Electronic Supplementary Information for

Vesicles Fabricated by Hybrid Nanoparticles

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Materials: 4,4'-Azobis(4-cyanopentanoic acid) (ABCPA, Aldrich, 97%) was recrystallized from methanol and dried under vacuum at room temperature. Styrene was purchased from KRS FINE CHEMICAL CO. LT. and purified by distillation at reduced pressure prior to use. $FeCl_3 \cdot 6H_2O$, $FeCl_2 \cdot 4H_2O$, 1.2M HCl solution and NaOH were purchased from Tianjin agent company and used as received. All the solvents were distilled before use. PS with pendant AuNPs were synthesized as reported previously.[1]

Measurements: The apparent molecular weights and molecular weight distributions of the polymers were determined at 35 ºC on a gel permeation chromatograph (GPC) equipped with a Waters 717 autosampler, Waters 1525 HPLC pump, three Waters Ultra Styragel columns with 5K-600K, 500-30K, and 100-10K molecular ranges, and a Waters 2414 refractive index detector. THF was used as the eluent at a flow rate of 1.0 mL/min. The number average molecular weights (Mn) and the molecular weight distributions of the polymers were calibrated on polystyrene standards. Transmission electron microscopy (TEM) images were obtained on a Tecnai G2 20 S-TWIN electron microscope equipped with a Model 794 CCD camera (512×512) at an operating voltage of 200 kV. Atom force microscopy (AFM) measurements were performed with a multi Model atomic force microscope (Digital Instrumental Nanscope IV) on a fresh mica surface in the tapping mode at room temperature in air. The samples were prepared by spin-coating a drop of dilute aqueous solution onto a fresh mica surface at room temperature. Thermogravimetric analysis (TGA) measurements were performed on a Netzsch TG 209 at a heating rate of 10K/min under nitrogen atmosphere.

Preparation of PS-coated Fe_3O_4 nanoparticles: Fe_3O_4 nanoparticles with hydroxyl groups on the surface were prepared according to the literature.[2] $FeCl_3 \cdot 6H_2O$ (2.16 g, 7.99 mmol) and $FeCl_2 \cdot 4H_2O$ (0.835 g, 4.20 mmol) were added into 6.50 mL of deoxidized HCl solution (0.411M) under an argon atmosphere at stirring. The resulted solution was added dropwise into 82.5 mL of NaOH solution (1.50 M) under rigorous stirring. The solution was stirred for 30 min, and then centrifuged at 8000 rpm for 2 min. Dark Fe_3O_4 nanoparticles powder was filtered, washed by deoxidized doubly-distilled water, and dried in vacuum.

Fe_3O_4 nanoparticles coated with ABCPA: An acetone solution (20 ml) containing the Fe_3O_4 nanoparticles (1 g) was combined with ABCPA (1.3 g, 4.64 mmol) under argon atmosphere. The Fe_3O_4 nanoparticles were dispersed under ultrasonic at room temperature for 1.5 h. The solution was centrifuged at 8000 rpm for 5 min, and the dark-brown Fe_3O_4 nanoparticles were filtered, washed by CH_2Cl_2, and dried in vacuum.

Fe_3O_4 nanoparticles coated with polystyrene: Fe_3O_4 nanoparticles coated with ABCPA (8 mg) were dispersed in toluene (2 mL) under ultrasonic, and then styrene (2 mL) was added. The solution was bubbled with argon for 30 min, and the polymerization was conducted at 80 ^oC for 12 h. The PS-coated Fe_3O_4 nanoparticles were precipitated in methanol and centrifuged at 8000 rpm for 5 min. In order to remove free polystyrene, the hybrid nanoparticles were redispersed in 5 mL of chloroform and centrifugated, and the hybrid nanoparticles at the bottom of vials were collected. A drop of the PS-coated Fe_3O_4 nanoparticles dispersion in chloroform was casted on a TEM grid and allowed to dry, and then TEM measurement was conducted. The average size of PS-coated Fe_3O_4 nanoparticles determined by TEM was about 8 nm (Figure S1). The number-average molecular weight and molecular weight distribution of PS were 161K and 2.48, respectively. TGA measurements (Figure S2) for free-radical initiator modified Fe_3O_4 and PS-coated Fe_3O_4 nanoparticles were found to have 17 wt% and 28 wt% volatile materials, so the weight percentage of PS on Fe_3O_4 nanoparticles was about 11 wt%.

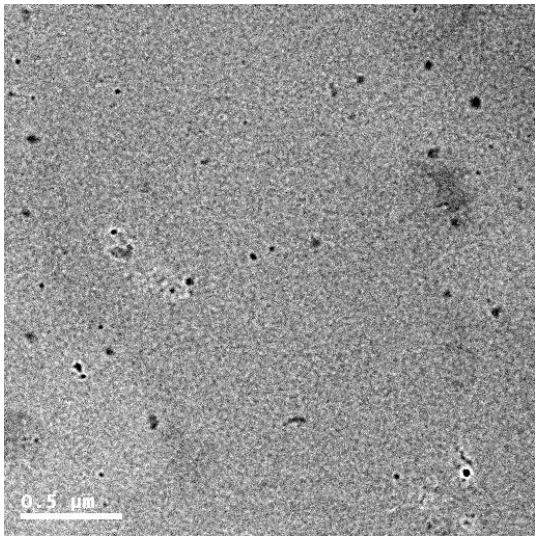

Figure S1. A TEM image of Fe_3O_4 nanoparticles coated with polystyrene in THF solution.

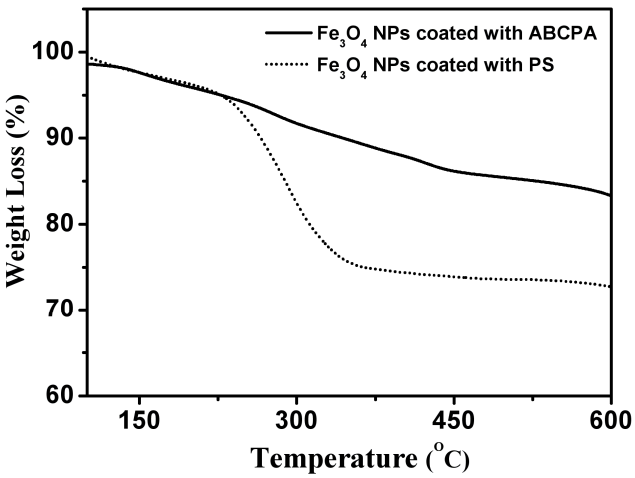

Figure S2. TGA curves for free-radical initiator modified Fe_3O_4 and PS-coated Fe_3O_4 nanoparticles.

Preparation of vesicles: THF solutions of PS with pendant AuNPs and PS-coated Fe_3O_4 nanoparticles were mixed under ultrasonic at room temperature. Then 7-fold of deionized water was added dropwise to the solution of the mixture under ultrasonic at room temperature. In order to remove THF, the solution was dialyzed against water.

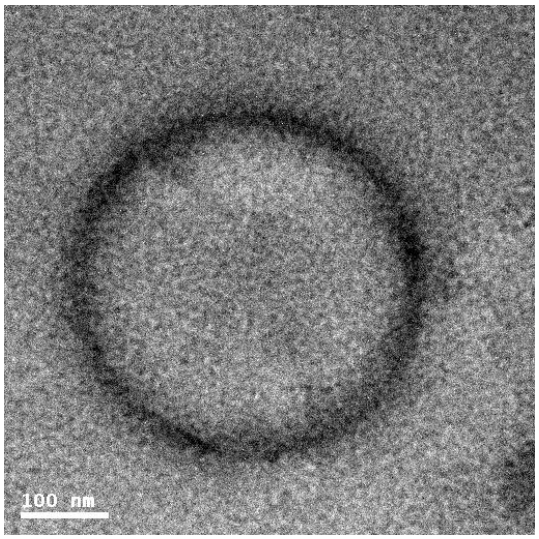

Figure S3. A magnified TEM image of a typical vesicle showing details of the structure.

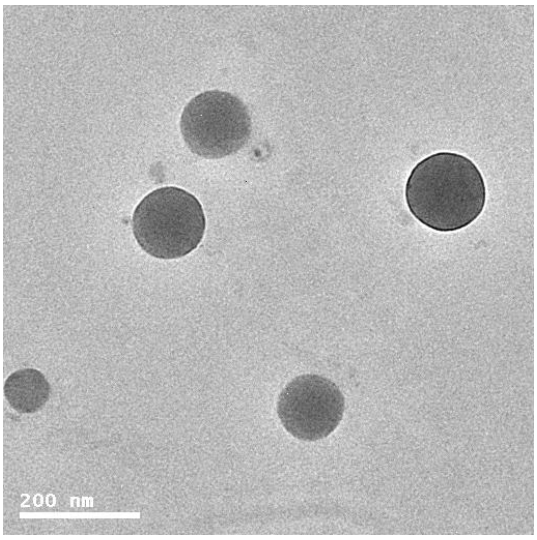

Figure S4. A TEM image showing the micellar structures of PS-AuNPs in water.

references

1. X. Zhang, L. Liu, J. Tian and H. Zhao, Chem. Commun., 2008, **48**, 6549.
2. Y. S. Kang, S. Risbud, J. F. Rabolt and P. Stroeve, Chem. Mater., 1996, **8**, 2209.