Supporting information

One-Pot Stöber Route Yields Template for Ag@Carbon Yolk-Shell Nanostructures

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Ag,AgBr@SiO₂@RF polymer: In a typical synthesis, CTAB (0.10 g) was dissolved in a mixture of water (20 mL) and ethanol (8 mL). Then, an aqueous solution of ammonia (NH₄OH, 0.1 mL, 25 wt%) was added and stirred at 30 °C for 15 min, followed by addition of an aqueous solution of silver nitrate (1.0 mL, 0.15 M). After stirring for 15 min, TEOS (2 mL) was added. After stirring for an additional 30 min, a solution of formaldehyde (0.28 mL) was added. After further stirring for 1 h, resorcinol (0.2 g) was added. The mixture was stirred for 24 h at 30 °C and subsequently heated for 24 h at 100 °C under static conditions in a Teflon-lined autoclave. The solid product was recovered by centrifugation and vacuum dried at 100 °C for 24 h.

Ag@Carbon yolk-shell: Ag,AgBr@SiO₂@RF polymer was carbonized under N_2 atmosphere at 600 °C for 1 h with a heating rate of 1 °C/min using MTI OTF-1200X tube furnace. After washing in 5wt % HF aqueous solution for 24 h, Ag@Carbon yolk-shell was obtained.

Characterization: Scanning electron microscopy (SEM) images, scanning TEM (STEM) images and energy dispersive x-ray analysis (EDS) mapping were obtained on a FEI Quanta 200 FEG Environmental-SEM equipped with an EVEX EDS. Transmission electron microscopy (TEM) images and selected area electron diffraction (SAED) patterns were recorded using a Philips CM200 FEG-TEM. X-ray diffraction (XRD) patterns were recorded on a Bruker D8 Discover Diffractometer operated in grazing incidence diffraction mode. N₂ sorption analysis was performed on a Micromeritics ASAP2010 volumetric adsorption analyzer at 77 K. The surface area and pore size were obtained by using Brunauer–Emmett–Teller (BET) and Barrett–Joyner–Halenda (BJH) methods, respectively. The Raman spectra were taken by Horiba LabRAM Aramis Raman spectrometer with excitation wavelength at 532 nm.



Figure S1 TEM electron diffraction pattern of a) Ag,AgBr@SiO₂@RF and b) Ag,AgBr@SiO₂.



Figure S2 Wide-angle X-ray diffraction (WAXRD) patterns of a) Ag,AgBr@SiO₂@RF, b) Ag,AgBr@SiO₂ and c) Ag@C yolk-shell.



Figure S3 a) TEM of single Ag,AgBr@SiO₂ nanosphere and b)BET nitrogen sorption isotherms and (inset) Barrett-Joyner-Halenda (BJH) pore size distribution plots of Ag,AgBr@SiO₂.



Figure S4 a) TEM of Ag@C yolk-shell nanosphere at 800 °C, b) Raman spectra of Ag@C yolk-shell carbonized at 600 °C (red) and 800 °C (black). The Raman spectra showed two broadband at 1330 and 1587 cm⁻¹, assigned to the D band and G band, respectively, suggesting an amorphous carbon framework.



Figure S5 TEM images of Ag,AgBr@SiO₂@RF and corresponding Ag@C yolk-shell nanostructure at different feed concentrations while other parameters are fixed. (a, b) 0.075M AgNO3; (c, d) 0.125g resorcinol; (e, f) 3 mL TEOS and (g, h) 6mL EtOH.