Supporting Information

Helix-Induced Full-color Circularly Polarized Luminescence Films with Multiple Information Encryption and Multi-stimuli Responsiveness

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1. Measurements

Circular dichroism (CD) and ultraviolet-visible (UV-vis) spectra were obtained using a JASCO J1700 spectropolarimeter at room temperature. Fluorescence spectra were recorded using a Shimadzu RF-5301(PC)S fluorescence spectrophotometer. The circularly polarized luminescence (CPL) spectra using a JASCO CPL-300 spectrometer at room temperature.

2. Materials

Chiral helical PI were prepared with reference to previously reported polymerization methods (M_n = 80.5kDa, M_w/M_n = 1.24).¹ The fluorescein Nile red, coumarin 6, 1-(4-carboxyphenyl)-1,2,2-triphenylethene and spiropyran were procured from Energy Chemicals. The polymer matrix PMMA was procured from TCI chemicals, PVB and PC were procured from Titan Technology Exploration Platform Chemicals Ltd. All solvents are from Sinopharm. Co. Ltd. and were purified according to standard procedures before use. All chemicals were purchased from Energy Chemical and Titan Technology Exploration Platform Chemicals Ltd. and were used as received without further purification.

The composite film was prepared as follows: Take fluorescent composite film as an example, in a 10 ml screw top bottle, 80 mg of PMMA (PVB or PC) was added to 2 mL of chloroform solution, and after it was completely dissolved, 2 mg of PI and 0.2 mg of Nile red (coumarin 6 or TPE) were added. After stirring for 60 minutes, 1 ml of the mixed solution was taken and cast into a PTFE mold. The chloroform was then evaporated at room temperature to obtain a film of uniform thickness (around 50 μ m). Other composite films were prepared in a similar method



Figure S1. CD and UV-vis spectra of the MPI-PMMA.



Figure S2. (a) CD and UV–vis spectra of the MPI-PMMA with different PI content. (b) CD and UV–vis spectra of the MPI-G-PMMA with different G content.



Figure S3. g_{lum} spectra of the PMMA composite films, PVB composite films and PC composite films.



Figure S4. (a) CD and UV–vis spectra of the PVB composite films. (b) PL spectra and luminescence photographs of the PVB composite films.



Figure S5. (a) CD and UV–vis spectra of the PC composite films. (b) PL spectra and luminescence photographs of the PC composite films.



Figure S6. CPL spectra of PVB composite films.



Figure S7. CPL spectra of PC composite films.



Figure S8. PL spectra of (a) PMMA, PVB and PC films (b) PMMA-PI, PVB-PI and PC-PI films (c) PMMA-R, PMMA-G and MMA-B films (d) PVB-R, PVB-G and PVB-B films (e) PC-R, PC-G and PC-B films.



Figure S9. CD spectra of (a) PMMA, PVB and PC films (b) PMMA-PI, PVB-PI and PC-PI films (c) PMMA-R, PMMA-G and MMA-B films (d) PVB-R, PVB-G and PVB-B films (e) PC-R, PC-G and PC-B films.

Figure S10. CPL spectra of (a) PMMA, PVB and PC films (b) PMMA-PI, PVB-PI and PC-PI films (c) PMMA-R, PMMA-G and MMA-B films (d) PVB-R, PVB-G and PVB-B films (e) PC-R, PC-G and PC-B films.

Figure S11. (a,c) Scheme of CPL generation mechanism and CPL spectra when the excitation light passed through R-PVB, G-PVB or B-PVB first and then PI-PVB. (b,d) Scheme of CPL generation mechanism and CPL spectra when the excitation light passed through PI-PVB first and then R-PVB, G-PVB or B-PVB at 25 °C.

Figure S12. (a,c) Scheme of CPL generation mechanism and CPL spectra when the excitation light passed through R-PC, G-PC or B-PC first and then PI-PC. (b,d) Scheme of CPL generation mechanism and CPL spectra when the excitation light passed through PI-PVB first and then R-PC, G-PC or B-PC at 25 °C.

Figure S13. The phosphorescence decay curves (λ_{ex} = 365 nm) at room temperature of the PMMA composite films, PC composite films and PVB composite films.

Figure S14. Stress-strain curves of the (a) PC composite films and (b) PVB composite films.

Figure S15. CD and UV-vis spectra of the MPI-SP-PMMA.

Figure S16. PL spectra of the PMMA composite films.

Figure S17. (a) PL spectra of the MPI-SP-PMMA composite films. (b) CPL spectra of the MPI-SP-PMMA composite films. (c) g_{lum} spectra of the MPI-SP-PMMA composite films.

code	secret code	code	secret code	code	secret code
000	А	101	К	202	U
001	В	102	L	210	V
002	С	110	Μ	211	W
010	D	111	Ν	212	х
011	E	112	0	220	Y
012	F	120	Р	221	Z
020	G	121	Q	222	*
021	н	122	R		
022	I	200	S		
100	J	201	т		

Table S1. The customized codebook

References

1 J. Yin, L. Xu, X. Han, L. Zhou, C. Li, Z.-Q. Wu, Polym. Chem. 2017, 8, 545-556.