Supplementary material (ESI) for Journal of Materials Chemistry

Supplementary information for

Uniformed nano-downsizing of organic pigments through core-shell structuring

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TEM observation

TEM pictures of dry-milled nanoparticles were taken on a JEM-1200EX II (JEOL) at an accelerating voltage of 120 kV. Specimens for the observation were prepared by putting an aqueous suspension of a powdery sample on a carbon-coated copper grid, followed by drying at an ambient temperature. Fig. S1 displays TEM images of the enlarged version of Fig. 1, whereas Fig. S2 shows phthalocyanine green and diketopyrrolopyrrol red before and after the hybridisation. TEM observation of a hybrid of phthalocyanine blue with the silica dispersed in a solution of a copolymer of methyl methacrylate and methacrylic acid was carried out on a JEM-2000 (JEOL) at an accelerating voltage of 200 kV by placing the dispersion on a carbon-coated copper grid, followed by drying at an ambient temperature, and the result is shown in Fig. S2. Measurements of diameters of particles in TEM pictures were carried out to obtain an averaged diameter and geometrical standard deviation (GSD) for each sample.

X ray diffraction measurements

X ray diffraction data of powders were recorded on a diffractometer (RINT 2500; Rigaku) using CuKα radiation with a graphite monochrometer. The results are shown in Fig. S3.

Evaluation of contrast ratio of pigment-dispersed colour filters

A dispersion of 15 wt % of a pigment with or without the hybridization in PGMEA containing a copolymer of methyl methacrylate and methacrylic acid was spin-cast on a glass plate, followed by air-drying, to fabricate a thin film with a constant thickness. Fig. S4 shows transmission spectra of the films of three orginal colours. Each film was placed between a couple of polariser sheet at parallel and crossed positions to record transmittances *Tp* and *Tc*, respectively. Contrast ratio *C* is defined as $C = Tp / Tc$, and the results are summarised in Table S1.

Table S1 Contrast ratios of pigment-dispersed coloured films

Pigment	Type	Contrast ratio (*C*)	Level of contrast enhancement
Phthalocyanine green	Core-shell	5244	1.41
	Original	3732	
Phthalocyanine blue	Core-shell	3866	1.44
	Original	2680	
Diketopyrrolopyrrole red	Core-shell	2106	1.73
	Original	1218	

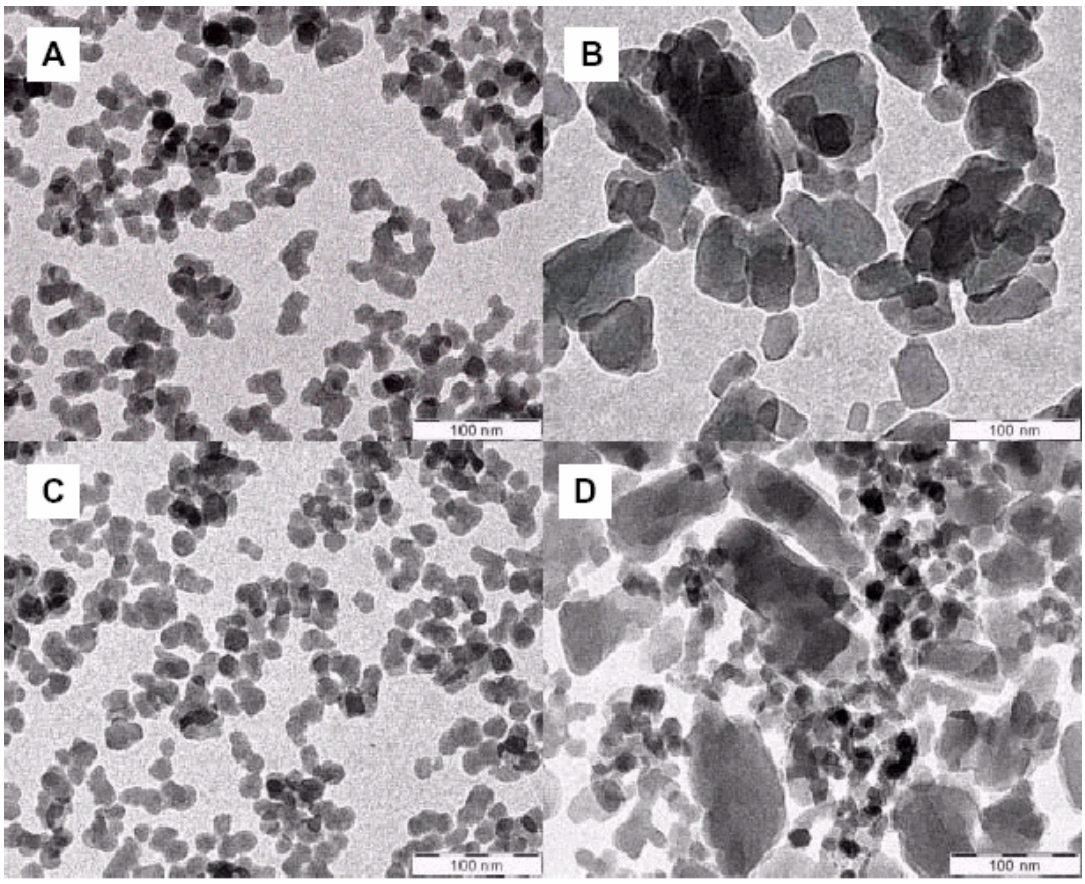

Fig. S1 TEM images of (**A**) surface-modified silica particles, (**B**) the original phthalocyanine blue, (**C**) a 1:1 (w/w) co-milled mixture of the both and (**D**) a 1:1 physical mixture of the both.

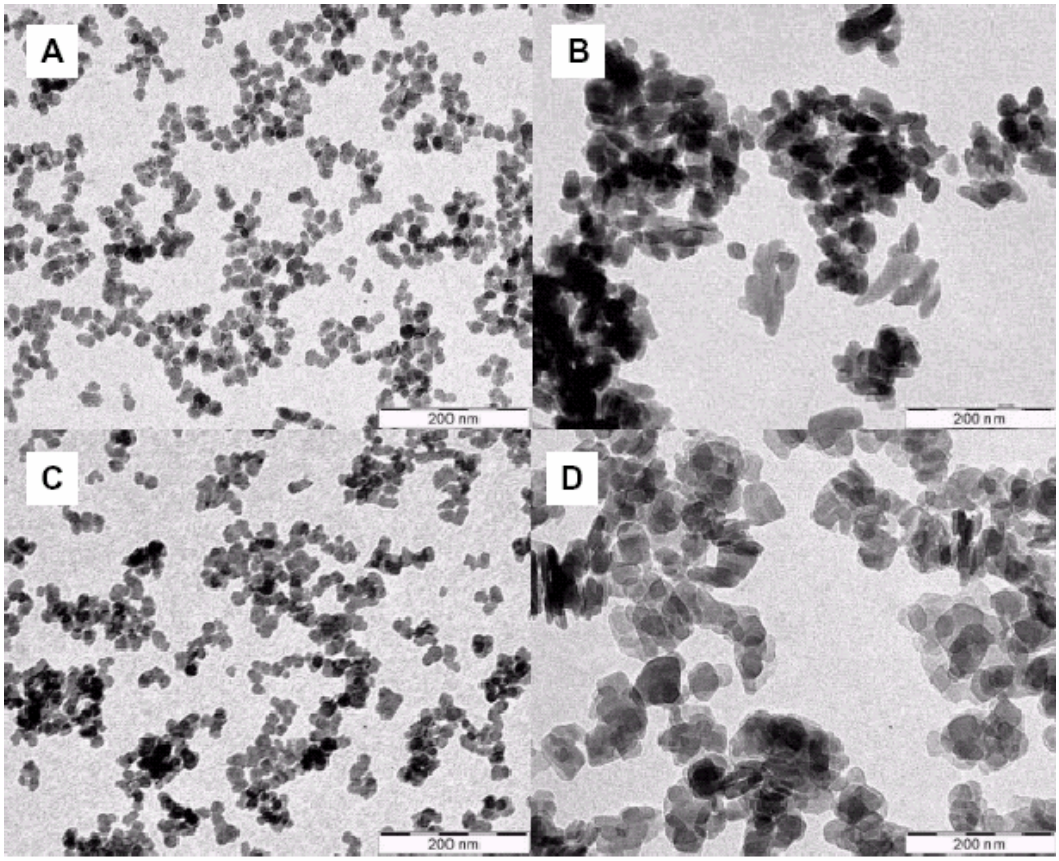

Fig. S2 TEM pictures of (**A**) 1:1 (wt/wt) silica hybrids of phthalocyanine green, (**B**) the original green pigment, (**C**) 1:1 (wt/wt) silica hybrids of a diketopyrrolopyrrole red and (**D**) the red original pigment.

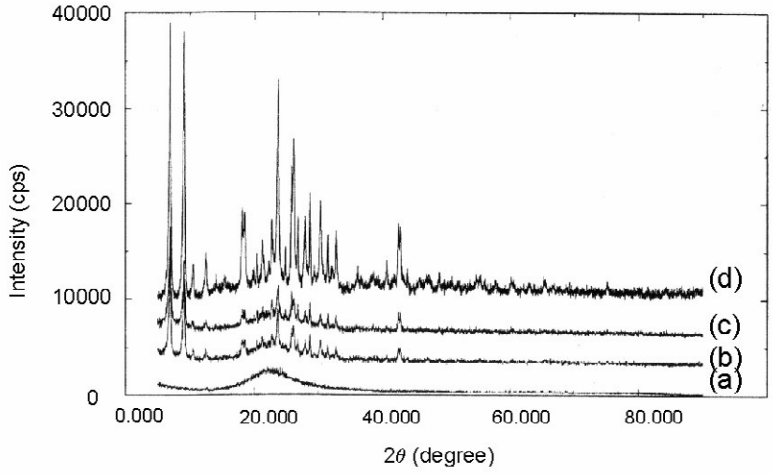

Fig. S3 XRD of (a) surface-modified silica powder, (b) the phthalocyanine blue and the milled 1:1 (w/w) mixtures of the pigment with the silica (c) with and (d) without the surface modification.

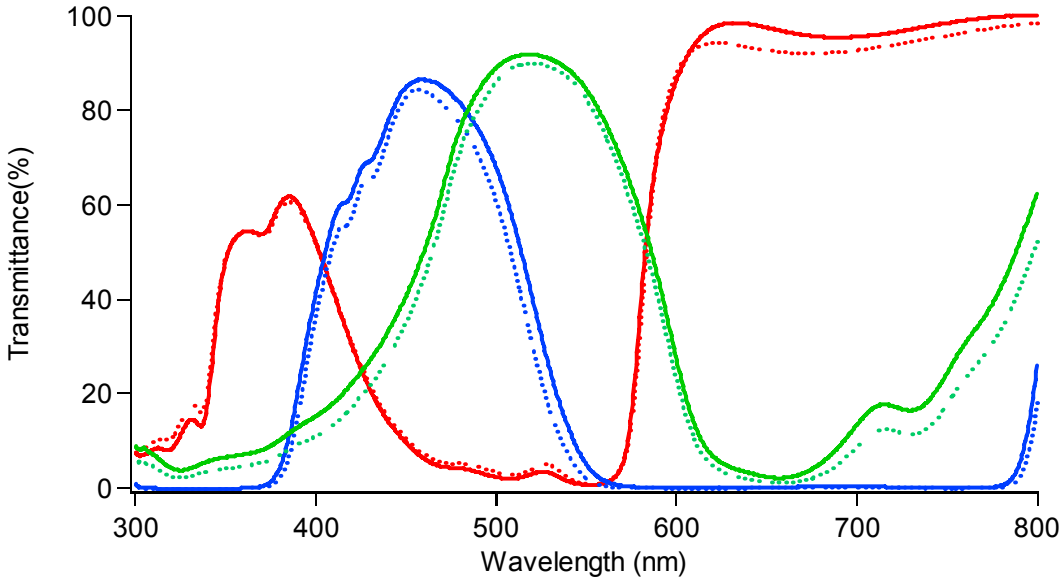

Fig. S4 Transmission spectra of films dispersing the hybrid particles of the phthalocyanine blue (blue line), phthalocyanine green (green line) and diketopyrrolopyrrole (red line). The broken lines are those dispersing the corresponding original pigments.