Electronic Supplementary Information

Carbon-supported hollow palladium nanoparticles with enhanced electrocatalytic performance

Dong Chen, Penglei Cui, Hongyan He, Hui Liu, Feng Ye and Jun Yang*

State Key Laboratory of Multiphase Complex Systems, Institute of Process Engineering, Chinese Academy of Sciences, Beijing, China 100190. Fax: 86-10-8254 4915; Tel: 86-10-8254 4915; E-mail: jyang@ipe.ac.cn

Financial support from the 100 Talents Program of the Chinese Academy of Sciences, National Natural Science Foundation of China (No.: 21173226, 21376247, 21476246), and State Key Laboratory of Multiphase Complex Systems, Institute of Process Engineering, Chinese Academy of Sciences (MPCS-2012-A-11) is gratefully acknowledged.

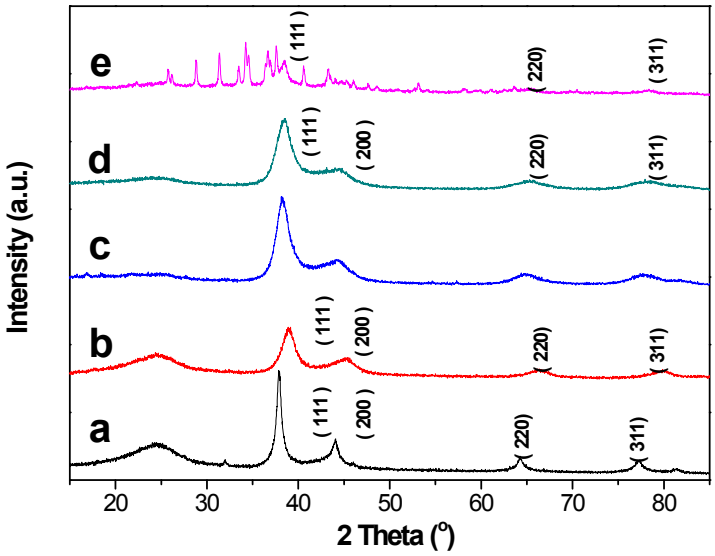

Fig. S1 X-ray diffraction (XRD) patterns of Ag nanoparticles (a), Pd nanoparticles prepared in the absence of Ag seeds (b), core-shell Ag@Ag-Pd nanoparticles by galvanic replacement reaction (c), hPdNPs/C by NaCl treatment (d), and hPdNPs/C by Na_2S treatment, respectively.

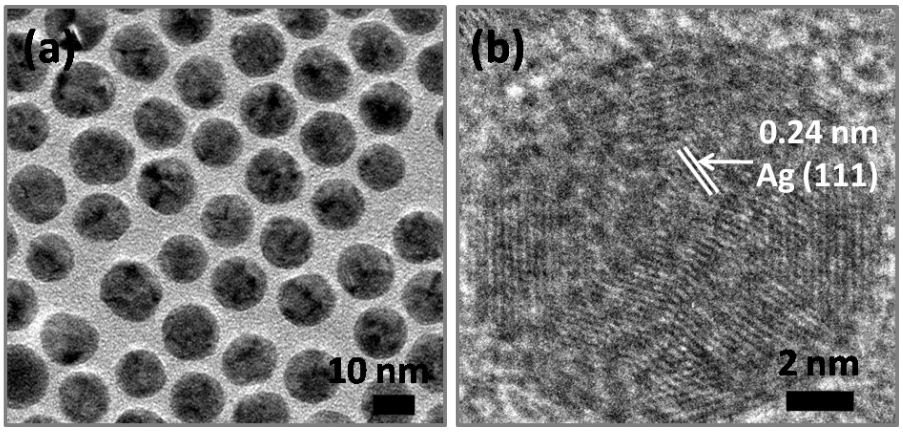

Fig. S2 TEM image (a) and HRTEM image (b) of the as-prepared Ag nanoparticles as sacrificed template with an average diameter of 12.4 nm.

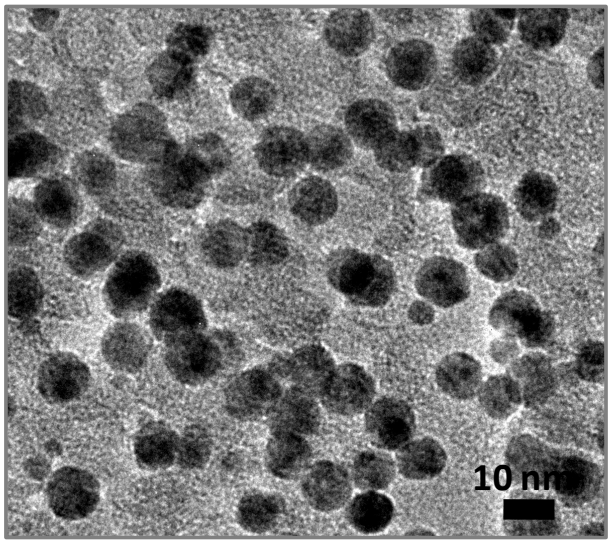

Fig. S3 TEM image of carbon-supported core-shell Ag@Ag-Pd NPs (Ag@Ag-PdNPs/C) after refluxing in acetic acid for 3 h at 120°C.

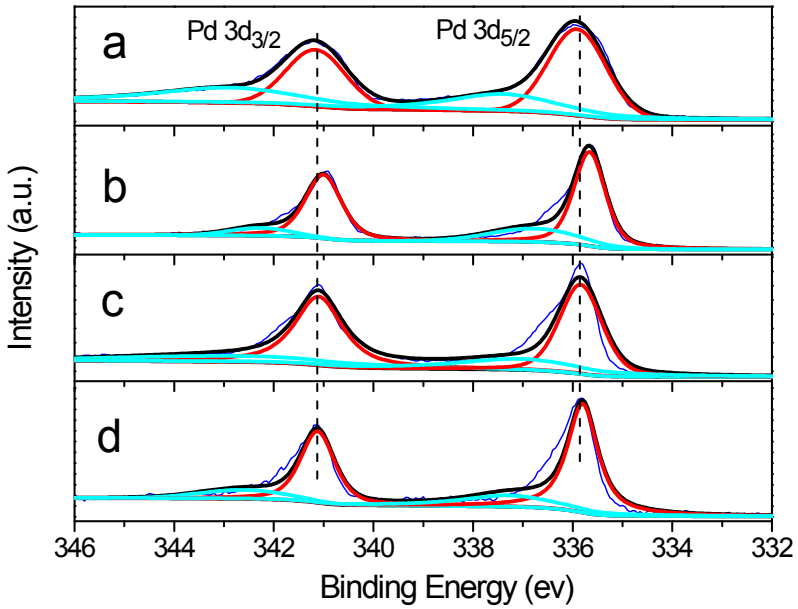

Fig. S4 The 3d XPS spectra of Pd in Pd NPs prepared by oleylamine reduction of $Pd(acac)_2$ in the absence of Ag seeds (a), core-shell Ag@Ag-Pd NPs (b), hPdNPs/C-Cl (c), and hPdNPs/C-S (d).

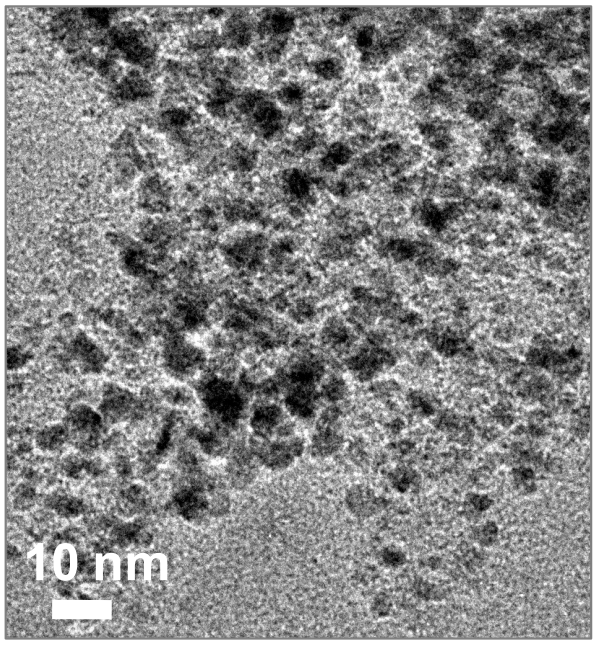

Fig. S5 TEM image of commercial Pd/C catalyst purchased from Johnson Matthey Company (JM).

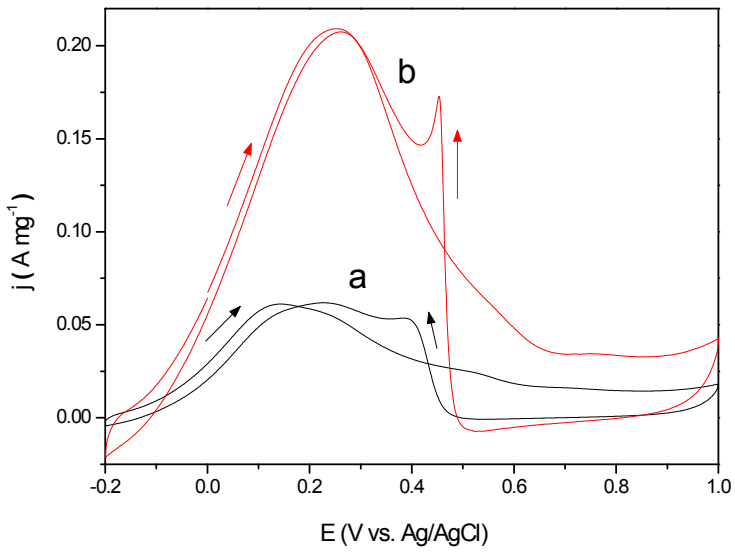

Fig. S6 Cyclic voltammograms of hPdNPs/C-S (a) and hPdNPs/C-S after calcination at 300°C for 1 h (b) in 0.1 M $HClO_4$ and 1 M formic acid at a scan rate of 50 mV s^{-1}.