Supporting Information for

Monodisperse Light Color Nanoparticle Ink toward Chromatic Electro-phoretic Displays

Bo Peng,[a, b] Yue Li,[a, b] Jian Li,[a, b] Lei Bi,[a, b] Haipeng Lu,[a, b] Jianliang Xie,[a, b] Xiangling Ren,[c] Yonghai Cao, [d] Ning Wang,[b,*] Xianwei Meng,[c,*] Longjiang Deng,[a, b, *] and Zhanhu Guo[d,*]

[a] National Engineering Research Center of Electromagnetic Radiation Control Materials, University of Electronic Science and Technology of China, Chengdu 610054, China

[b] State Key Laboratory of Electronic Thin Films and Integrated Devices, University of Electronic Science and Technology of China, Chengdu 610054, China

[c] Laboratory of Controllable Preparation and Application of Nanomaterials, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing, 100190, China

[d] Integrated Composites Laboratory (ICL), Department of Chemical & Biomolecular Engineering, University of Tennessee, Knoxville, TN 37996, USA

Experimental section

Chemical materials: Potassium persulfate (KPS), styrene and methacrylic acid (MAA) were all supplied by the Beijing Chemical Reagent Company. Styrene and MAA were purified by distillation under reduced pressure. Blue 684, Red 454, and Yellow 104 organic dyes were purchased from BASF SE and used without purification.

Synthesis of Charged Chromatic particles: Anionic chromatic particles were prepared by emulsifier-free, emulsion polymerization using KPS as the anionic initiator.[23] In a typical procedure of 230 nm yellow particles, under gentle stirring, 2 mL styrene containing 100 mg Yellow 104 and 0.2 mL MAA were added to 50 mL deionized water at room temperature, which was purged with nitrogen before the reaction. After 40 mg KPS was added, the temperature was increased gradually to 70 °C, and the mixture was stirred for 24 h at 70 °C. The resulting chromatic particles were recovered by centrifugation and washed three times with deionized water. The sample was dried in air for subsequent experiments. Blue 684, and Red 454 organic dyes were used to synthesize blue and pink nanoparticles. The size can be controlled via tuning the volume of styrene. The experimental parameters were shown in the following Table S1, S2, S3.

Table S1. 230 nm diameter particles.

230 nm		Yellow particles	Red particles	Blue particles
styrene	MAA	yellow 104	red 454	blue 684
2 mL	0.2 mL	100 mg		
2 mL	0.2 mL		30 mg	
2 mL	0.2 mL			75 mg

Table S2. 270 nm diameter particles.

270 nm		Yellow particles	Red particles	Blue particles
styrene	MAA	yellow 104	red 454	blue 684
3 mL	0.3 mL	150 mg		
3 mL	0.3 mL		45 mg	
3 mL	0.3 mL			112.5 mg

Table S3. 310 nm diameter particles.

310 nm		Yellow particles	Red particles	Blue particles
styrene	MAA	yellow 104	red 454	blue 684
4 mL	0.4 mL	200 mg		
4 mL	0.4 mL		60 mg	
4 mL	0.4 mL			150 mg

Fabrication of electrophoretic displays: The display cell is composed of two parallel ITO-covered glass slices with a distance of ~500 μm. The texts were fabricated by etching the ITO layer. The cell filled with yellow, blue and pink electrophoretic inks. All three kinds of electrophoretic inks are prepared by dispersions of negatively charged chromatic ink particles and dye in ethylene glycol. The nanoparticles loading are controlled at 10 – 15 wt%.

Character: A scanning electron microscope (SEM, Hitachi 4300) with an accelerating voltage of 5 kV were used to observe the morphology of the particles. Ultraviolet and visible (UV-Vis) diffuse reflectance spectra were recorded with JASCO V-570 spectrophotometer equipped with

an integrated sphere at room temperature. The polydispersity and Zeta potential were measured by Malvern Zetasizer 3000HS. The conductivity was investigated in ethylene glycol by REX DDS-307 conductivity meter with platinum black electrode.

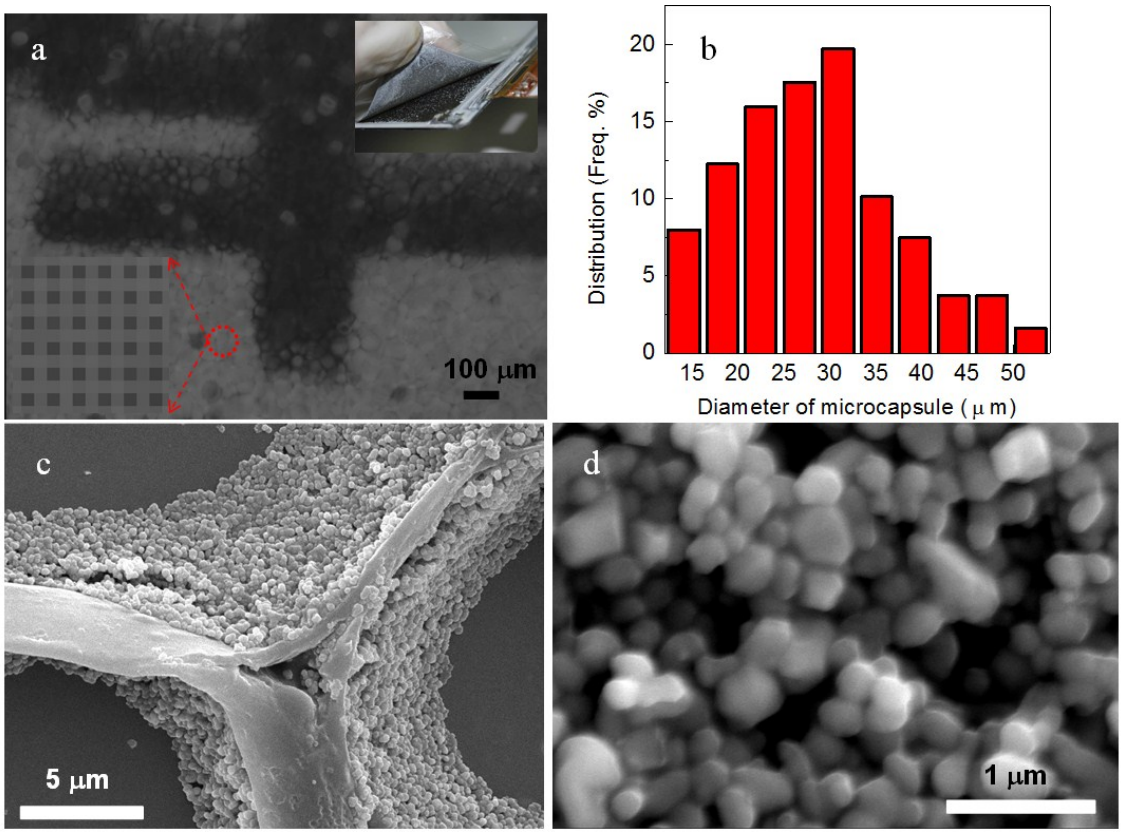

Fig. S1 Analysis of E-ink commercial electrophoretic display: (a) optical microscope image of electrophoretic display cut from the commercial device, shown in the inset image in the upper-right corner in Figure R2a. The microcapsules are clearly observed. The inset in the lower left corner is the zoom-in image of the highlighted area, which shows that the driving circuits with line width of ~1.0 μm are on the top of microcapsules. (b) The size distribution of microcapsules. (c) The zoom-in SEM image of the inside of microcapsule. (d) The SEM image of inside electrophoretic nanoparticles.

The commercial E-ink electrophoretic display was characterized, Fig. S1. It should be noted that the commercial colorful polystyrene particles with diameter of 3-5 μm are not suitable for electrophoretic displays, because the particle size is much larger than pixel size (1 μm), resulting in the drastic decrease of display resolution.

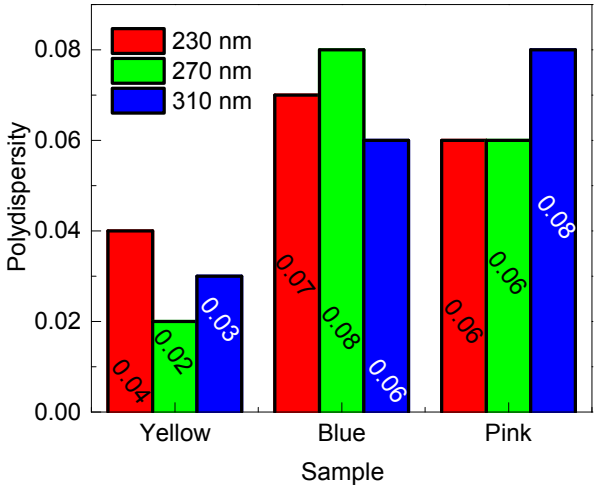

Fig. S2 Polydispersity of yellow, blue and pink chromatic nanoparticles.

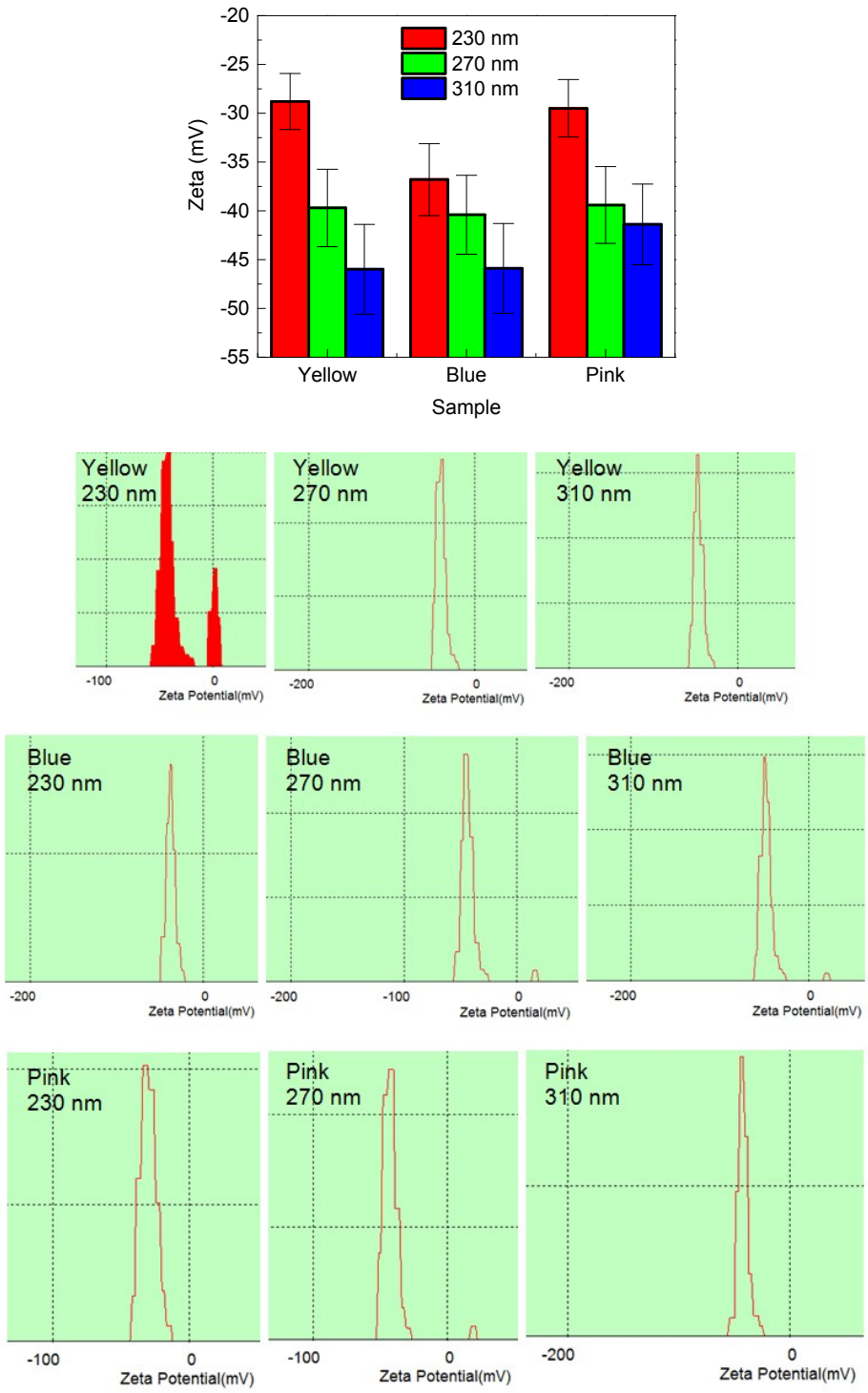

Fig. S3 Zeta potential of yellow, blue and pink chromatic PS nanoparticles.