Supplementary information

Au@Pd@Pt Core-Shell Nanoparticles with Mesoporous Structures and Nanocavities for Enhanced Electrocatalytic Performance

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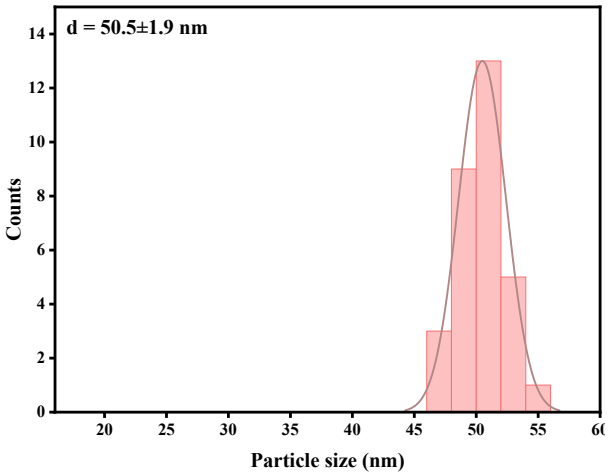

Fig. S1 Size distribution of the synthesized Au@Pd@Pt CSNs.

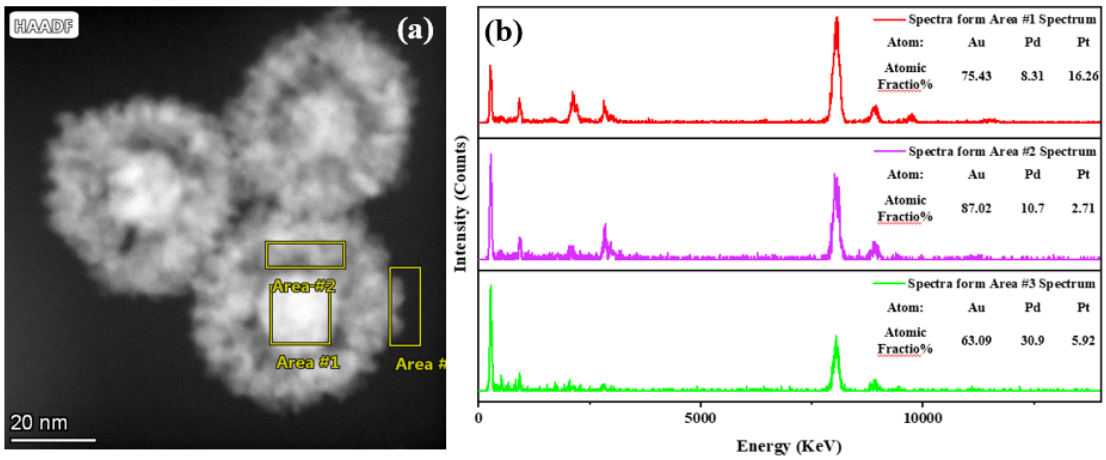

Fig. S2 (a) HAADF-STEM image and **(b)** the atomic fractions of Au, Pd, and Pt across the three designated regions in the Au@Pd@Pt CSN.

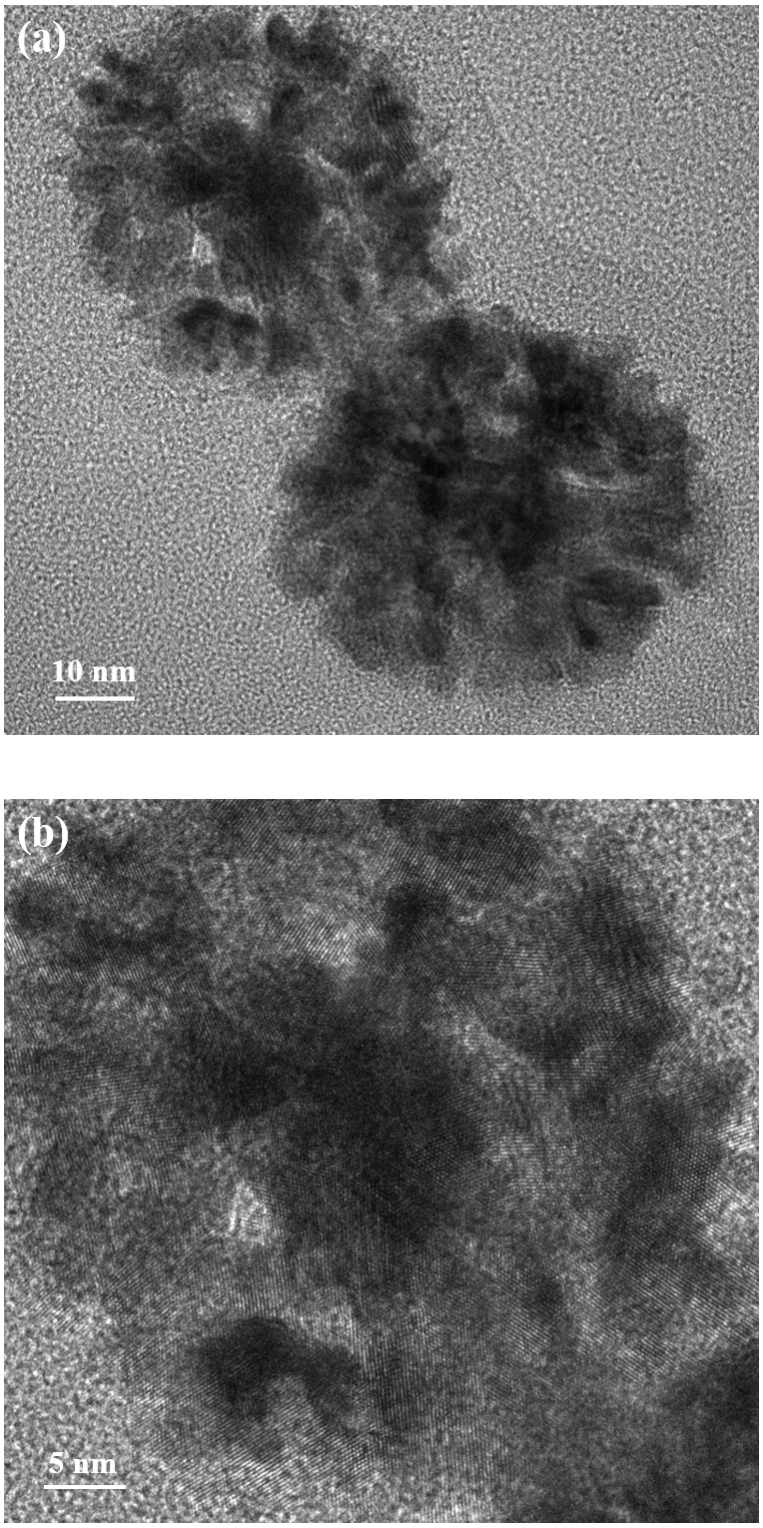

Fig. S3 High-resolution TEM images of Au@Pd@Pt CSNs with different magnification.

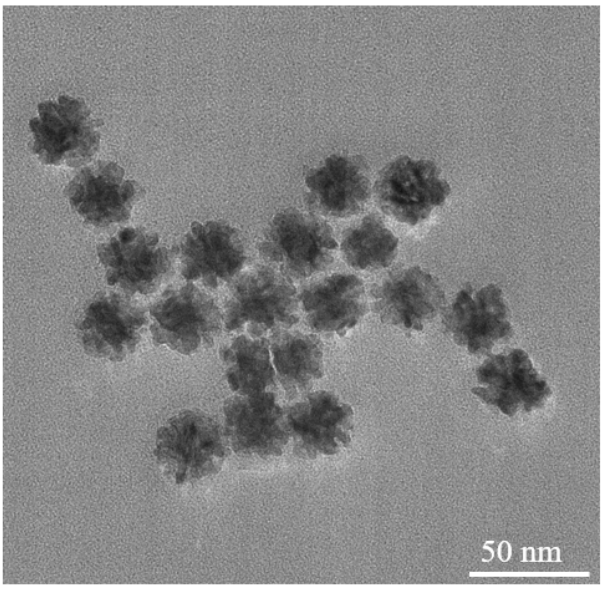

Fig. S4 TEM image of Au@Pd CSNs.

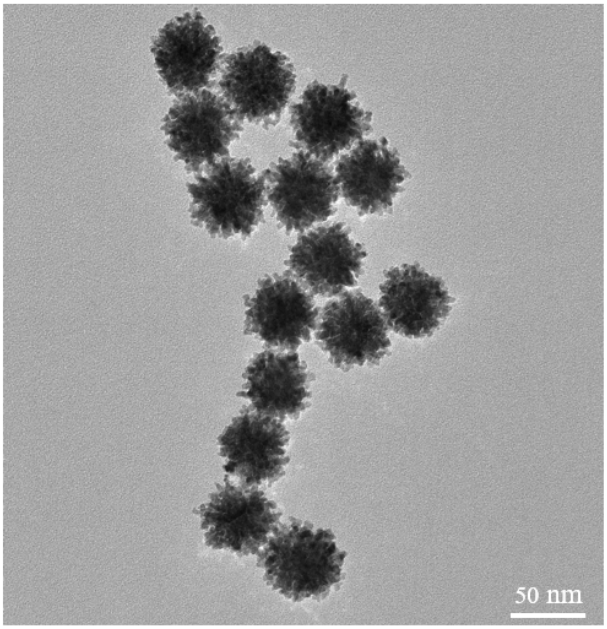

Fig. S5 TEM image of Au@Pt CSNs.

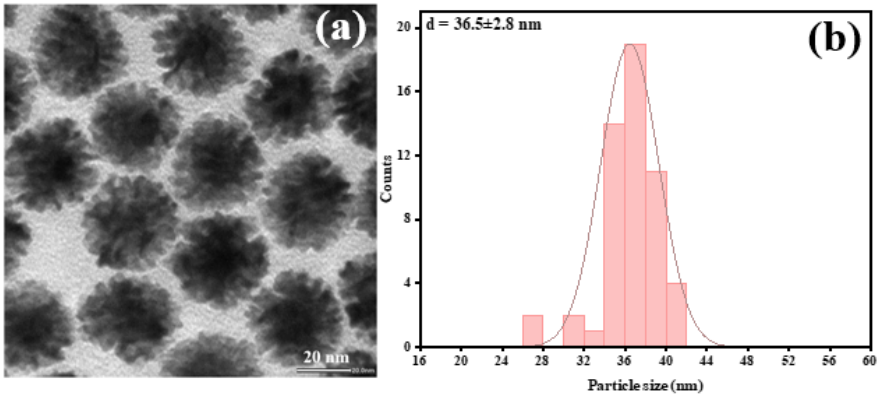

Fig. S6 (a) TEM image and (b) the corresponding particle size distribution of the Au@Pd@Pt CSNs synthesized with 5 mL of Au seeds.

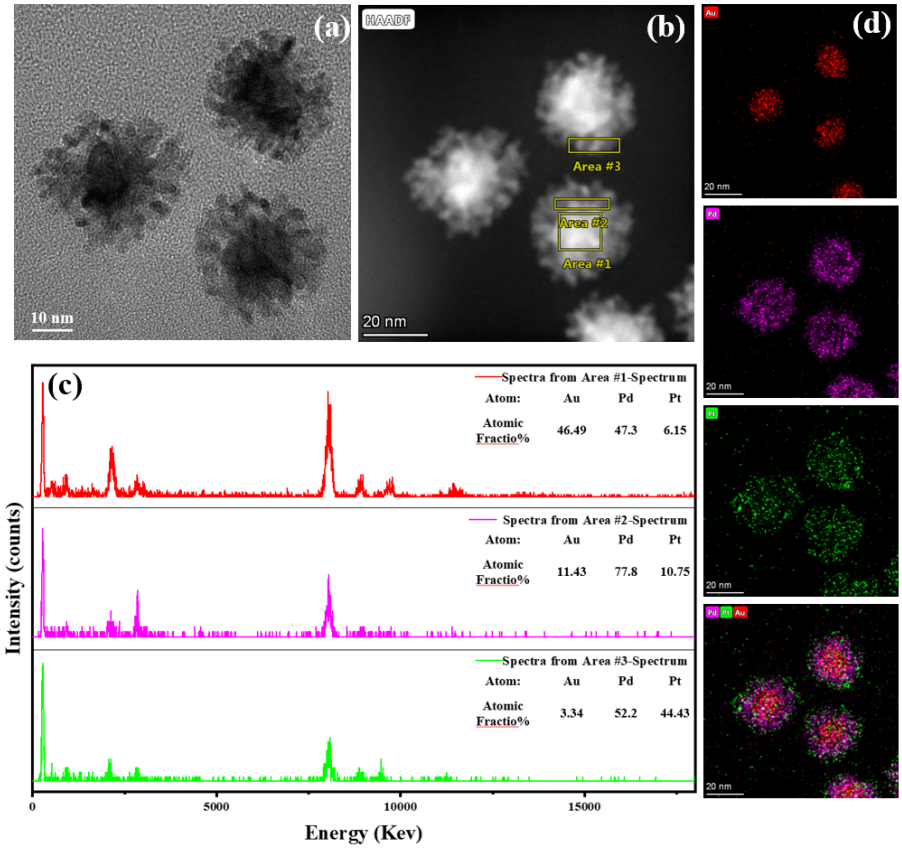

Fig. S7 Structural and elemental characterization of Au@Pd@Pt (Pd/Pt precursor molar ratio of 1:3) CSNs: (a) TEM image, (b) HAADF-STEM image, (c) EDS quantitative analysis of the selected-area in (b), and (d) EDS elemental mapping images of Au, Pd, Pt, and the composite overlay.

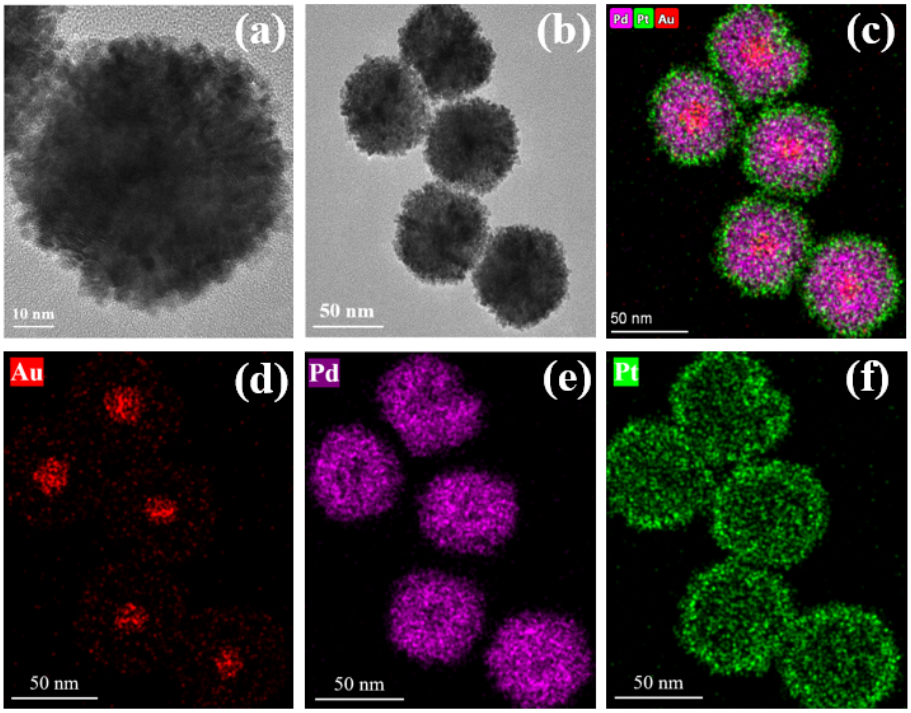

Fig. S8 (a, b) TEM images and (c-f) EDX elemental mapping of Au@Pd@Pt CSNs synthesized with 200 μL of VC in the absence of CTAC.

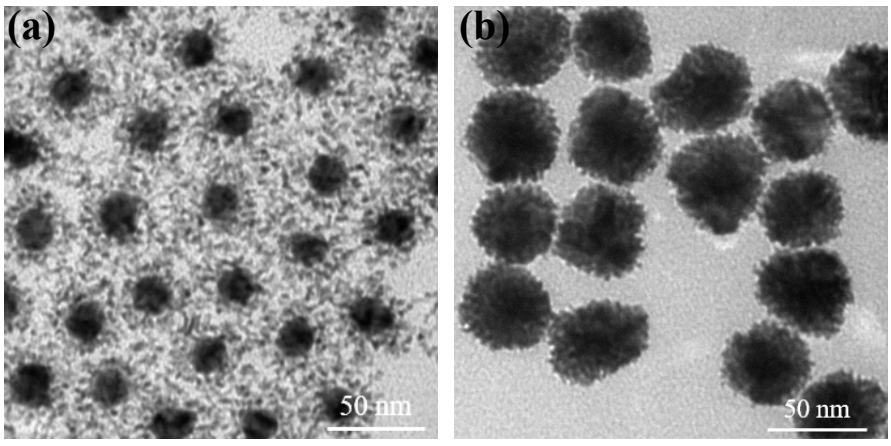

Fig. S9 TEM images of the samples obtained (a) using sodium ascorbate as the reducing agent (pH = 12.5) and (b) using HCl to adjust the pH to 1.2.

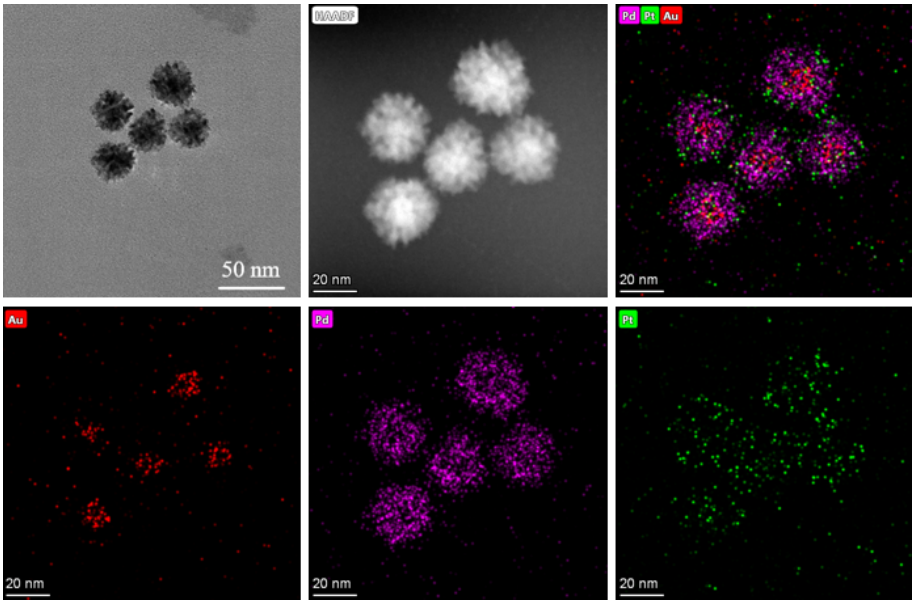

Fig. S10 TEM, HAADF-STEM, and EDX mapping images of Au@Pd@Pt CSNs obtained via the typical synthesis with different reaction times of 5 min.

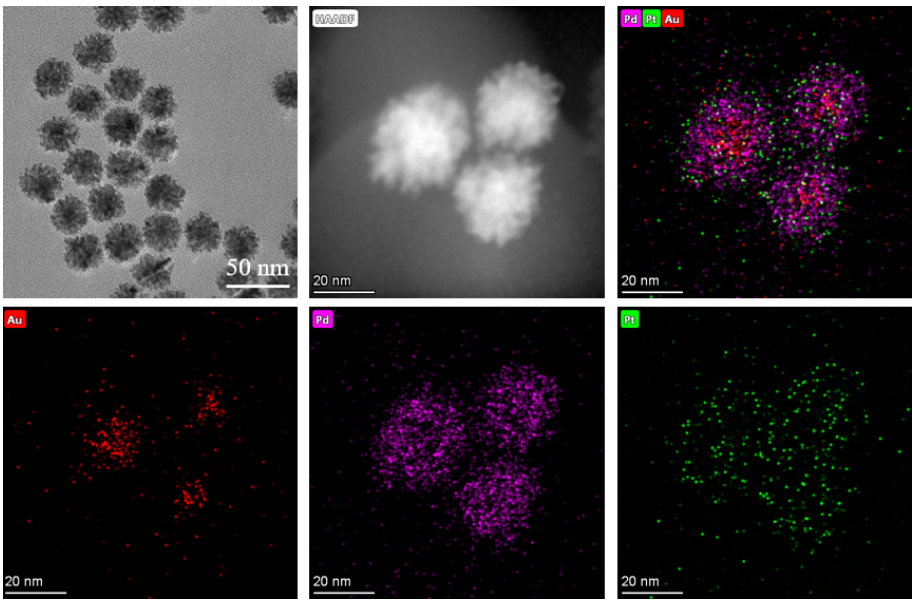

Fig. S11 TEM, HAADF-STEM, and EDX mapping images of of Au@Pd@Pt CSNs obtained via the typical synthesis with different reaction times of 30 min.

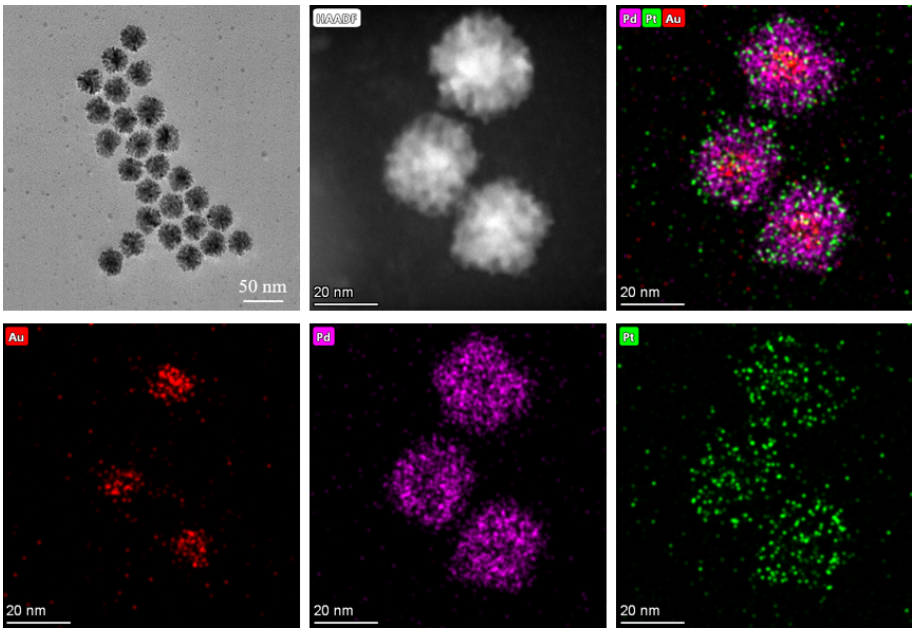

Fig. S12 TEM, HAADF-STEM, and EDX mapping images of Au@Pd@Pt CSNs obtained via the typical synthesis with different reaction times of 2h.

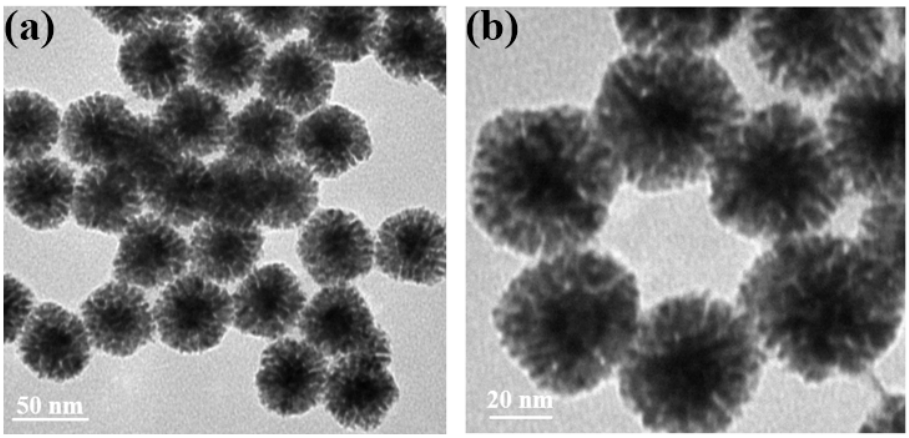

Fig. S13 (a) Low- and (b) high-magnification TEM images of Au@Pd@Pt CSNs synthesized with 1 mL VC.

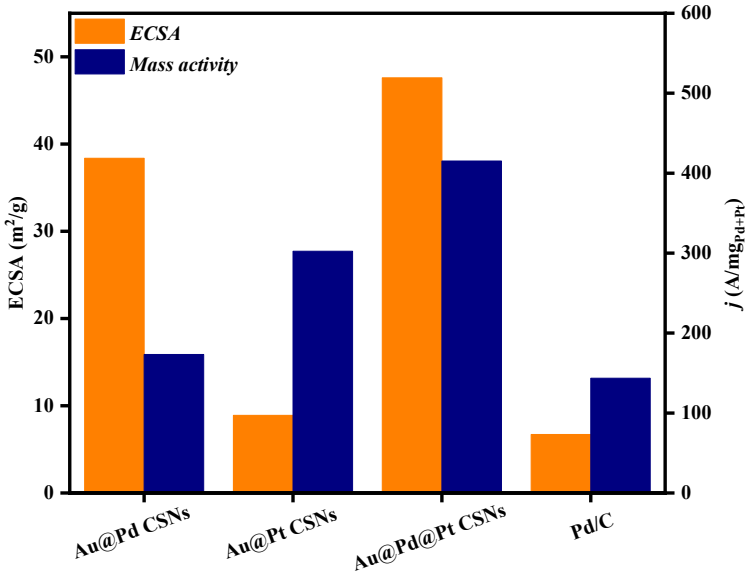

Fig. S14 Catalyst performance comparison: ECSA and mass activity of Au@Pd@Pt CSNs, Au@Pd CSNs, Au@Pt CSNs, and commercial Pd/C.