Electronic Supplementary Information

Balancing the galvanic replacement and reduction kinetics for the general formation of bimetallic CuM (M = Ru, Rh, Pd, Os, Ir, Pt) hollow nanostructures

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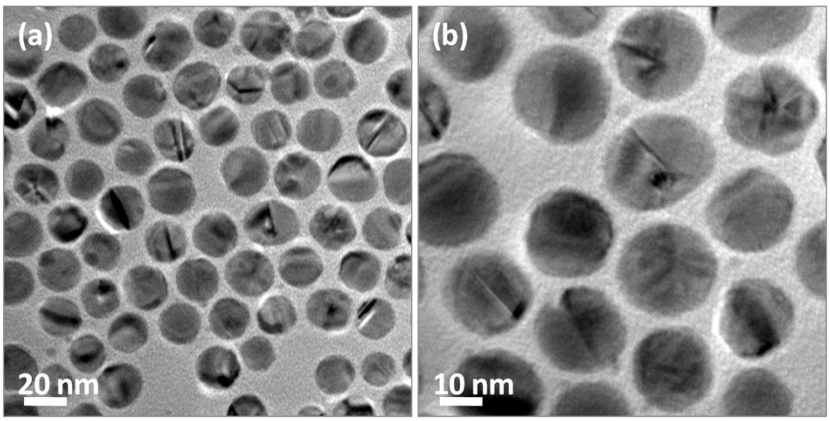

Fig. S1 TEM image (a) and HRTEM images (b) of the Cu nanoparticles synthesized in oleylamine at 180°C, which are used as seeds for the formation of bimetallic hollow nanostructures in a galvanic replacement reaction at appropriate temperatures.

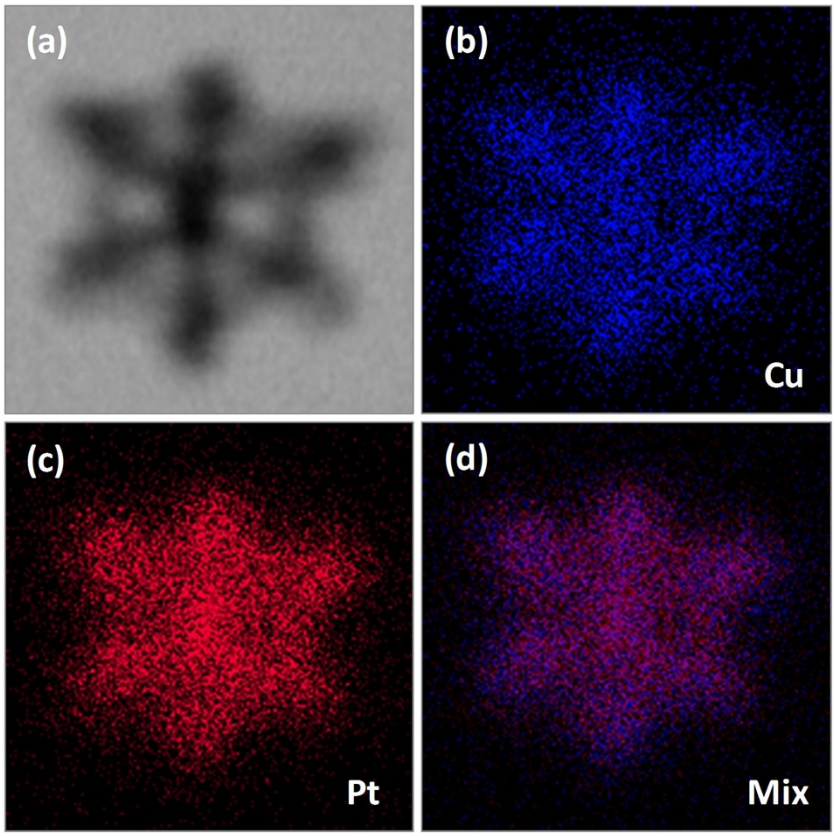

Fig. S2 elemental mapping of a single particle (a–d) of the bimetallic Cu-Pt hollow nanostructures synthesized in oleylamine at a temperature of 160°C.

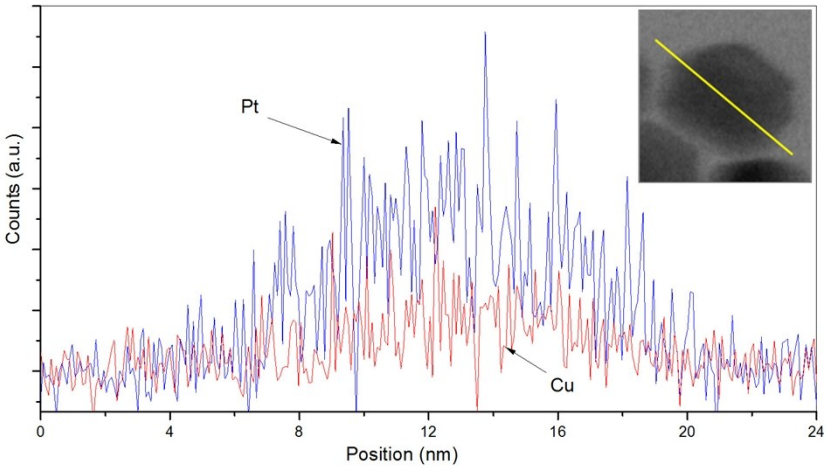

Fig. S3 EDX-based element profiles of bimetallic CuPt nanoparticles as-prepared by reacting Pt^{4+} ions with the Cu seeds in oleylamine at temperature of 220°C.

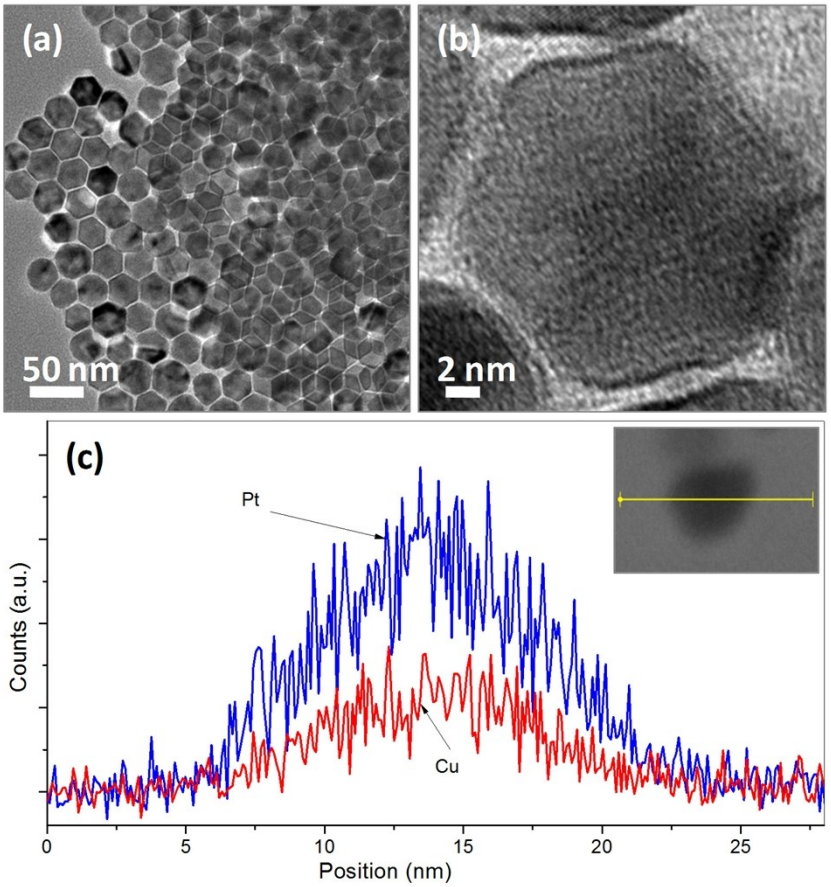

Fig. S4 TEM image (a), HRTEM image (b), and EDX-based element profiles (c) of bimetallic CuPt nanoparticles as-prepared by reacting Pt^{4+} ions with the Cu seeds in oleylamine at temperature of 250°C.

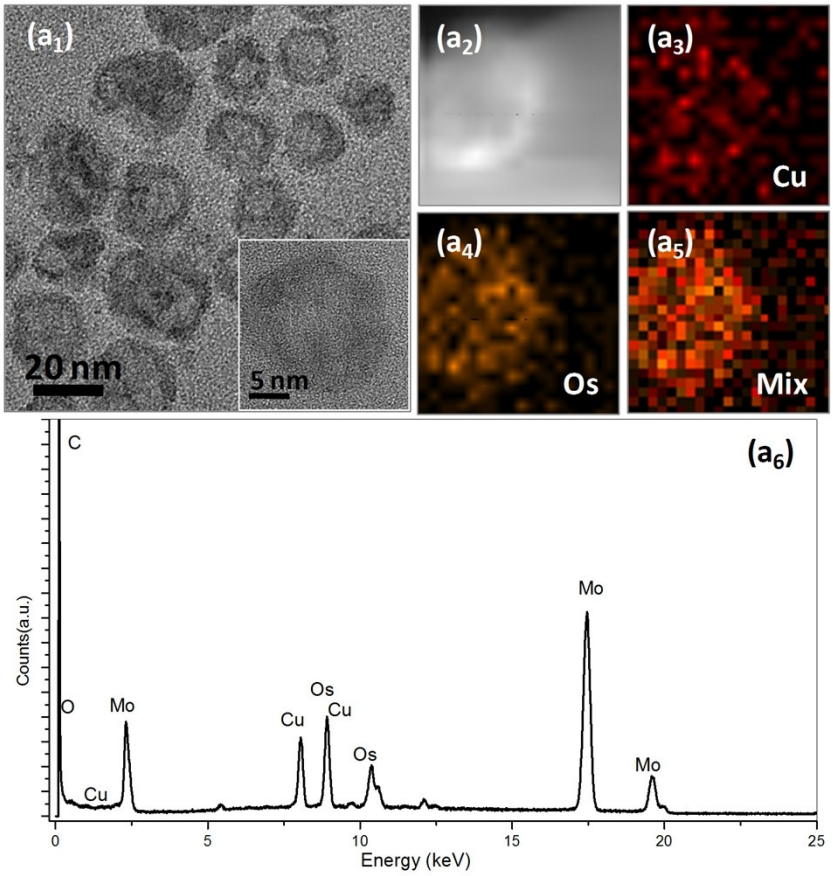

Fig. S5 TEM images (a_1), elemental mappings (a_2–a_5), and STEM-EDX analyses (a_6) of binary CuOs nanostructures synthesized by GRR between Cu seeds and Os ion precursors in oleylamine at temperature of 245°C. Inserts in (a_1) is HRTEM images of the a single CuOs nanostructure.

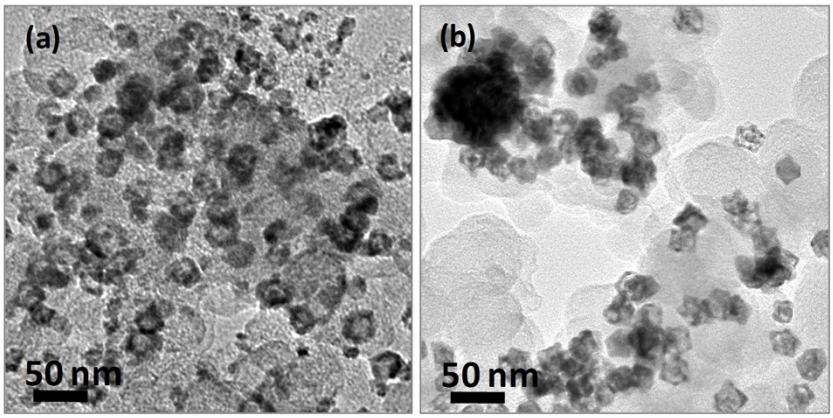

Fig. S6 TEM images carbon-supported hCuPtNSs prepared at temperature of 120°C (a) and 160°C (b) in oleylamine.

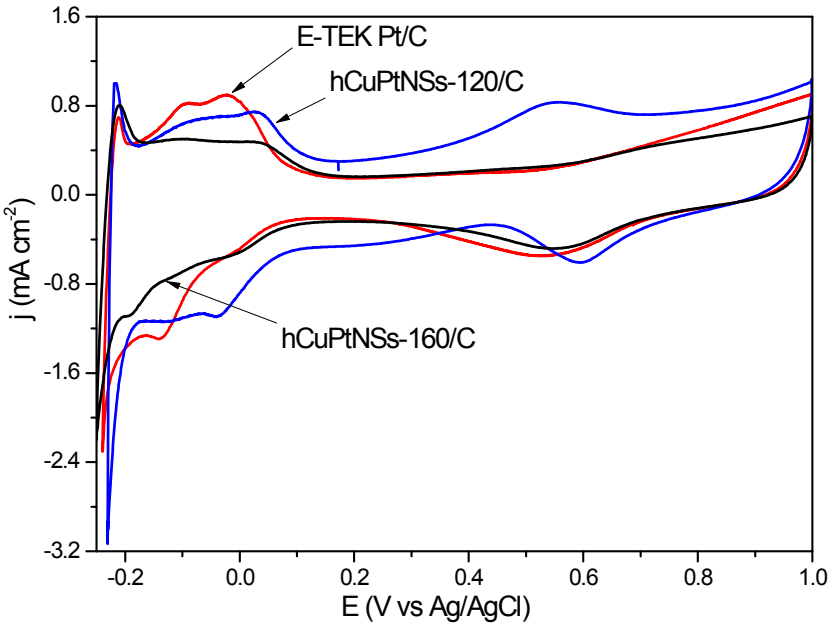

Fig. S7 Cyclic voltammograms of hCuPtNSs-120/C, hCuPtNSs-160/C, and E-TEK Pt/C catalysts in argon-purged $HClO_4$ (0.1 M) at room temperature obtained with scan rate of 50 mV s^{-1}.

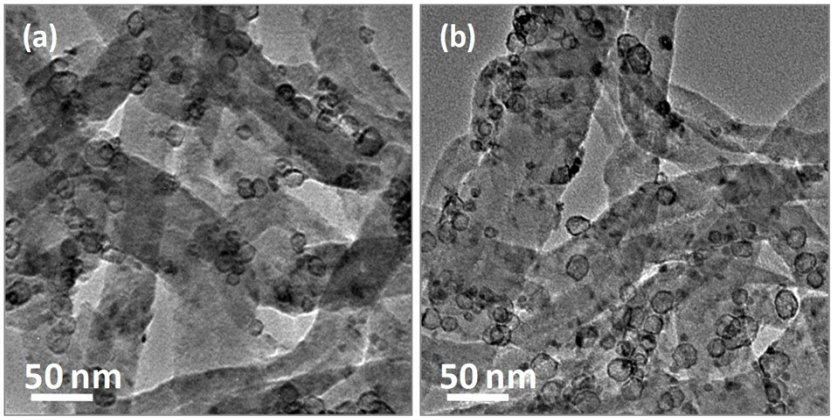

Fig. S8 TEM images of as-prepared hCuRuNSs (a) and hCuO-RuO_2/CNT (b) supported on the surface of carbon nanotube substrates.