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Supplementary Material

Novel electric responsive columnar liquid crystals based on perylene tetra *sec*-alkyl ester derivatives

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Table S1 Absorbance and fluorescence data of PS8 in different solvents and PS8, PPi8 and PPn8 in CH_2Cl_2 solution.

Samples	Solvents	Absorption	Fluorescence	Φ_f[a]	Stokes shift
PS8	DMF	468 nm	516 nm	0.919	48 nm
PS8	CH_2Cl_2	470 nm	517 nm	0.871	47 nm
PPi8	CH_2Cl_2	470 nm	519 nm	0.650	49 nm
PPn8	CH_2Cl_2	472 nm	519 nm	0.296	47 nm
PS8	Hexane	464 nm	510 nm	0.833	46 nm
PS8	THF	466 nm	515 nm	0.822	49 nm
PS8	Ethanol	466 nm	512 nm	0.703	46 nm
PS8	CH_2Cl_2	470 nm	517 nm	0.871	47 nm

[a] Fluorescence quantum yields , determined by fluorescein (Φ_f = 0.55 in 0.01M H_2O) as a reference compound.

Electronic energy levels and redox properties of PSn

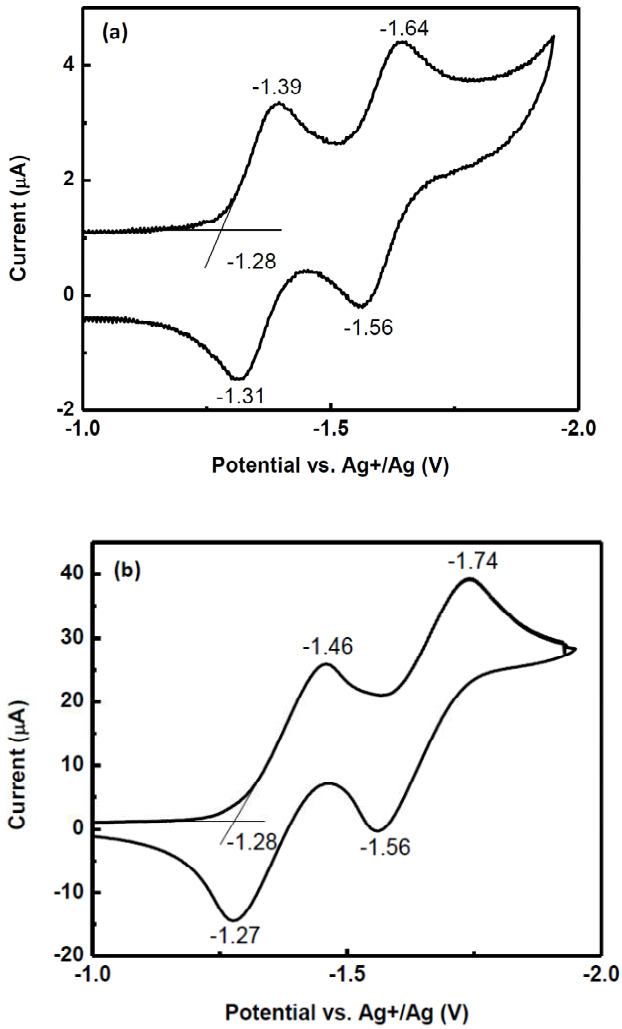


Fig. S1 (a) CV curve of the compound PS4. (b) CV curve of the compound PS6.

Thermal Properties

1. TGA of the compounds PSn

Thermogravimetric analyses (TGA) were carried out under air atmosphere to evaluate the thermal stability. All the PSn compounds are stable up to 300 °C, the *sec*-alkyl chains of which decompose from ca. 300 to 380 °C and continuous heating induces the decomposition of the core structure of perylene until the mass goes to zero.

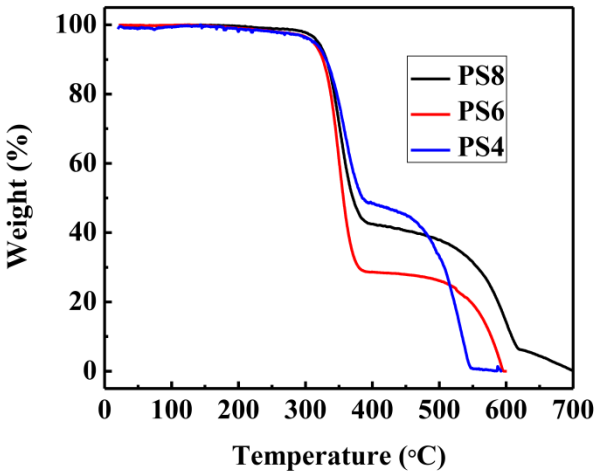
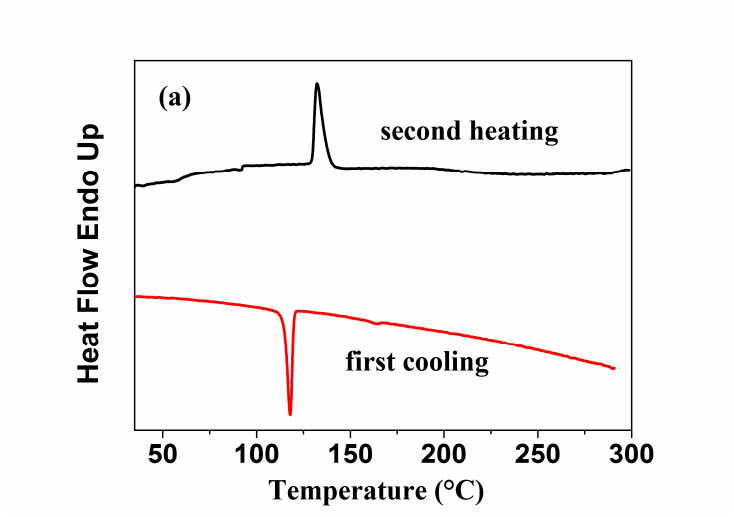
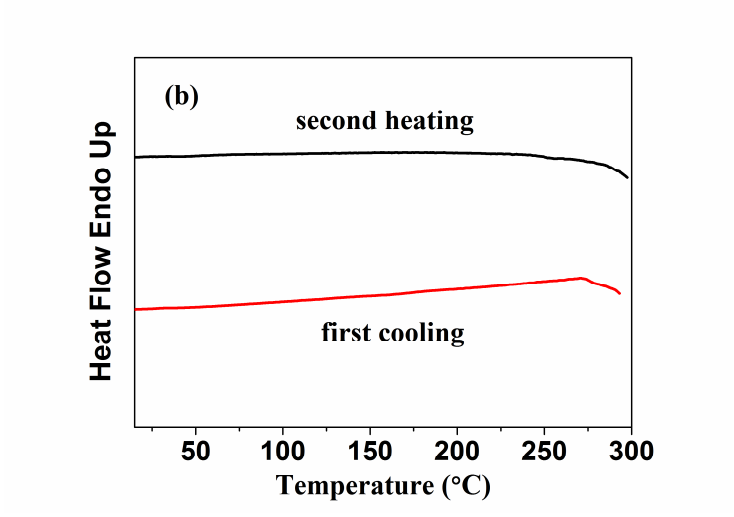


Fig. S2 TGA curves of compounds PS4-PS8, scan rate is 10 °C min^{-1}.

2. DSC of the compounds PSn





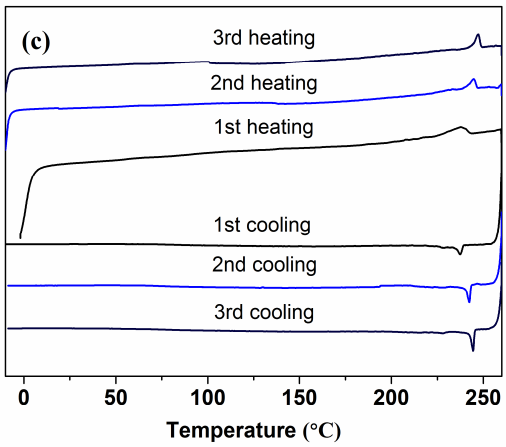


Fig. S3 DSC curves of compounds PS4-PS8: (a) PS4, (b) PS6, and (c) PS8, scan rate is 10 °C min^{-1}.

1D WAXD measurements of the compounds PSn

Alignments of PS8 on different substrates

1. Alignments of PS8 in the cells of different substrates

Several LC cells utilizing different substrates (bare glass, ITO covered glass, PVA covered glass, quartz and CaF_2 disk) with the thickness of 8 μm were made for alignment investigation. The PS8 were heated to the clear point and then filled into the cells, the textures were observed upon cooling the sample from the isotropic phase with the cooling rates of 5 °C min^{-1}. All the samples showed black color between crossed polarizers indicating homeotropic alignment at high temperatures. Here the microscopic images without crossed polarizers were given to illustrate the homeotropic alignment, too. When the samples were cooled down to room temperature, the homeotropic alignment was partially broken for all the samples based on different substrates. PS8 in the ITO glass cell showed the best homeotropic alignment at high temperatures in all the substrates.

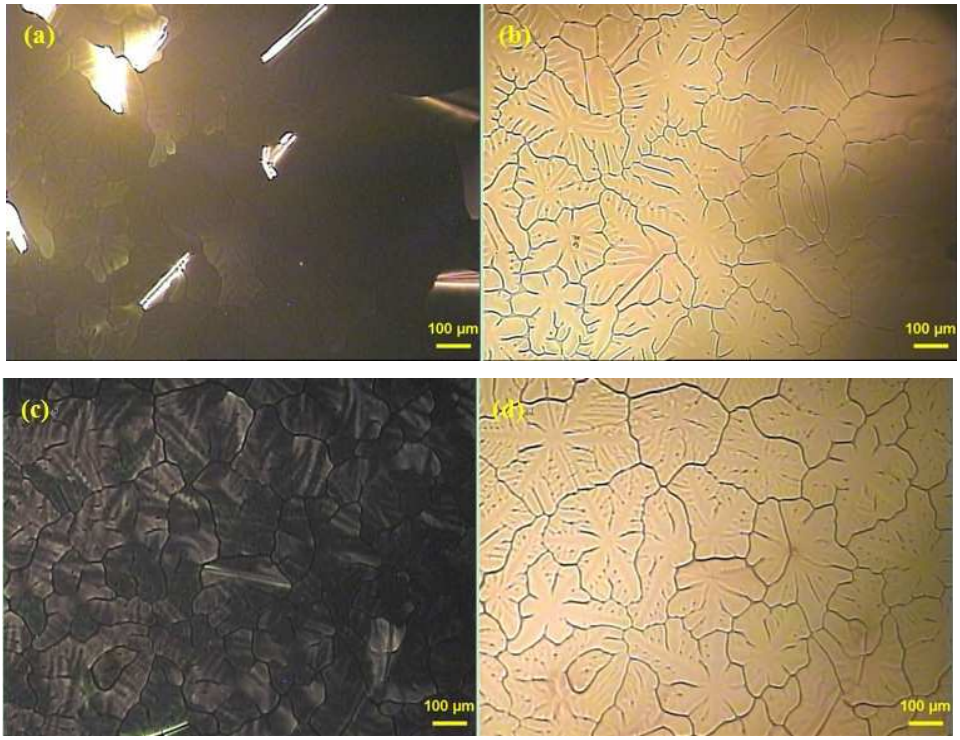


Fig. S4 Optical microscopic images of PS8 in the bare glass cell: (a) at 230.0 °C, under crossed polarizers; (b) at 230.0 °C, without crossed polarizers; (c) at 30.0 °C, under crossed polarizers; (d) at 30.0 °C, without crossed polarizers.

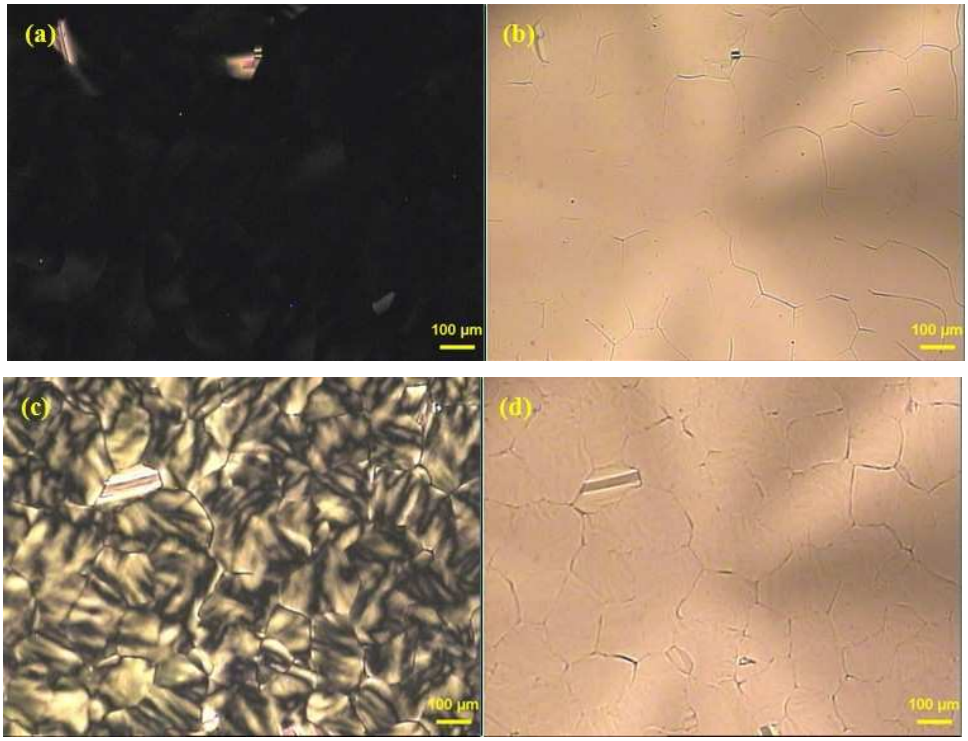


Fig. S5 Optical microscopic images of PS8 in the PVA glass cell: (a) at 202.0 °C, under crossed polarizers; (b) at 202.0 °C, without crossed polarizers; (c) at 30.0 °C , under crossed polarizers; (d) at 30.0 °C, without crossed polarizers.

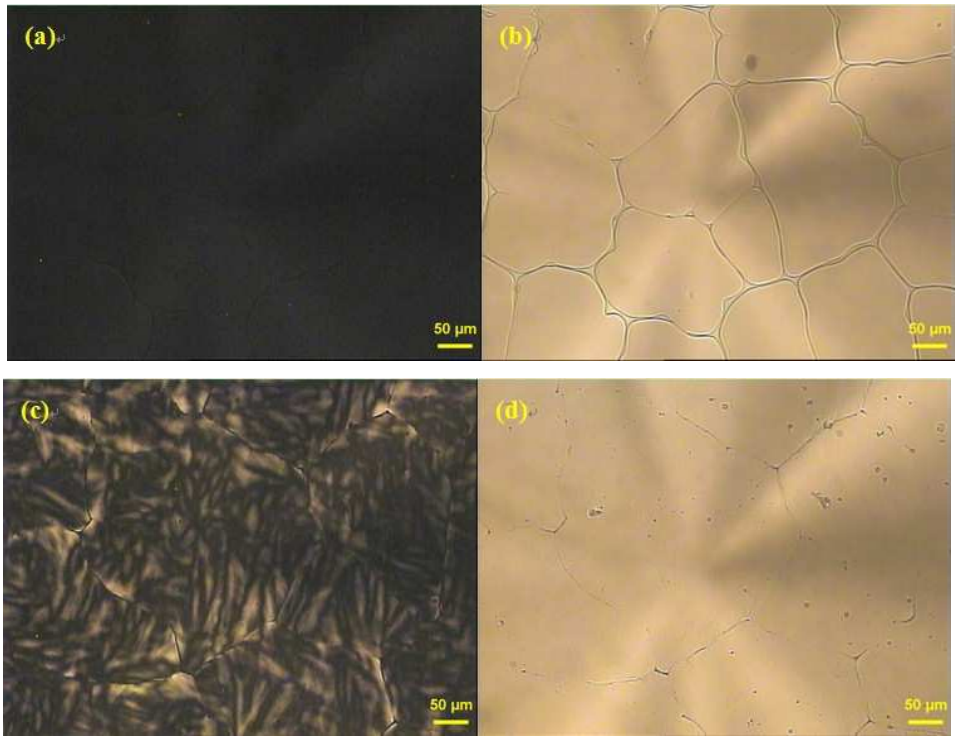


Fig. S6 Optical microscopic images of PS8 in the quartz cell: (a) at 236.0 °C, under crossed polarizers; (b) at 236.0 °C , without crossed polarizers; (c) at 30.0 °C, under crossed polarizers; (d) at 30.0 °C, without crossed polarizers.

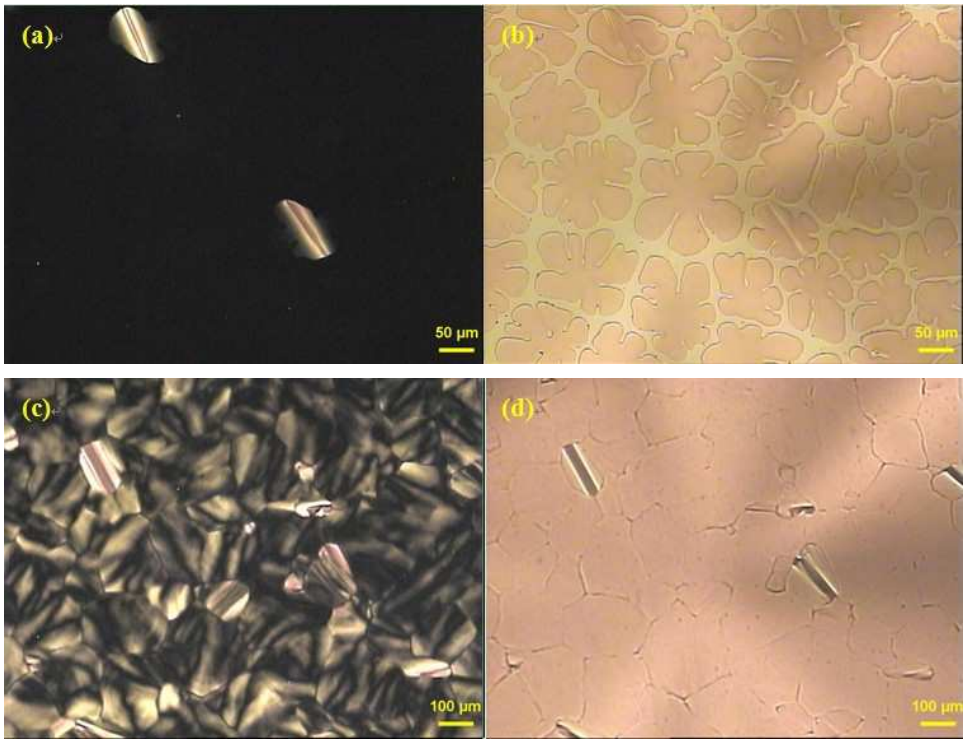


Fig. S7 ptical microscopic images of PS8 in the CaF_2 cell: (a) at 254.0 °C, under crossed polarizers; (b) at 254.0 °C, without crossed polarizers; (c) at 30.0 °C , under crossed polarizers; (d) at 30.0 °C, without crossed polarizers.

3. Alignment of spin coated PS8 film on different substrates

The PS8 solution was spin coated on different substrates (ITO covered glass, PVA covered glass, quartz, CaF_2 disk and bare glass) for thin film alignment. The textures of the samples were taken at room temperature on different substrate surfaces, which were cooled down from isotropic phase with cooling rate 2 °C min^{-1}. Homeotropic alignment was kept on all the substrates except on the bare glass.

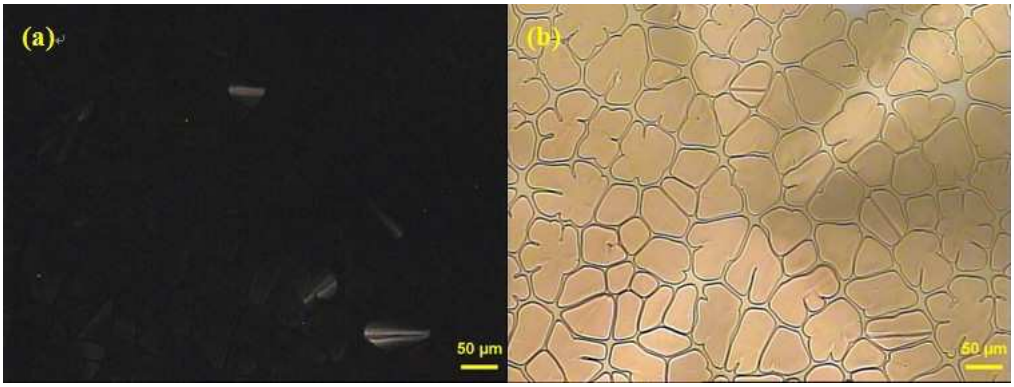


Fig. S8 ptical microscopic images of PS8 on PVA glass substrate, (a) at 30.0 °C, under crossed polarizers; (b) at 30.0 °C, without crossed polarizers.

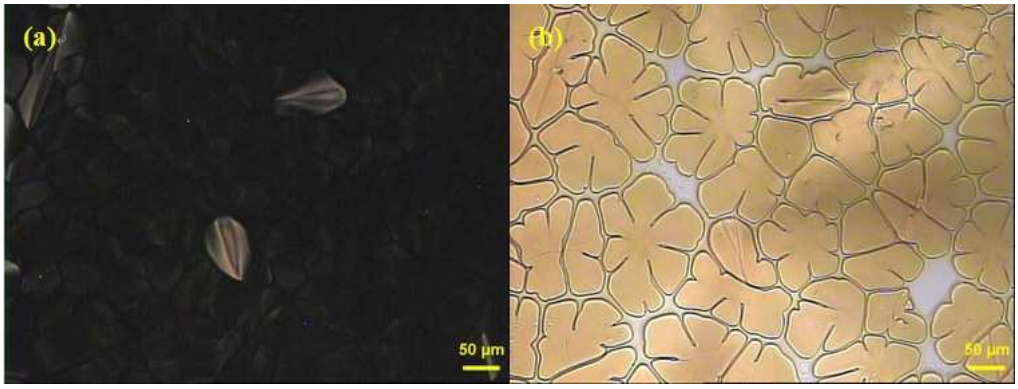


Fig. S9 ptical microscopic images of PS8 on quartz substrate, (a) at 30.0 °C, under crossed polarizers; (b) at 30.0 °C, without crossed polarizers.

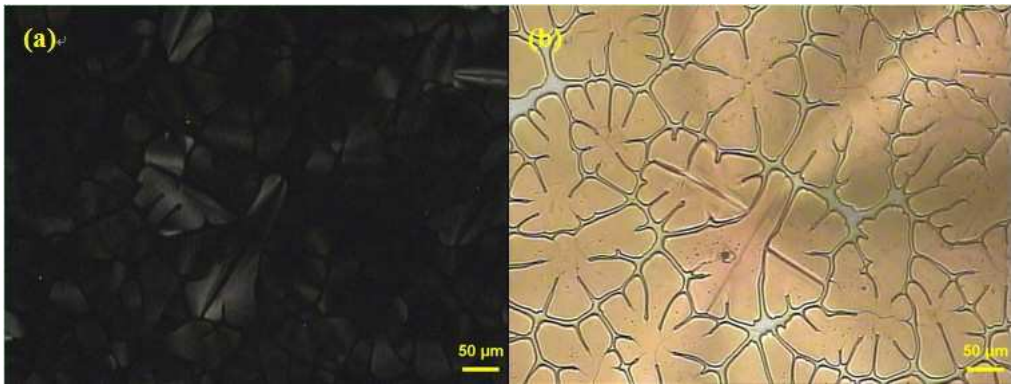


Fig. S10 optical microscopic images of PS8 on CaF_2 substrate, (a) at 30.0 °C, under crossed polarizers; (b) at 30.0 °C, without crossed polarizers.

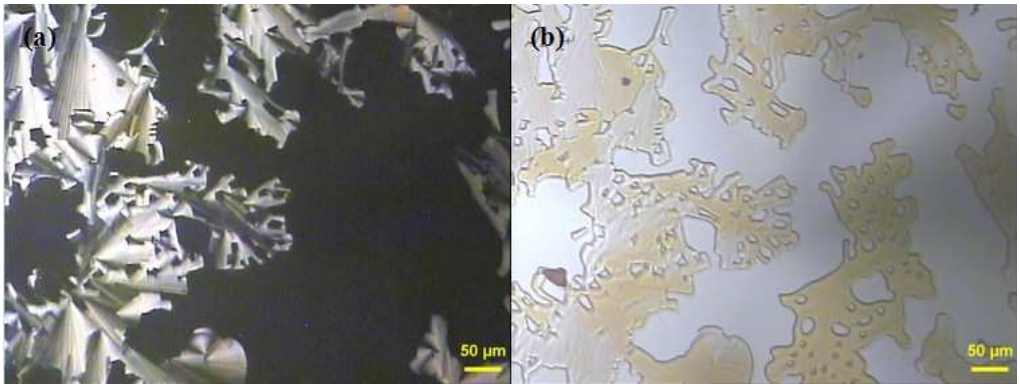


Fig. S11 Optical microscopic images of PS8 on bare glass substrate, (a) at 30.0 °C, under crossed polarizers; (b) at 30.0 °C, without crossed polarizers.

1D WAXD patterns of PS8 with different alignment mode

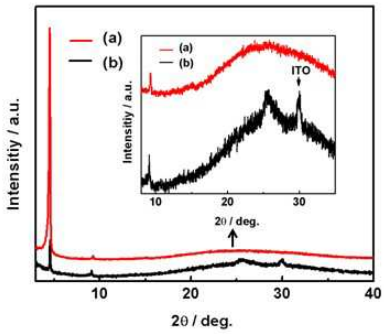


Fig. S12 1D WAXD patterns of PS8 with different alignment mode at room temperature: (a) The sample was sheared at 220 °C before the isotropic phase for quasi homogeneous alignment on glass substrate; (b) The sample was cooled down from the isotropic phase on ITO glass substrate for homeotropic alignment.