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

Supporting Information

Continuously Fabricated Transparent Conductive Polycarbonate/Carbon Nanotube Nanocomposite Film for Switchable Thermochromic Applications

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Supporting Videos

Video S1: The home-made R2R spraying equipment movement process.

Supporting Figures

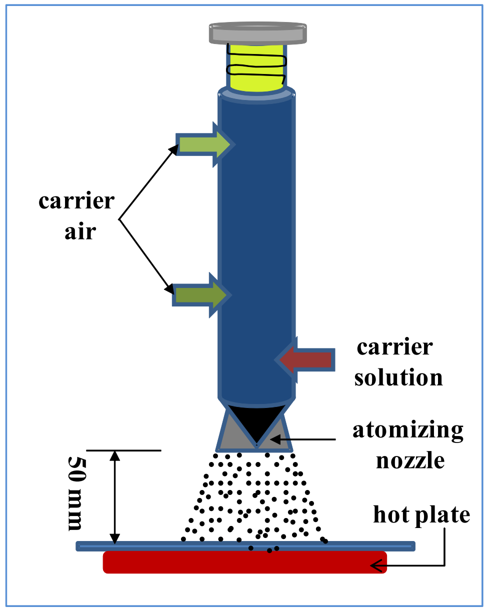

Fig. S1. Schematic diagram of the spraying process.

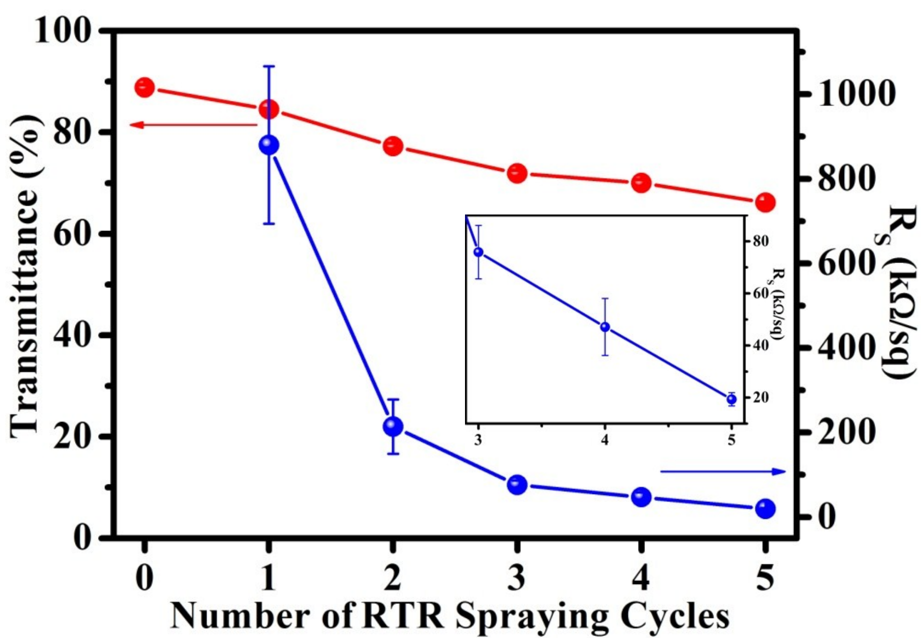

Fig. S2. Sheet resistance and transmittance (at 550 nm) versus the number of R2R spraying cycles for PM_xS_0.

Fig. S2 shows the transmittances at 550 nm and sheet resistances of PM_xS_0 as a function of the increasing R2R spraying cycles of MWNTs dispersion. Exactly, the sheet resistances and transmittance are monotonically decreased (i.e., R_S, from 880 kΩ/sq to 19.33 kΩ/sq, and T, from 90.0 % to 65.7%) with increasing the spraying cycles of MWNTs dispersion, which indicate that there is a trade-off between the R_S and T.

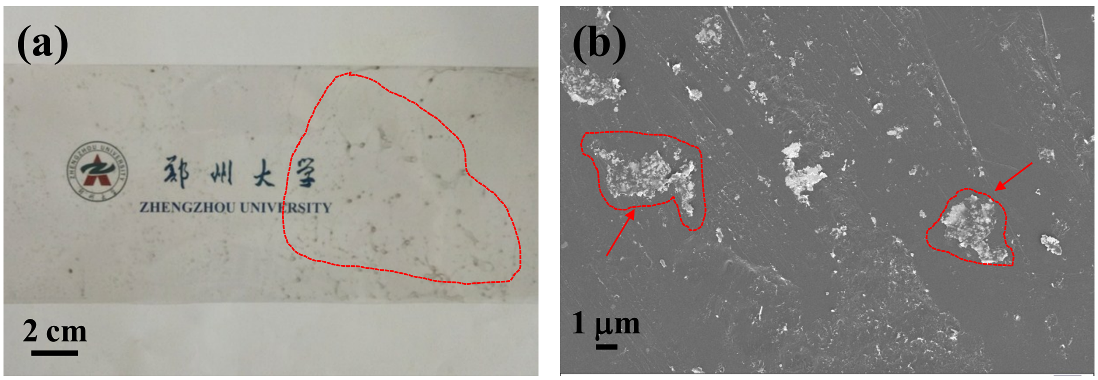

Fig. S3. Photograph of PM_0S_1 (a) and corresponding SEM image (b).

From this photograph Fig. S3, a large number of black spots appear on the surface of PC film. In other words, SWNT can't be evenly sprayed on the PC surface. From the corresponding SEM images, many large carbon nanotube aggregates appear on the surface of the PC film (shown by arrows in Fig. S3b).

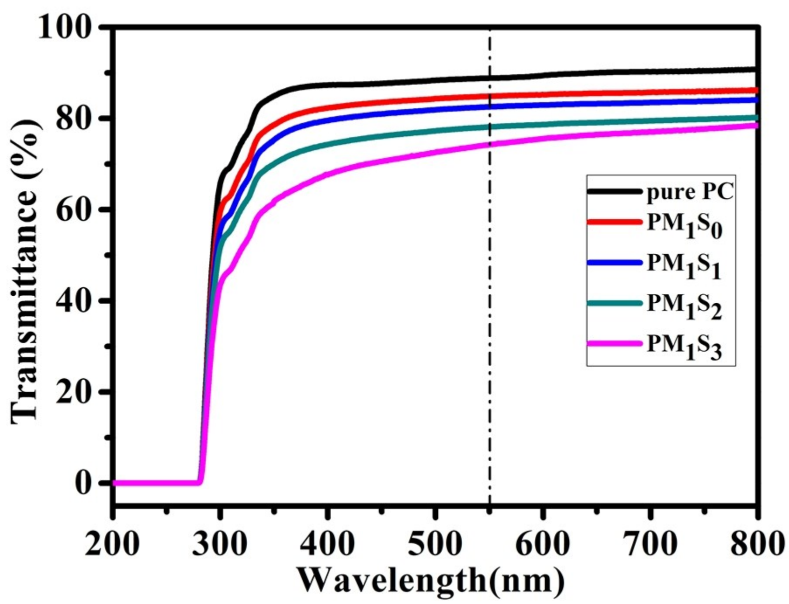

Fig. S4. Optical transmittance spectra of pure PC and PM_1S_y.

Fig. S4 shows the optical transmittance spectra of pure PC and PM_1S_y. The optical transmittance of PC film is approximately 90% in the wavelength range of 400–800 nm. Moreover, within the spectrum range from 400 to 800 nm, although PM_1S_y transparency is found to be gradually reduced with increasing the number of R2R spraying cycle of SWNTs dispersion. However, reduced amplitude of transparency is very small.

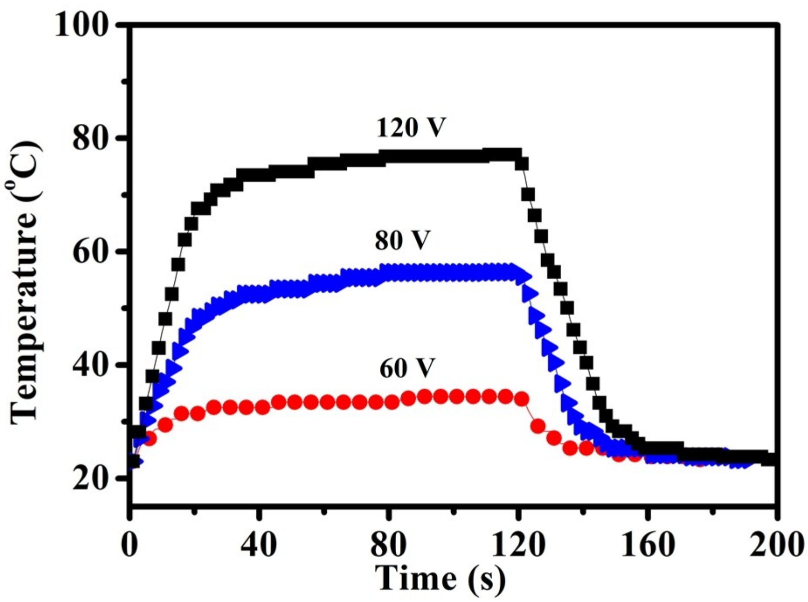

Fig. S5. Temperature–time curves of PM_1S_1 at voltages of 60, 80 and 120 V.

Fig. S5 demonstrates the temperature–time curves of PM_1S_1 at different voltages. On the whole, when the voltage is supplied to PM_1S_1, the temperature of PM_1S_1 increases drastically and reaches a maximum. It quickly returns to the original room temperature after removal of the voltage.

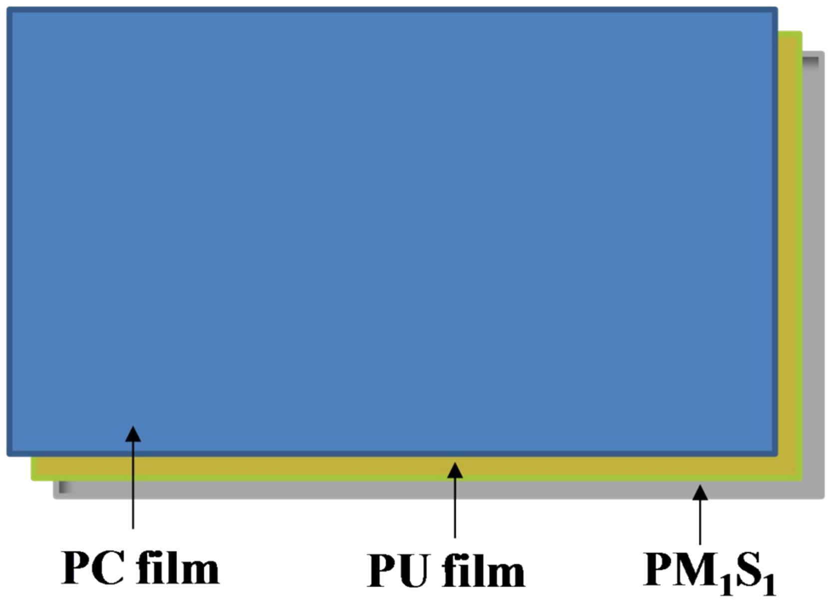

Fig. S6. The sandwiched PM_1S_1/PU/PC composite film.

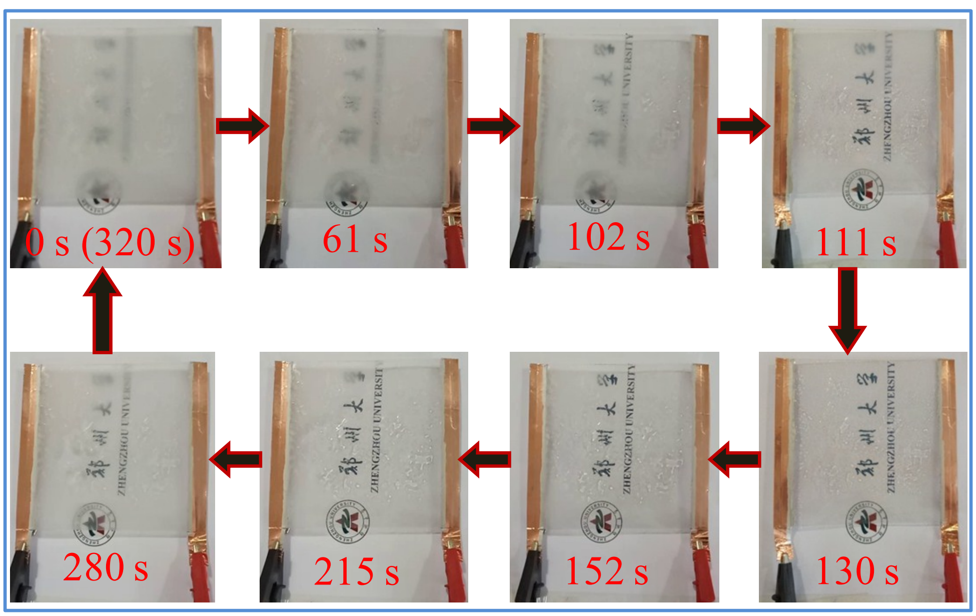

Fig. S7. Snapshots of switchable transparency process of composite film with applied voltage of 120 V.

Fig. S7 shows the opaque-to-transparent transition process of PM_1S_1/PU/PC composite film at voltage of 120 V. The composite film is initially opaque (0 s), while it gradually turns transparent after the voltage is applied (0 s–130 s). Then, it gradually returns to opaque state after turning off the voltage (130 s–320 s). The whole process is performed in the air environment.

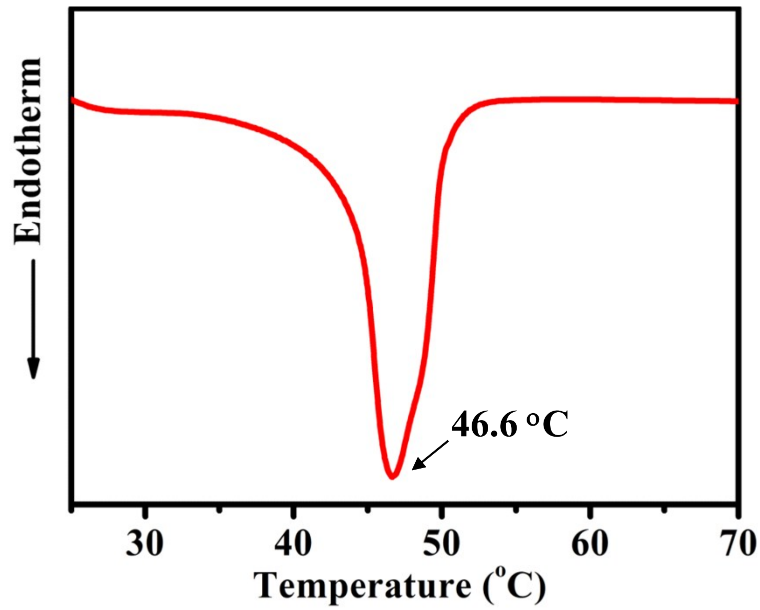

Fig. S8. DSC curve of PU film.

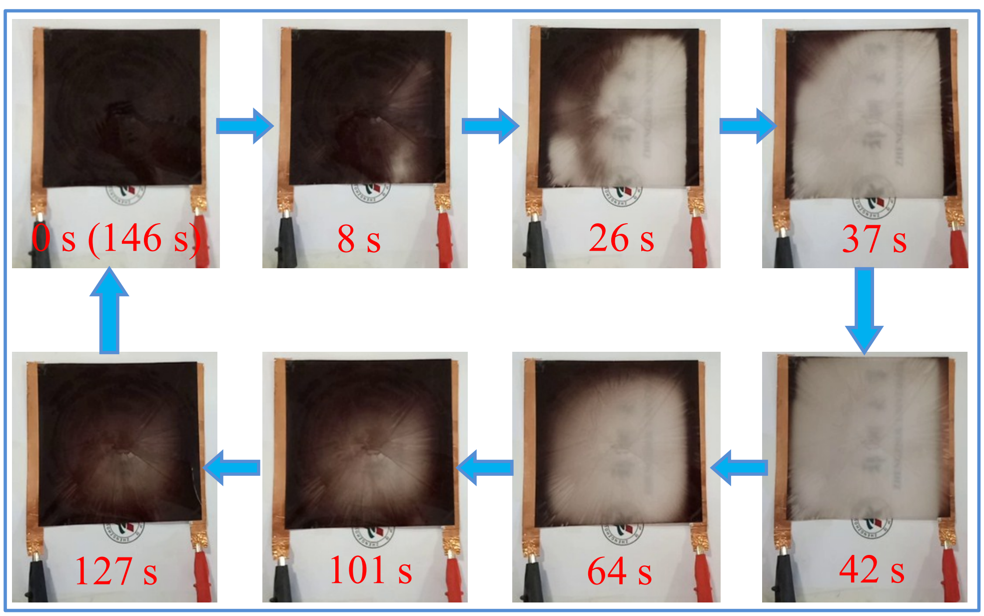

Fig. S9. Snapshots of color-changing process of composite film with applied voltage of 120 V.

Fig. S9 shows the color-changing process of PM_1S_1/thermochromic ink/PC composite film at voltage of 120 V. The composite film is initially black (0 s), while it gradually turns from black to white after the voltage is applied (0 s–42 s). Then, it gradually returns to their initial color after turning off the voltage (42 s–146 s). The whole process is performed in the air environment.

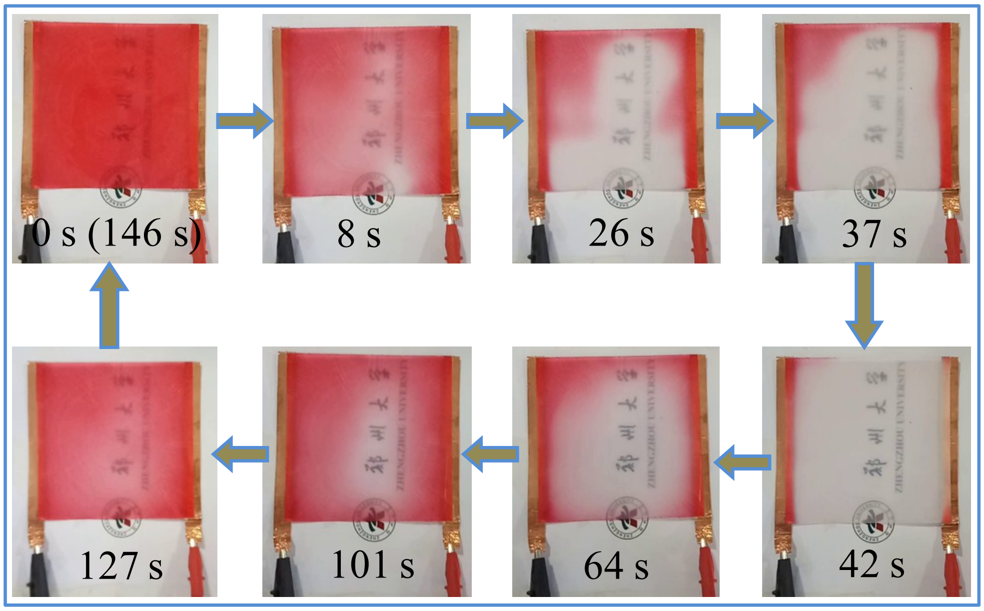

Fig. S10. Snapshots of color-changing process of composite film with applied voltage of 120 V.

Fig. S10 shows the color-changing process of PM_1S_1/thermochromic ink/PC composite film at voltage of 120 V. The composite film is initially red (0 s), while it gradually turns from red to white after the voltage is applied (0 s–42 s). Then, it gradually returns to their initial color after turning off the voltage (42 s–146 s). The whole process is performed in the air environment.