Supplementary Information

Polystyrene-Encapsulated Diarylethene Nanocrystals by Soap-Free Emulsion Polymerization

Norio Tagawa,[a] *Akito Masuhara,*[b] *Tsunenobu Onodera,*[a] *Hitoshi Kasai,*[a,c] *and Hidetoshi Oikawa*[a]

[a] Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, 2-1-1 Katahira, Aoba-ku Sendai, Miyagi 980-8577, Japan, [b] Graduate School of Science and Engineering, Yamagata University, 4-3-16 Jonan, Yonezawa, Yamagata 992-8510, Japan, [c] PRESTO, Japan Science and Technology Agency (JST), 4-1-8 Honcho, Kawaguchi, Saitama 332-0012, Japan

Experimental

All chemicals were commercially available and used without further purification. Water purified up to 18.2 MΩ cm was also used through all experiments. Diarylethene (DAE) was first dissolved in THF. Then 20 mL of this solution was injected into water (500 mL) with a pulseless syringe pump (260D; Teledyne Isco Inc.) at room temperature in a dark room, while it was stirred vigorously using a ramond stirrer (1400 rpm). The resulting aqueous dispersion liquid of DAE nanocrystals was irradiated immediately (within 30 sec) with microwaves (2.45 GHz, 500 W, 7 min). Then, DAE nanocrystals were encapsulated by soap-free emulsion polymerization method using styrene monomer, divinylbenzene as a cross-linking agent, and potassium persulfate as an initiator, respectively. The weight ratio of styrene monomer and divinylbenzene was 95:5, and their total amount was 100 mg. The polymerization was carried out at 253 K with mechanical stirring (1000 rpm) for 6 h under the nitrogen atmosphere. The resulting aqueous dispersion liquid was purified by centrifugation and redispersion.

PS-encapsulated DAE nanocrystals were evaluated using a dynamic light scattering instrument (DLS: Zetasizer Nano series Nano-ZS; Malvern Instruments, Ltd.), scanning electron microscopy (SEM: JSM-6700F; JEOL), and transmission electron microscopy (TEM: H-7650; Hitachi Ltd.). Powder X-ray diffraction (XRD) patterns were measured (D8 Advance; Bruker AXS K.K.). The wavelength of insident X-ray was 1.54 Å (CuK_{α}). The UV-vis absorption spectrum was measured using a UV-visible spectrometer (V-570DS; Jasco Corp.). UV-light irradiation was performed using UV lamp (λ = 254 nm, SUV-16; AS ONE Corp.).

Figures

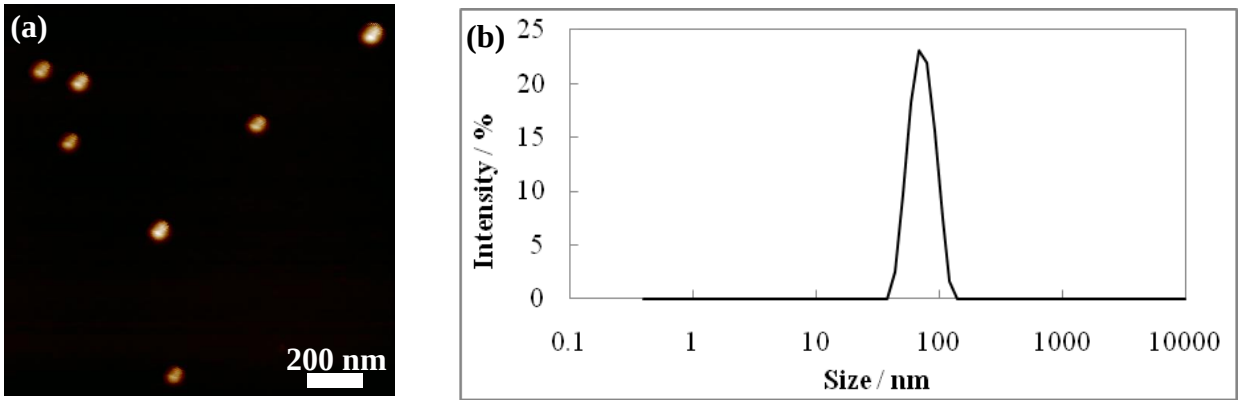

Figure S1. AFM image (a) and size distribution by DLS (b) of DAE nanocrystals sized 76 nm. The size was evaluated by AFM and DLS.

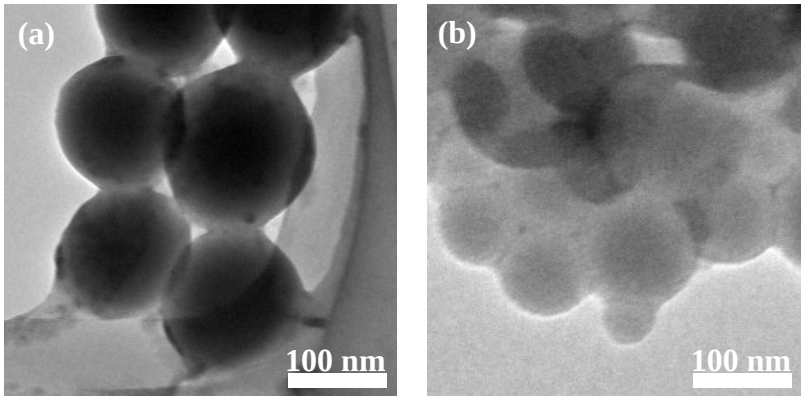

Figure S2. TEM images of PS-encapsulated DAE nanocrystals (a) and PS nanoparticles (b). The core DAE nanocrystals can be observed in only figure S2a. A low contrast between DAE nanocrystals and PS shell was observed because both materials were organic and they had similar densities: 1.42 g/cm^3 for DAE nanocrystals and 1.05 g/cm^3 for PS. PS nanoparticles are light color because of lower density than DAE nanocrystal.