Deviation of Phase Transition Process in Surface-tethered Thermotropic Liquid Crystalline Polymer Nanocomposites with Graphene Oxide：A Spectroscopic Study

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1. TGA result of GO-PMPCS composite

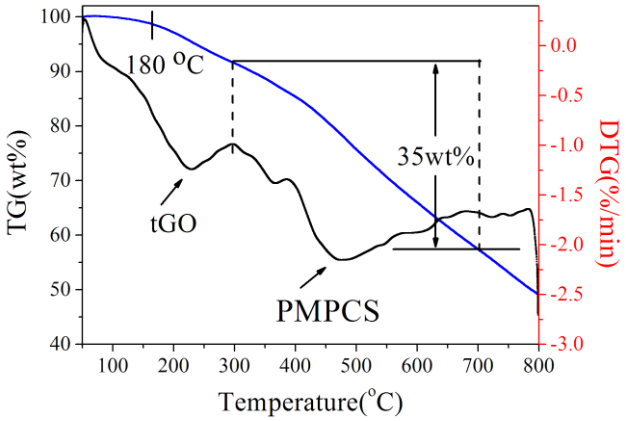

Fig. S1. TGA result of GO-PMPCS composite

2. 2D correlation analysis of PMPCS/GO-PMPCS system in 100~140 °C

Table S1. Symbols of the cross-peaks in synchronous and asynchronous spectra of the three representative spectral regions of PMPCS/GO-PMPCS system in 100~140 °C

Cross-peak	Variation order	Cross-peak	Variation order
2958/2910(+,-)[a]	2910→2958	2910/2875 (+,+)	2910→2875
3004/2910(+,+)	3004→2910	2958/2875 (+,+)	2958→2875
3032/2910(-,-)	3032→2910	3080/2875 (+,+)	3080→2875
3080/2910(+,+)	3080→2910	2935/2875 (+,0)	2935,2875
3004/2958(+,+)	3004→2958	2935/2835 (+,-)	2835→2935
3032/2958(-,-)	3032→2958	2958/2935 (+,+)	2958→2935
3080/2958(+,+)	3080→2958	2935/2910 (+,-)	2910→2935
3004/2875(+,+)	3004→2875	3080/3032(-,+)	3032→3080
3032/2875(-,-)	3032→2875	3080/3004(+,0)	3080,3004
2910/1508(+,-)	1508→2910	2910/1498(-,+)	1498→2910
2958/1508(+,-)	1508→2958	3004/1498(-,+)	1498→ 3004
3032/1508(-,+)	1508→3032	3032/1498(+,+)	3032→1498
1732/1508(+,-)	1508→1732	2958/1732(+,-)	1732→2958
1732/1498(-,+)	1498→1732	2935/1732(+,-)	1732→2935
2910/1732(+,-)	1732→2910	3004/1732(+,+)	3004→1732

[a] The first symbol in the brackets represented symbol in synchronous spectrum, and the second symbol in the brackets represented symbol in asynchronous spectrum

[b] "→" meant "prior to" and "," meant "simultaneously"

3. 2D correlation analysis of pure PMPCS system in 100~140 °C

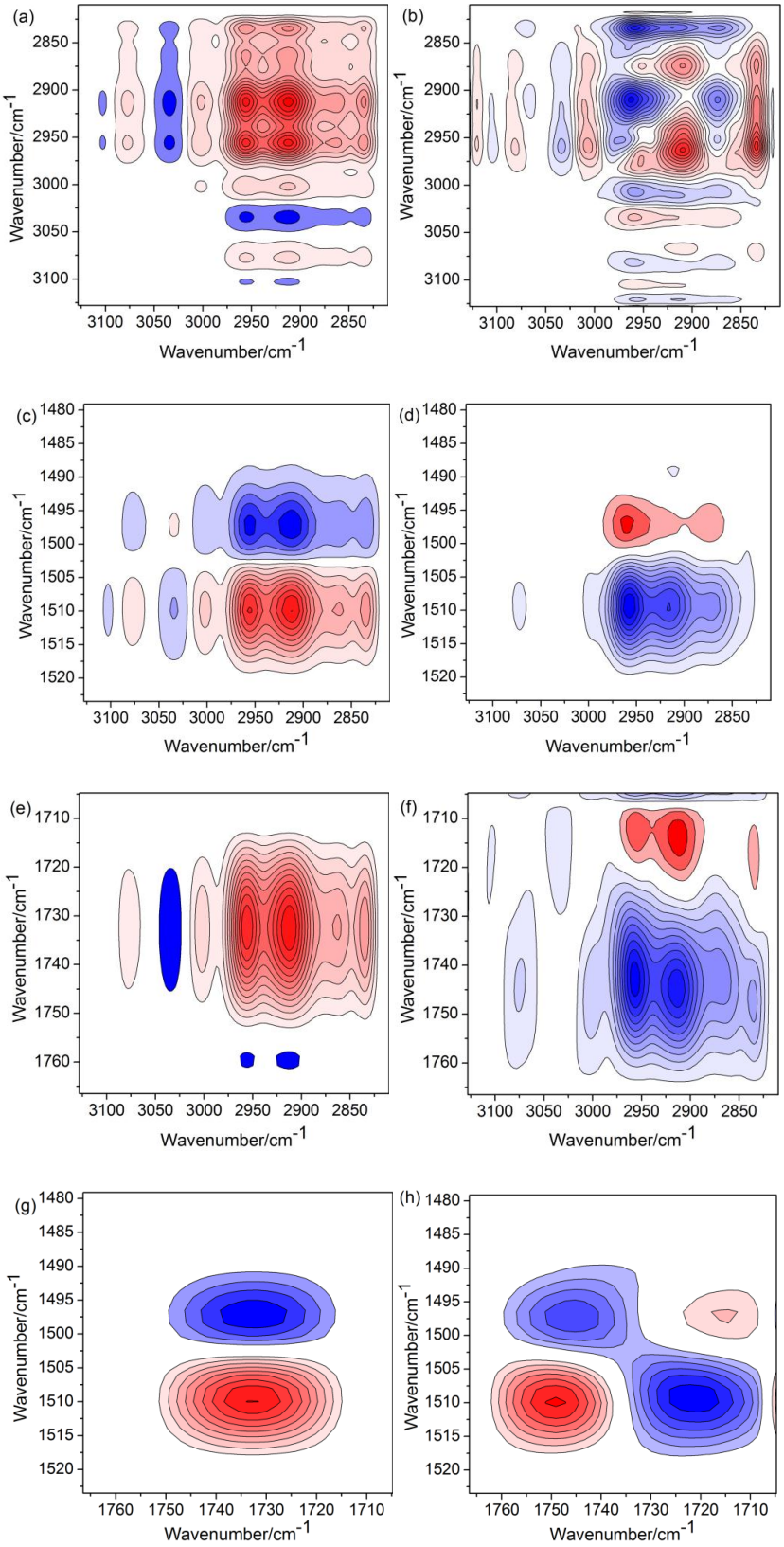

Fig. S2. 2D synchronous spectra of (a) C-H stretching vibration region 3127-2811 cm^{-1} ;(c) C-H stretching vibration region 3127-2811 cm^{-1} with skeleton vibration of aromatic ring II 1540-1474 cm^{-1} ; (e) C-H stretching vibration region 3127-2811 cm^{-1} and carbonyl stretching vibration of

1766-1706 cm^{-1} ; (g) carbonyl stretching vibration of 1766-1706 cm^{-1} and skeleton vibration of aromatic ring II 1540-1474 cm^{-1} and 2D asynchronous spectra of (b) C-H stretching vibration region 3127-2811 cm^{-1} ;(d) C-H stretching vibration region 3127-2811 cm^{-1} with skeleton vibration of aromatic ring II 1540-1474 cm^{-1} ; (f) C-H stretching vibration region 3127-2811 cm^{-1} and carbonyl stretching vibration of 1766-1706 cm^{-1} ; (h) carbonyl stretching vibration of 1766-1706 cm^{-1} and skeleton vibration of aromatic ring II 1540-1474 cm^{-1}.

Table S2. Symbols of the cross-peaks in synchronous and asynchronous spectra of the three representative spectral regions of pure PMPCS system in 100~140 ^{o}C

Cross-peak	Variation order	Cross-peak	Variation order
2910/1508 (+,-)[a]	1508→2910[b]	2910/1732(+,-)	1732→2910
3004/1508(+,-)	1508→3004	3004/1732(+,-)	1732→3004
3080/1508 (+,-)	1508→3080	3080/1732(+,-)	1732→3080
1732/1508(+,-)	1508→1732	3032/2910 (-,-)	3032→2910
3004/2910(+,+)	3004→2910	3080/2910 (+,+)	3080→2910
3080/3004(+,0)	3004,3080	3032/3004(-,-)	3032→3004
3032/1508 (-,+)	1508→3032	3032/1732(-,+)	1732→3032

[a] The first symbol in the brackets represented symbol in synchronous spectrum, and the second symbol in the brackets represented symbol in asynchronous spectrum

[b] "→" meant "prior to" and "," meant "simultaneously"

4. 2D correlation analysis of PMPCS/GO-PMPCS system in 140~180 ^{o}C

Table S3. Symbols of the cross-peaks in synchronous and asynchronous spectra of the three representative spectral regions of PMPCS/GO-PMPCS system in 140~180 ^{o}C

Cross-peak	Variation order	Cross-peak	Variation order
3004/2958(+,-)	2958→3004	3080/2875(+,-)	2875→3080
3004/2910(+,-)	2910→3004	2910/2875(+,-)	2875→2910
3004/2875(+,-)	2875→3004	2958/2875(+,-)	2875→2958
3080/2958(+,-)	2958→3080	3080/3004(+,0)	3080,3004
3080/2910(+,-)	2910→3080	2910/1508(+,+)	2910→1508
2958/2910(+,+)	2958→2910	2958/1508(+,+)	2958→1508
3004/1508(+,+)	3004→1508	3080/1508(+,+)	3080→1508
2910/1732(+,+)	2910→1732	2958/1732(+,+)	2958→1732
3004/1732(+,+)	3004→1732	3080/1732(+,+)	3080→1732

[a] The first symbol in the brackets represented symbol in synchronous spectrum, and the second symbol in the brackets represented symbol in asynchronous spectrum

[b] "→" meant "prior to" and "," meant "simultaneously"

5. 2D correlation analysis of pure PMPCS system in 140~180 ^{o}C

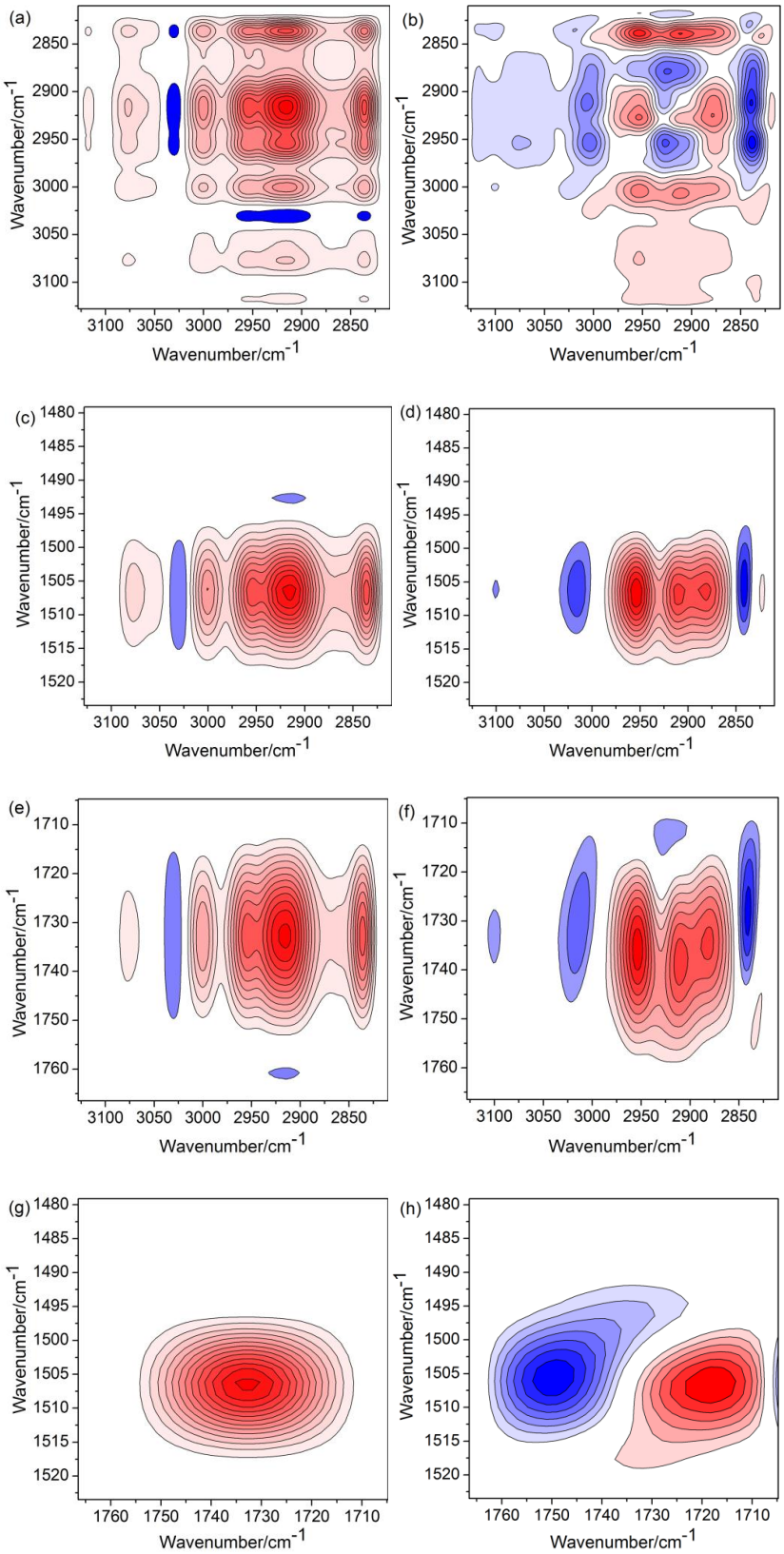

Fig. S3. 2D synchronous spectra of (a) C-H stretching vibration region 3127-2811 cm^{-1} ;(c) C-H stretching vibration region 3127-2811 cm^{-1} with skeleton vibration of aromatic ring II 1540-1474 cm^{-1} ; (e) C-H stretching vibration region 3127-2811 cm^{-1} and carbonyl stretching vibration of 1766-1706 cm^{-1} ; (g) carbonyl stretching vibration of 1766-1706 cm^{-1} and skeleton vibration of

aromatic ring II 1540-1474 cm^{-1} and asynchronous spectra of (b) C-H stretching vibration region 3127-2811 cm^{-1} ;(d) C-H stretching vibration region 3127-2811 cm^{-1} with skeleton vibration of aromatic ring II 1540-1474 cm^{-1} ; (f) C-H stretching vibration region 3127-2811 cm^{-1} and carbonyl stretching vibration of 1766-1706 cm^{-1} ; (h) carbonyl stretching vibration of 1766-1706 cm^{-1} and skeleton vibration of aromatic ring II 1540-1474 cm^{-1}.

Table S4. Symbols of the cross-peaks in synchronous and asynchronous spectra of the three representative spectral regions of pure PMPCS system in 140~180 ^{o}C

Cross-peak	Variation order	Cross-peak	Variation order
2910/2835(+,+)	2910→2835	3080/2835 (+,0)	3080,2835
3004/2910(+,-)	2910→3004	2925/2835 (+,+)	2925→2835
3080/2910(+,-)	2910→3080	2925/2910 (+,-)	2910→2925
3080/3004(+,0)	3080,3004	3080/2925 (+,-)	2925→3080
2835/1508(+,-)	1508→2835	3004/2925 (+,-)	2925→3004
2910/1508(+,+)	2910→1508	2835/1732 (+,-)	1732→2835
3004/1508(+,-)	1508→3004	2910/1732 (+,+)	2910→1732
3080/1508(+,-)	1508→3004	3004/1732 (+,-)	1732→3004
2925/1508(+,+)	2925→1508	3080/1732 (+,-)	1732→3080
2925/1732(+,+)	2925→1732	1732/1508 (+,+)	1732→1508

[a] The first symbol in the brackets represented symbol in synchronous spectrum, and the second symbol in the brackets represented symbol in asynchronous spectrum

[b] "→" meant "prior to" and "," meant "simultaneously"