A galvanic replacement-based Cu_2O self-templating strategy for the synthesis and application of Cu_2O–Ag hetero structures and monometallic (Ag) and bimetallic (Au–Ag) hollow mesocages

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Polyhedral Cu_2O microparticles as self-templates have been well-demonstrated for the synthesis of Cu_2O–M heterostructures (M = Au, Pd, Pt) and Au nano/mesocages utilizing the galvanic replacement reaction (GRR) strategy. However, reports on GRR-based fabrication of Cu_2O–Ag heterostructures and the ensuing Ag mesocages are scanty. There is no report that describes the phenomenon of facet selectivity during the GRR-based deposition of Ag on Cu_2O template particles. Here, we have identified the underlying rationale behind the observed difficulty in nucleating Ag nanoparticles on an octahedral Cu_2O self-template particle. Utilization of an appropriately chosen surfactant/complexant for the silver precursor helps in demonstrating the successful fabrication of Cu_2O–Ag heterostructures (octahedral, cubic) with a tunable loading density of Ag NPs on the Cu_2O surfaces. This is achieved using Cu_2O template particles that undergo GRR with silver nitrate in the presence of nitric acid, and 5-sulfosalicylic acid as the surfactant (key role players). We provide evidence that supports facet selectivity during the deposition of Ag NPs on Cu_2O cuboctahedral particles. Hollow octahedral Ag and Au–Ag bimetallic

mesocages are fabricated that have rough surfaces, uniform morphology, and excellent shape retention. The fabricated heterostructures and mesocages act as an excellent SERS substrate. This is the first report on the rational synthesis of octahedral Cu_2O–Ag heterostructures and octahedral hollow metallic mesocages utilizing the Cu_2O self-templating strategy along with the demonstration of facet selectivity of Ag deposition on Cu_2O template particles through GRR. The current approach offers a facile and versatile protocol for the synthesis of Cu_2O–metal heterostructures and hollow noble metal mesocages.