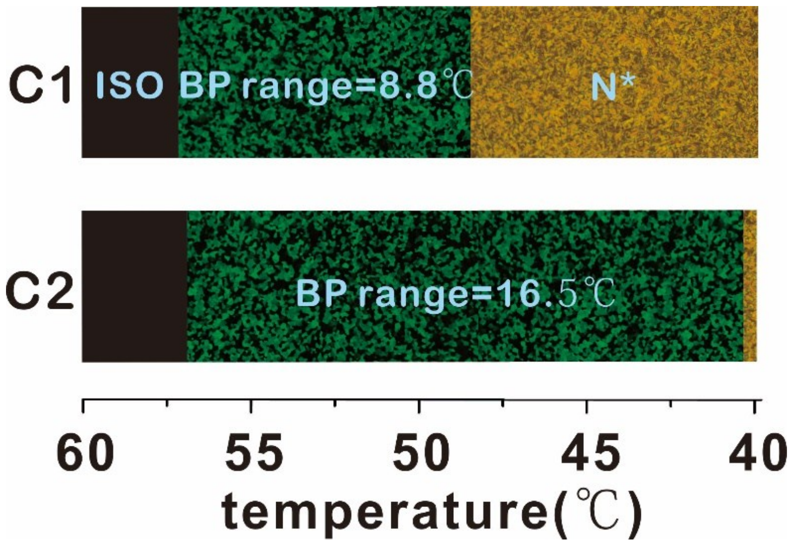

Fig. S3 The phase transition behaviours of samples containing the same content of polymer, but less H-bond complexes (*i.e.*, sample C1) and more H-bond complexes (*i.e.*, sample C2), respectively. The BP range of sample C2 is extended for almost 100% compared to sample C1.

The V-T texture of sample B1 at different applied voltage

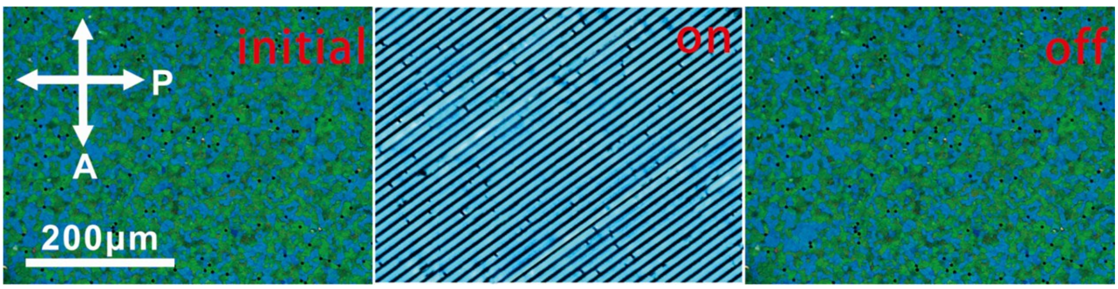

Fig. S4 The sample B1 appears the "on" state when applied with 100V voltage. These light stripes maybe ascribed to the complete BPLC structure distorted by external electric field. Once removing the external electric field shown in "off" state, it recovers to the similar texture with it in original state. Furthermore, this quick process indicates the sample B1 could stay in BPLC state even if applied voltage exceeds the driving voltage.

The V-T curve of sample B1 at low temperature

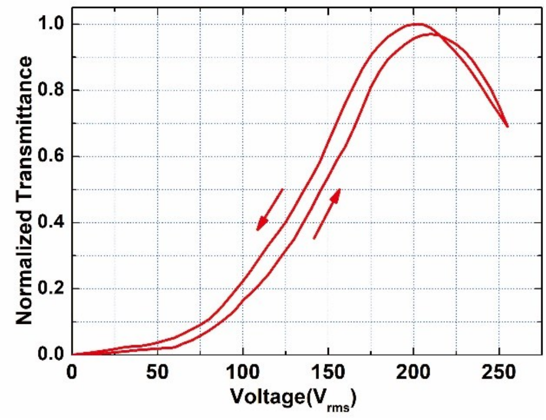

Fig. S5 V-T behaviours of sample B1 at -15 °C. The weak E-O hysteresis is still maintained, but the driving voltage is increased due to the decreasing of molecular dynamic activation energy at such a low temperature.