Dual-particle electronic ink based on organic pigment/silica composite particles for color electrophoretic displays

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Abstract: Color electrophoretic displays with good brightness and color sharpness have been attracted a great deal of academic and commercial interests in recent years. Here we prepared chromatic organic pigment/silica core/shell structure composite particles with six different colors (CYM and RGB). The White/color (CYM and RGB) dual-particle electronic inks based on titanium dioxide and organic pigment/silica composite particles were prepared and gave excellent performance and quick response, which had great potentials for application in vivid full-color EPD.

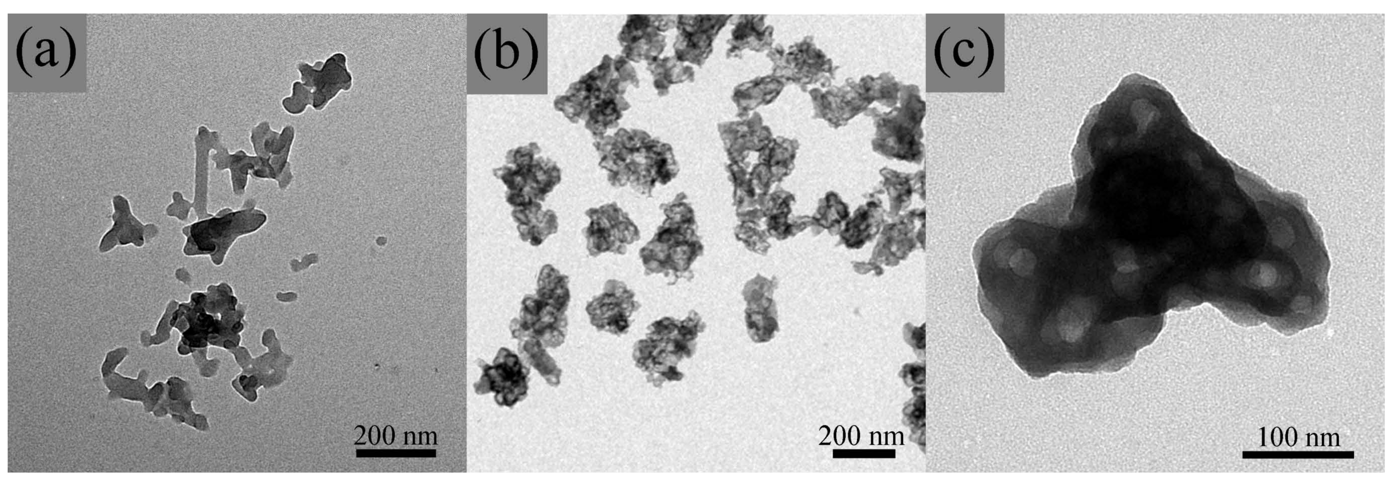


Fig. 1 TEM images of yellow pigment (a) and silica-coated yellow pigment particles (b, c)

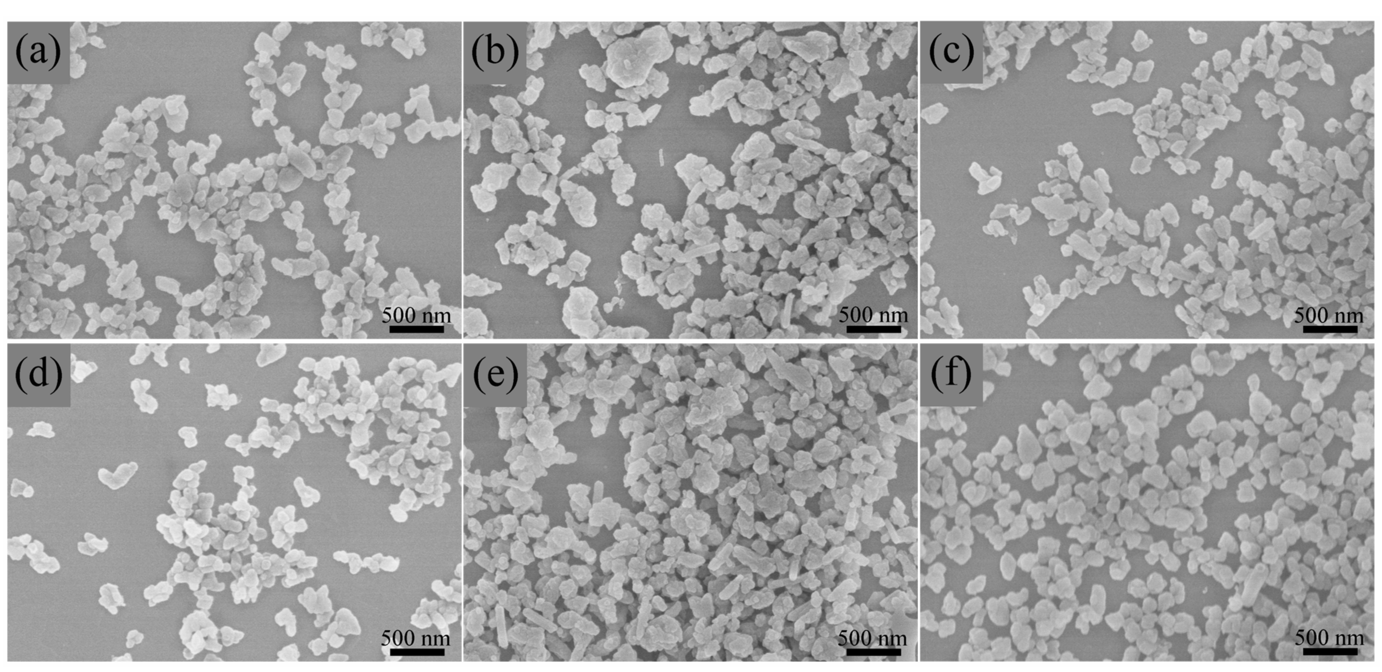


Fig. 2 SEM images of the silica-coated organic pigment composite particles: cyan (a), yellow (b), magenta (c), red (d), green (e) and blue (f)

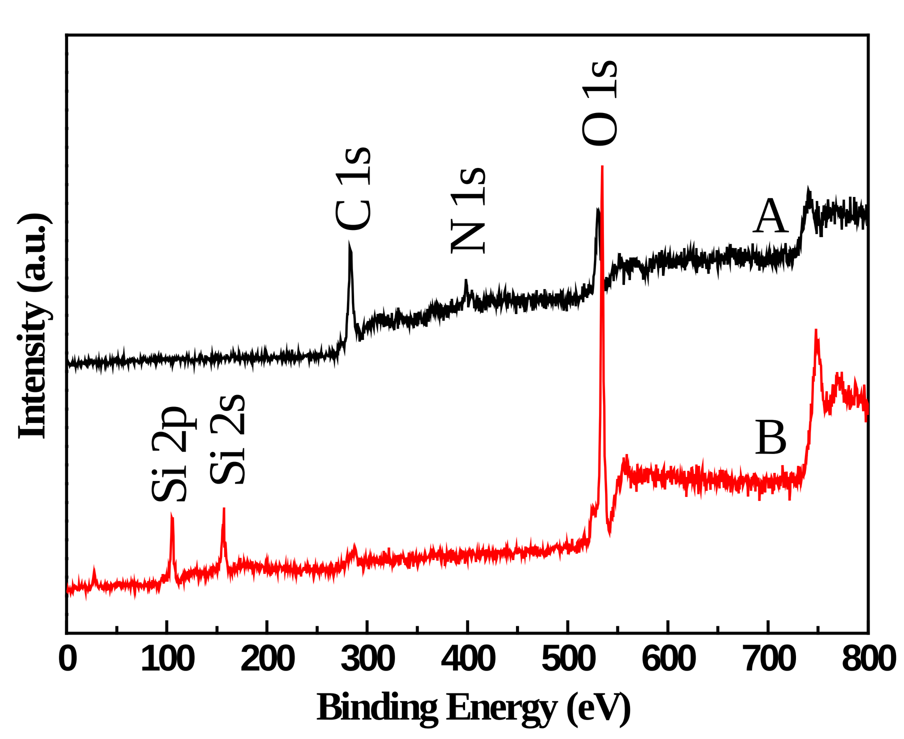


Fig. 3 XPS spectra of yellow pigment (A) and silica-coated yellow pigment particles (B)

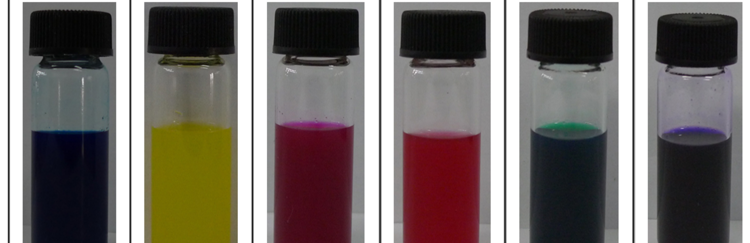
	C	Y	M	R	G	B
Appearance						
Zeta potential (mV)	28.6	28.8	31	30.7	27.3	31.8
Mobility ($\times 10^{-10} m^2 V^{-1} s^{-1}$)	4.49	4.52	4.87	4.82	4.28	4.99

Fig. 4 The appearance of the six chromatic electronic inks, Zeta potential and mobility of the corresponding electrophoretic particles

The chromatic electronic inks were prepared by dispersing the corresponding silica-coated organic pigment particles anchoring a block copolymer (PDMAEMA-b-PLMA) in tetrachloroethylene containing Span 85 .

The white electronic ink was prepared by dispersing the titanium dioxide grafted by PLMA in tetrachloroethylene containing OLOA 1200, the zeta potential and mobility was -26.4 mV and -4.1×10^{-10} $m^2 V^{-1} s^{-1}$, respectively.

The colored dual-particle electronic ink was obtained by blending the corresponding color ink with the white ink.

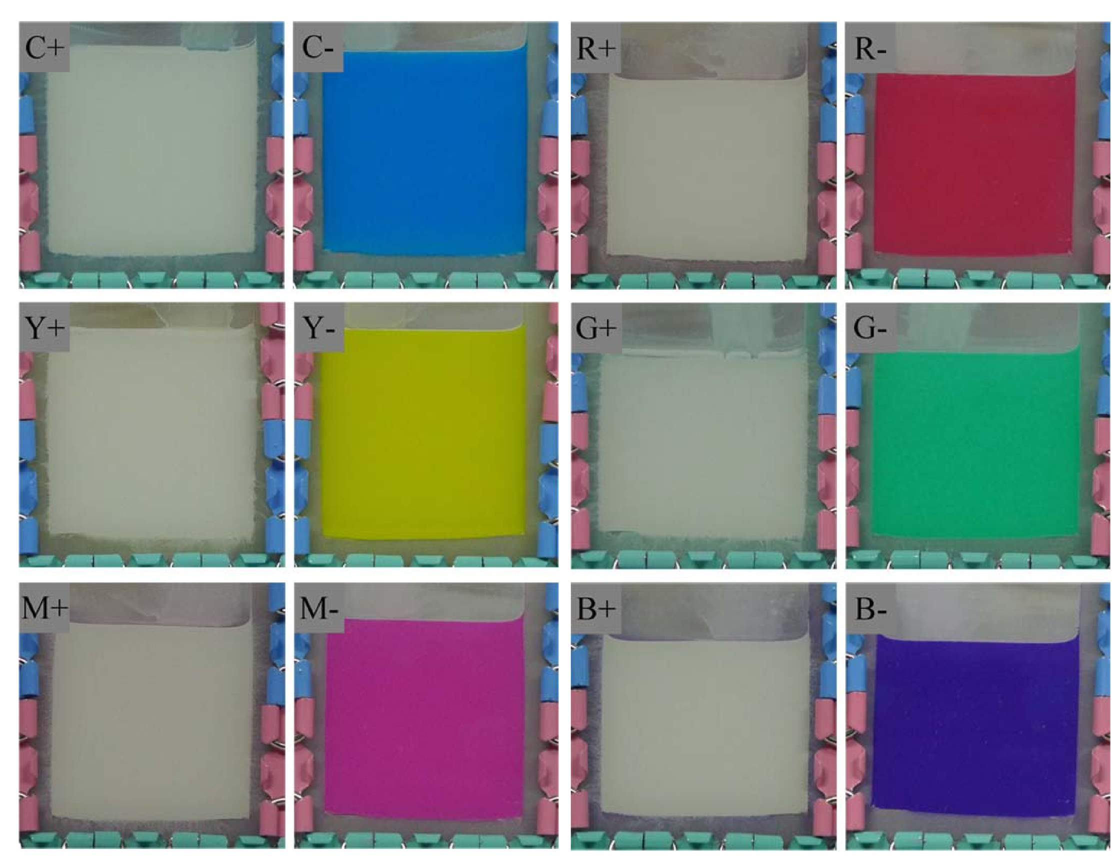


Fig. 5 The appearance of electrodes after applying an addressing voltage to the electrophoretic cell injected by white/cyan (C), white/yellow (Y), white/magenta (M), white/red (R), white/green (G) and white/blue (B) dual-particle electronic inks: positive electrode (+) and negative electrode (-)

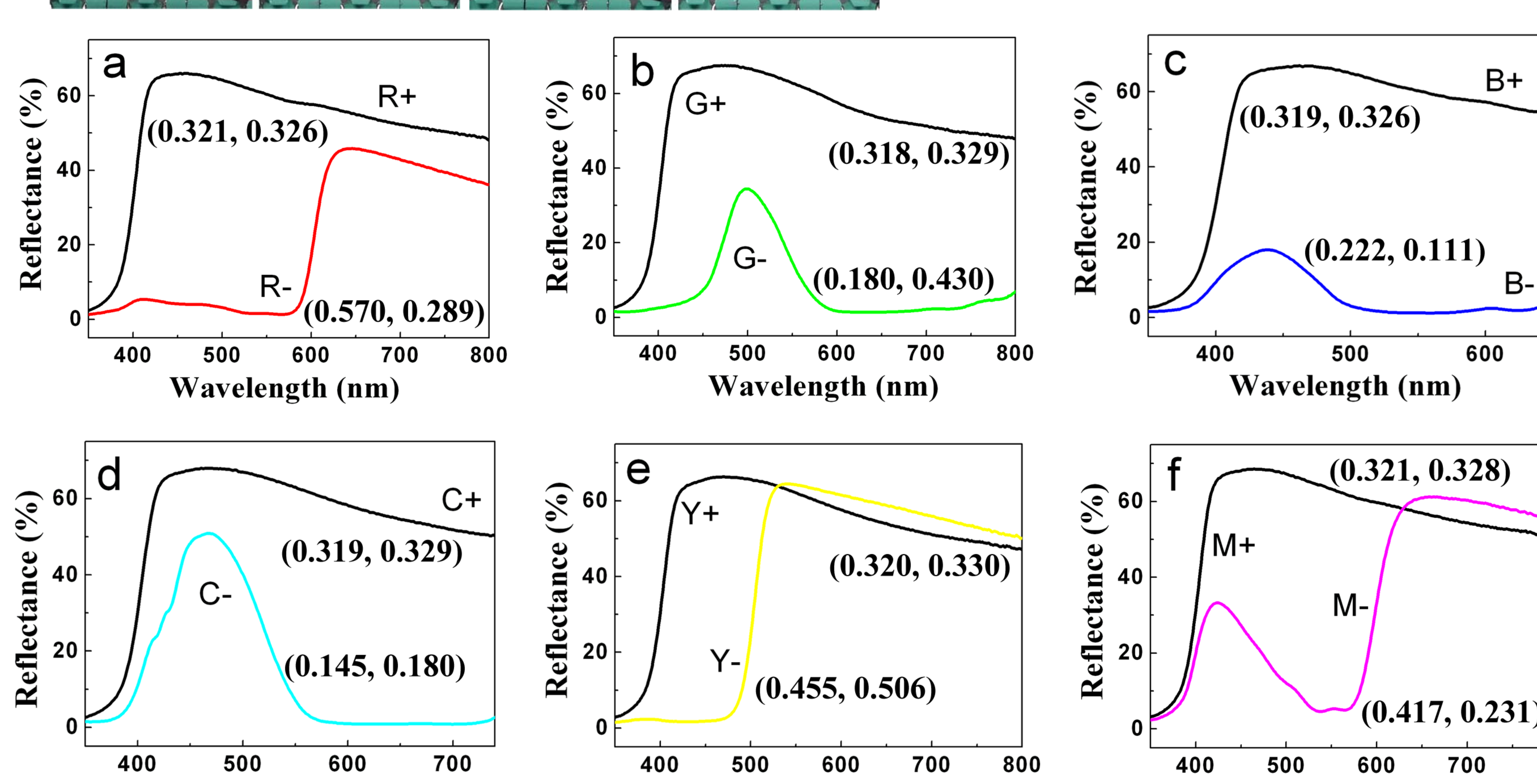


Fig. 6 The diffuse reflection spectra and CIE chromaticity coordinates of the different colored states for the white/red (a), white/green (b) and white/blue (c), white/cyan (d), white/yellow (e) and white/magenta (f) dual-particle electronic inks

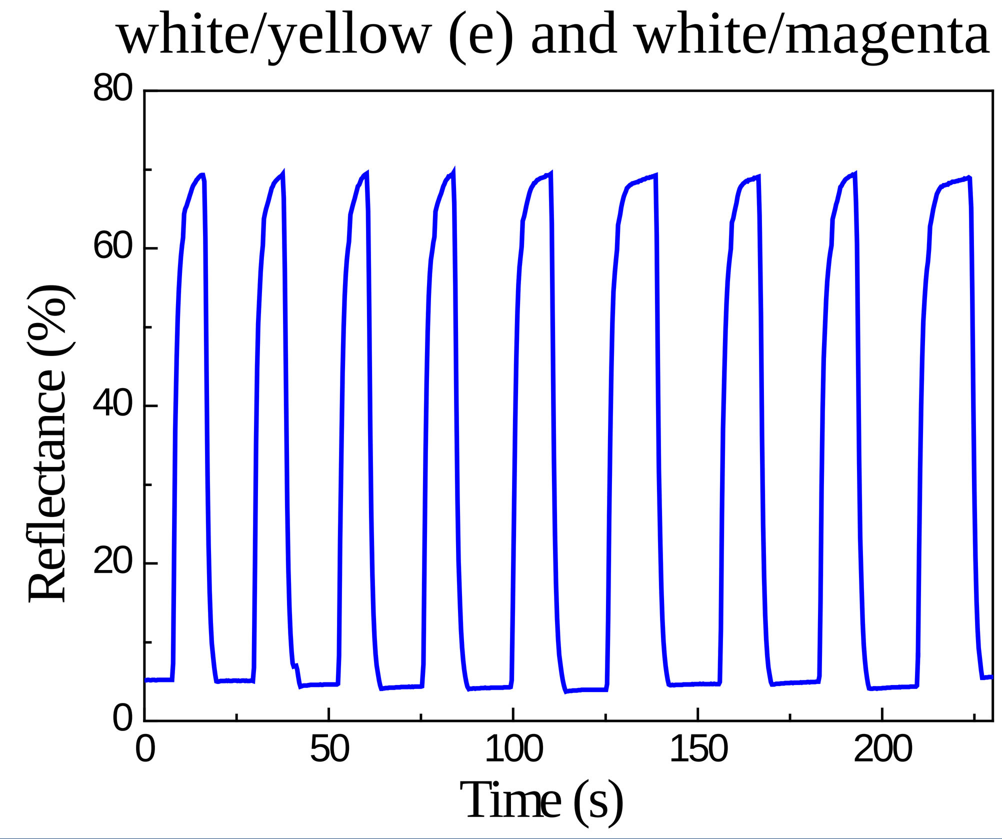


Fig. 7 Optical response of the dual-particle electronic ink for white/yellow display; wavelength of the incident light is 450 nm

Reference

1. B. Comiskey, J. Jacobson, An electrophoretic ink for all-printed reflective electronic displays. ***Nature* 394**, 253 (1998).
2. Peipei Yin, Gang Wu, Wenlong Qin, Xiaoqiang Chen, Mang Wang, Hongzheng Chen, CYM and RGB colored electronic inks based on silica-coated organic pigments for full-color electrophoretic displays, ***Journal of Materials Chemistry C***, 2013, 1, 843.