

Supporting Information

One-step synthesis of Janus hybrid nanoparticles using reverse atom transfer radical polymerization in emulsion

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Chemicals and Materials.

Styrene (CP, purchased from Sinopharm Chemical Reagent Co., Ltd.) was washed with 5% NaOH aqueous solution, dried over anhydrous MgSO₄, and distilled under reduced pressure. CuBr (CP, purchased from Sinopharm Chemical Reagent Co., Ltd.) was purified by washing with glacial acetic acid and absolute ethanol three times after steeping in dilute sulfuric acid and drying in a vacuum oven at 100 °C. 1, 10-phenanthroline (Phen, 99%) was purchased from TCI (Shanghai) and was used as received. NaOH (AR grade), MgSO₄ (AR grade), glacial acetic acid (AR grade), absolute ethanol (AR grade), sodium citrate (C₆H₅Na₃O₇·2H₂O, AR grade), 2, 2-azobisisobutyronitrile (AIBN, CP grade), CuCl₂·2H₂O (CP grade), chloroauric acid (HAuCl₄·4H₂O, AR grade), cetrimonium ammonium bromide (CTAB, AR grade) and other reagents were all purchased from Sinopharm Chemical Reagent Co., Ltd. without further purification. High purity N₂ was obtained from Yingjiang Shanghai Chemical., Ltd. All the solvents were distilled under reduced pressure before use.

Preparation of Gold Colloids

Gold nanoparticles ~30nm in size were prepared using the method reported by Frens and Li.[1] Aqueous solution of HAuCl₄ (1×10⁻⁴ g/ml, 25ml) was boiled under gentle stirring. After a few minutes, a freshly prepared aqueous sodium citrate solution (0.01g/ml, 0.4ml) was added dropwise with vigorous stirring. The mixture turned red in a few minutes. After further vigorous stirring for 0.5h, the product was collected by centrifugation and redissolved in the water.

Synthesis of Janus hybrid nanoparticles

We conducted precipitation polymerization of polystyrene (PS) by adding Au colloids into the system after the polymerization proceeded for a few minutes. In a typical synthesis, AIBN

(0.0019g), Phen (0.0061g), CTAB (0.0633g), water (15ml), the mixture of CuBr (0.0003g) and CuCl₂ (0.0027g) were added to a Schlenk flask under N₂ atmosphere. This system was heated to 70 °C under magnetic stirring. When the temperature reached 70 °C, 0.5ml of styrene was added to the Schlenk flask. 2 minutes later, 4.0 ml of gold colloids above prepared were introduced. The RATRP polymerization was conducted at 70 °C for 4 h under N₂ atmosphere and stopped by exposing to air. The product was collected by centrifugation and washed with a mixture of ethanol and water two times. The sample was finally dispersed in 10 ml of ethanol.

Characterization Techniques

Transmission electron microscopy (TEM) images were obtained by a JEOL 200CX electron microscope equipped with a Model GATAN782 CCD camera at an operating voltage of 120 kV. The samples for TEM studies were prepared by placing one droplet of the sample deposited onto carbon-coated copper grids.

An Agilent 8453 UV–vis spectrophotometer (Agilent technologies, CA, USA) was utilized to analyze the UV–vis absorption property of the sample. The slit width was 1 nm during the measurements.

References

- 1 G. Frens, *Nature*, 1973, 241, 20-22. Y. Li, L. Song, Y. Qiao, *RSC Adv.* 2014, 4, 57611–57614.