Supplementary Material (ESI) for Nanoscale

Electronic Supplementary Information

Hydrothermal transformation from Au core–sulfide shell to Au nanoparticle-decorated sulfide hybrid nanostructures

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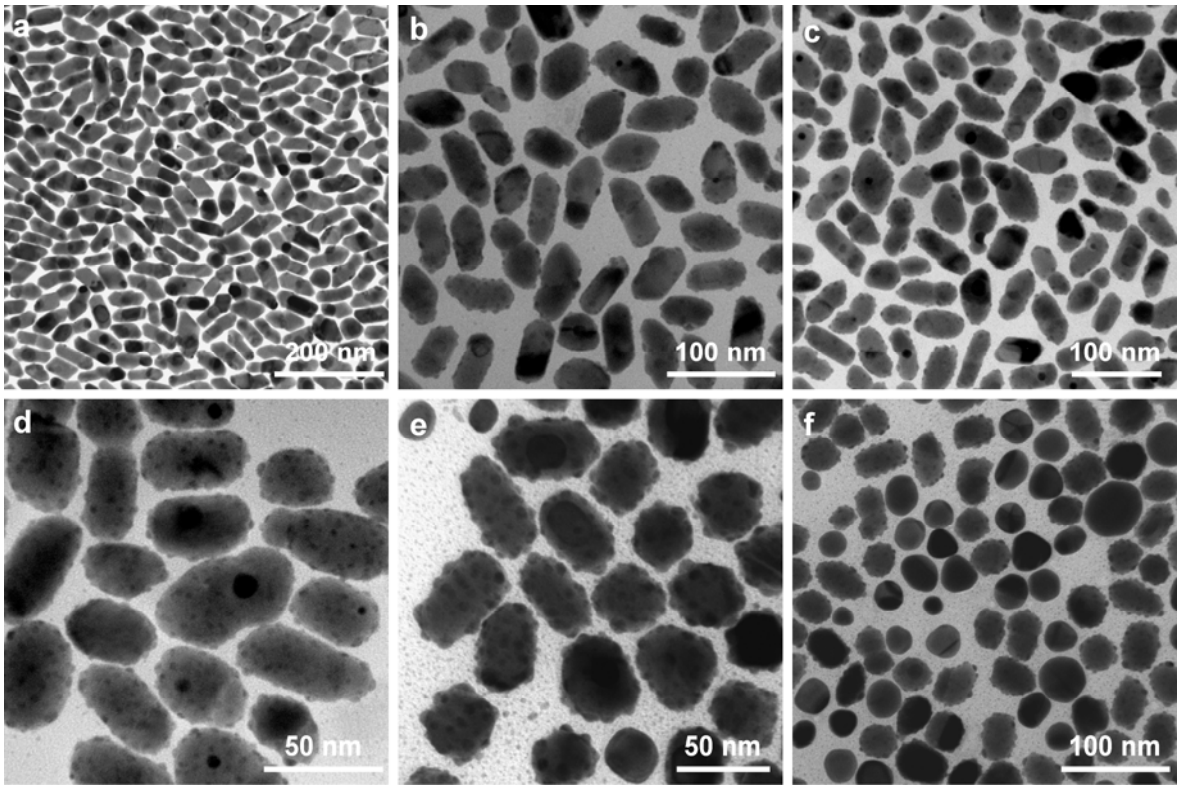

Fig. S1 (a–f) TEM images of the hybrid gold–gold silver sulfide nanostructures obtained from the hydrothermal process for 6, 12, 15, 18, 36, and 48 h, respectively. The low-manification imaging was performed on an FEI CM120 microscope.

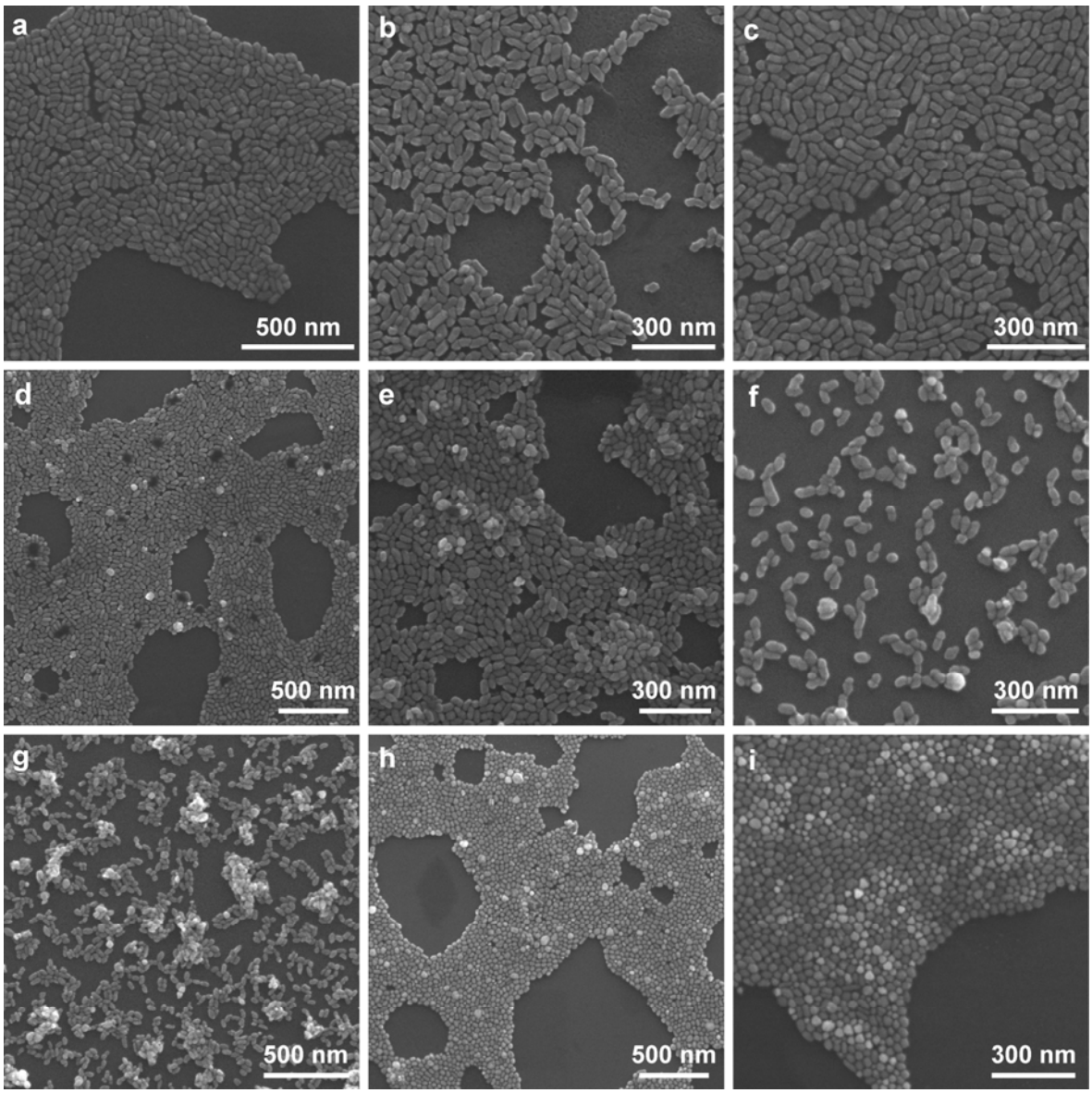

Fig. S2 (a–i) SEM images of the hybrid gold–gold silver sulfide nanostructures obtained from the hydrothermal process for 3, 6, 9, 12, 15, 18, 24, 36, and 48 h, respectively. The SEM imaging was carried out on an FEI Quanta 400 microscope equipped with an Oxford EDX analysis system. The nanostructure samples were deposited on conductive Si substrates for the SEM imaging.

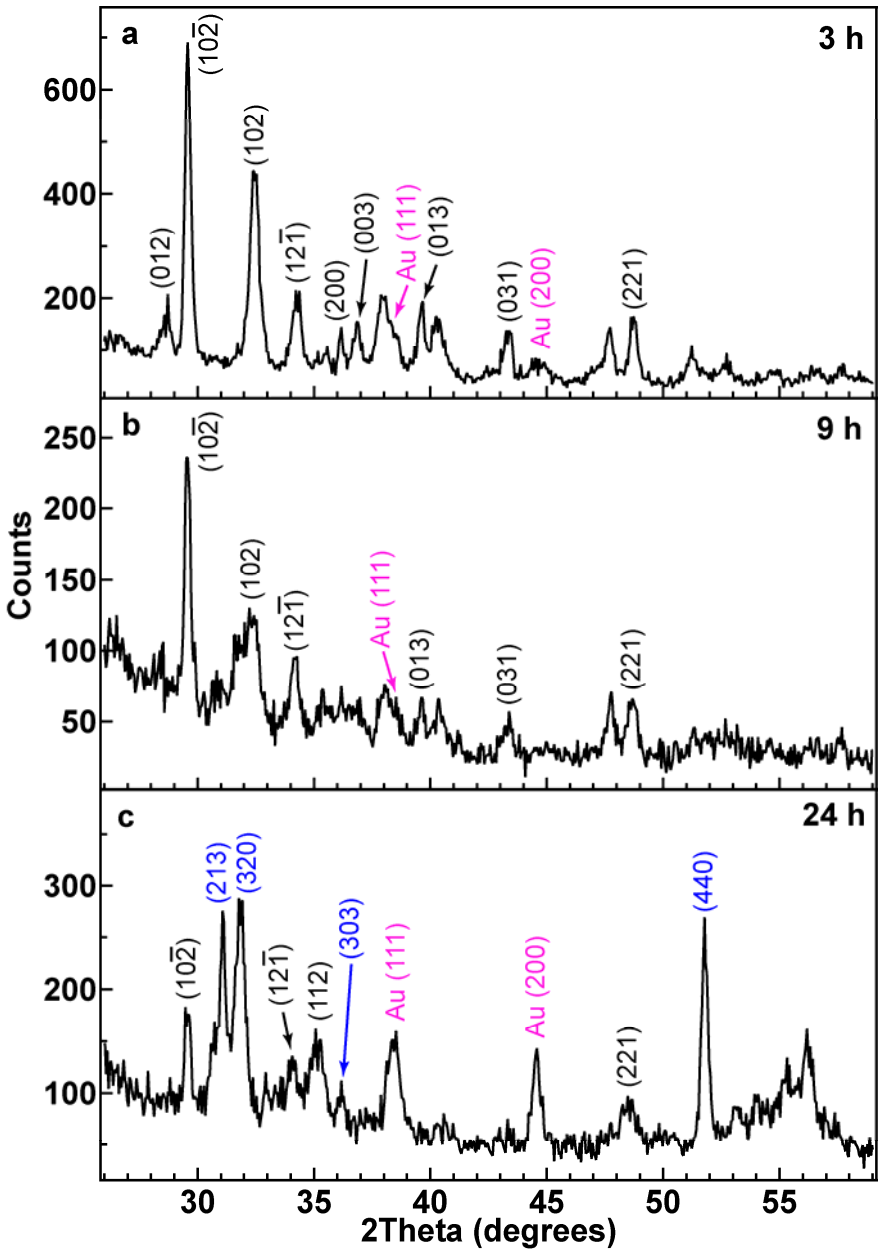

Fig. S3 XRD patterns of the hybrid gold–gold silver sulfide nanostructures produced by the hydrothermal process for (a) 3 h, (b) 9 h, and (c) 24 h, respectively. The diffraction peaks in (a) and (b) are indexed as a combination of the monoclinic Petrovskaite form of AgAuS (black indices, JCPDS 38-0396) and the face-centered-cubic form of Au (pink indices, JCPDS 65-2870). The diffraction peaks in (c) are indexed as a combination of the monoclinic Petrovskaite form of AgAuS (black indices, JCPDS 38-0396), the tetragonal Liujinyinite form of Ag_3AuS_2 (blue indices, JCPDS 44-1466), and the face-centered-cubic form of Au (pink indices, JCPDS 65-2870). The peaks at 38.0°, 40.3°, and 47.7° in (a) and (b), and that at 56.2° in (c) cannot be indexed, which can probably be ascribed to that gold silver sulfide possesses a number of crystalline phases. The XRD patterns were recorded on a Bruker D8 Advance diffractometer at 40 kV and 40 mA with $Cu_{k\alpha 1}$ radiation (λ = 1.54056 Å). The nanostructure samples were washed by centrifugation to remove the CTAB molecules and then deposited on Si substrates for the measurement, because CTAB can form liquid crystals when it is dried.

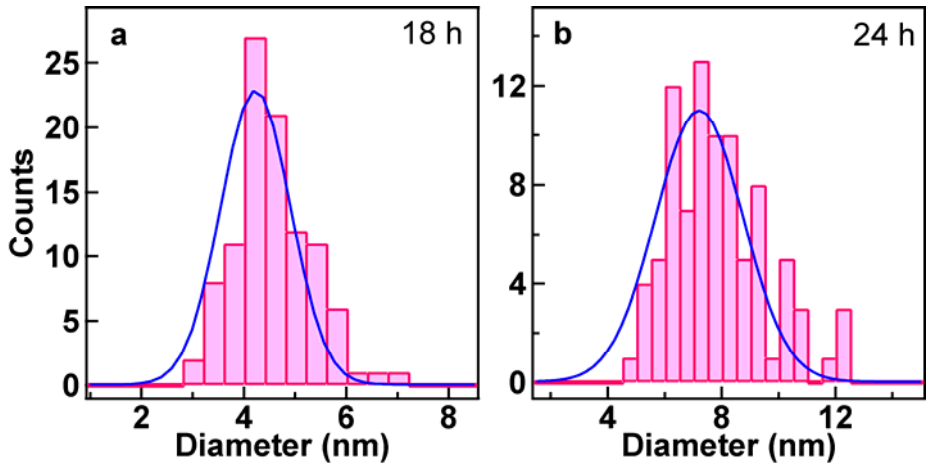

Fig. S4 Size distributions of the Au nanoparticles decorated on the exterior surface of the sulfide nanostructures produced by the hydrothermal process for (a) 18 h and (b) 24 h, respectively. The average sizes for (a) and (b) are (4.2 ± 0.7) and (7.2 ± 1.5) nm, respectively.

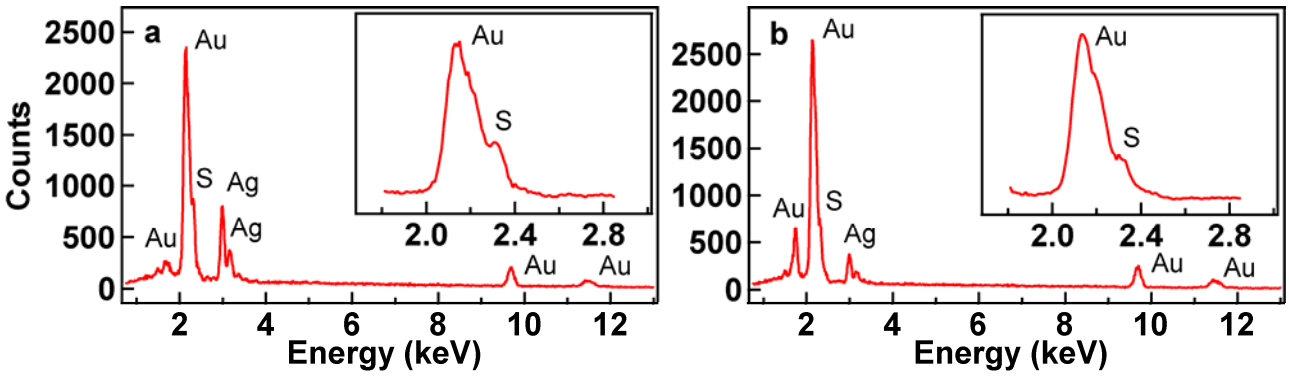

Fig. S5 EDX spectra of the hybrid gold–gold silver sulfide nanostructures produced by the hydrothermal process for (a) 3 h and (b) 15 h.

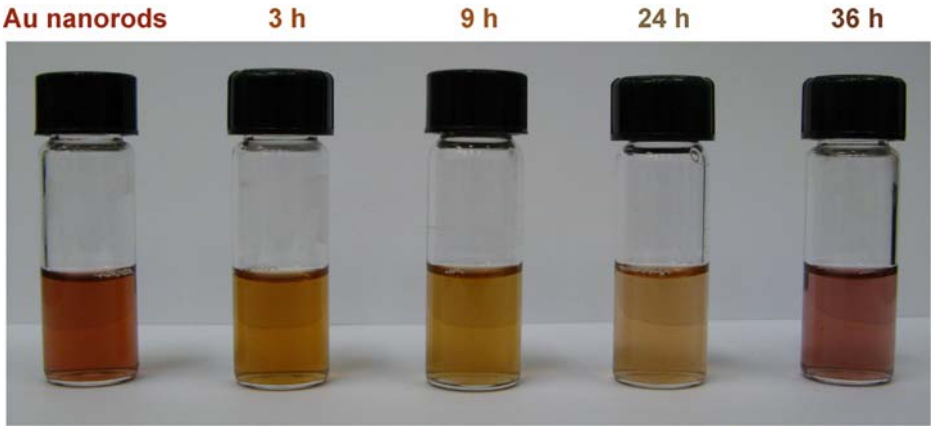

Fig. S6 Digital photo of the hybrid gold–gold silver sulfide nanostructures.