Supporting Information

Capping Agent-Free Highly Dispersed Noble Metal Nanoparticles Supported in Ordered Mesoporous Carbon with Short Channels and Their Catalytic Applications

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Chemicals

Poly(ethylene oxide)-*block*-poly(propylene oxide)-*block*-poly(ethylene oxide) triblock copolymer Pluronic F127 ($PEO_{106}PPO_{70}PEO_{106}$, M_w = 12600) was purchased from Acros Chemical Inc., USA. Phenol (C_6H_5OH, 99.98 wt%), formalin solution (HCHO, 37.0 – 40.0 wt%), sodium hydroxide (NaOH, 96.0 wt%), chloroauric acid tetrahydrate ($HAuCl_4 \cdot 4H_2O$, Au minimum 47.8 wt%), hexachloroplatinic acid hexahydrate ($H_2PtCl_6 \cdot 6H_2O$) and other chemicals were obtained from Shanghai Chemical Company, China. All chemicals were used as received without any further purification.

Characterization

The small-angle X-ray scattering (SAXS) measurements were taken on a Nanostar U SAXS system (Bruker, Germany) using Cu Kα radiation (40 kV, 35 mA). X-ray diffraction (XRD) measurements were carried out on a Bruker D8 Powder X-ray diffractometer with Ni-filtered Cu Kα radiation (40 kV, 40 mA). Transmission electron microscopy (TEM) measurements were conducted on a JEM-2100 F microscope (JEOL, Japan) operated at 200 kV. The samples for TEM measurements were suspended in ethanol and supported onto a holey carbon film on a Cu grid. Field-emission scanning electron microscopy (FESEM) images were taken on a Hitachi S-4800 microscope. Nitrogen sorption isotherms were measured at 77 K with a Micromeritics Tristar 3020 analyzer (USA). Before measurements, samples were degassed in a vacuum at 180 °C for at least 10 h. The Brunauer-Emmett-Teller (BET) method was utilized to calculate the specific surface areas. The pore size distribution (PSD) was calculated from the adsorption branch by using the Barrett-Joyner-Halenda (BJH) model. The total pore volume (V_{total}) was estimated from the adsorbed amount at P/P_0 = 0.995. The metal (Pt, Au) contents were determined by inductively coupled plasma atomic emission spectrometry (ICP-AES) using an IRIS Advantage Duo ER/S (Thermo Fisher Scientific). X-ray photoelectron spectroscopy (XPS) was recorded on an AXIS ULTRA DLD XPS System with MONO Al source (Shimadzu Corp.). Photoelectron spectrometer was recorded by using monochromatic Al KR radiation under vacuum at 5×10^{-9} Pa. All of the binding energies were referenced to the C1s peak at 284.6 eV of the surface adventitious carbon. UV-vis spectra were recorded on Shimadzu UV-2550 (Shimadzu, Kyoto, Japan).

Temperatures were manually regulated with a water-jacketed cell holder. The product solution was quantitatively analyzed using a gas chromatograph Agilent 7820 equipped with a HP-WAX capillary column connected to a flame ionization detector. Identification of the products was performed by using a GC-MS spectrometer.

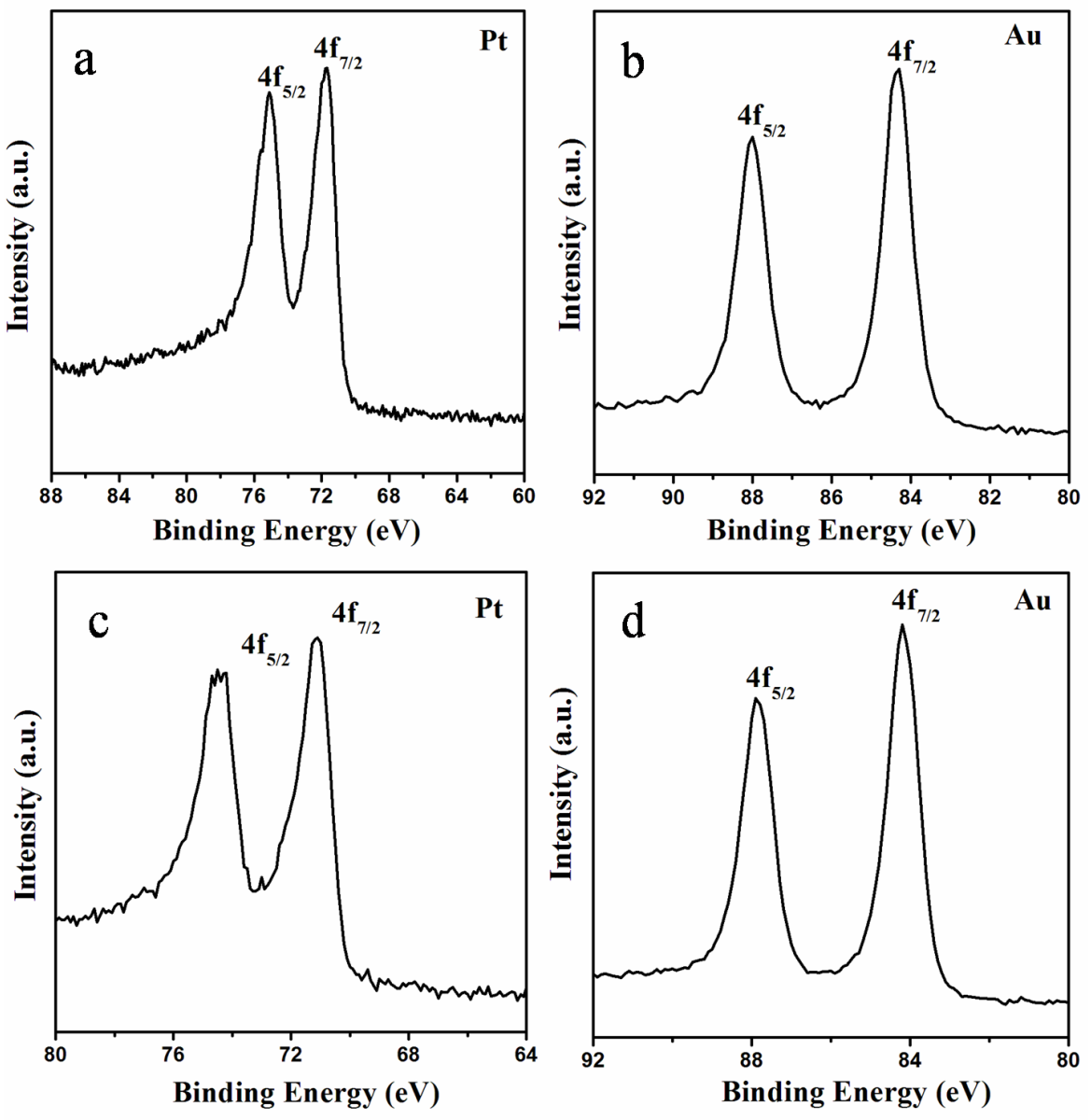

Fig. S1 XPS spectra of the mesoporous noble metal/C composite catalysts prepared *via* a hydrothermal method: (a) Pt/C, (b) Au/C, (c, d) Pt-Au/C.

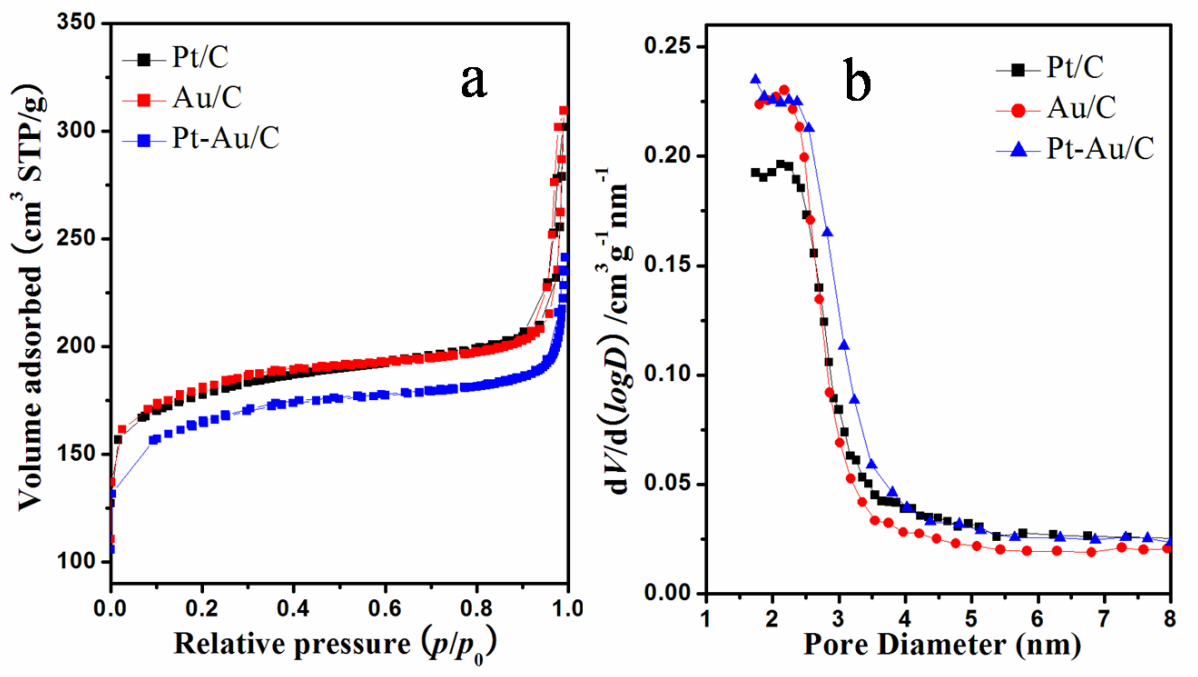

Fig. S2 (a) N_2 sorption isotherms and (b) pore size distribution curves of the mesoporous noble metal/C catalysts.

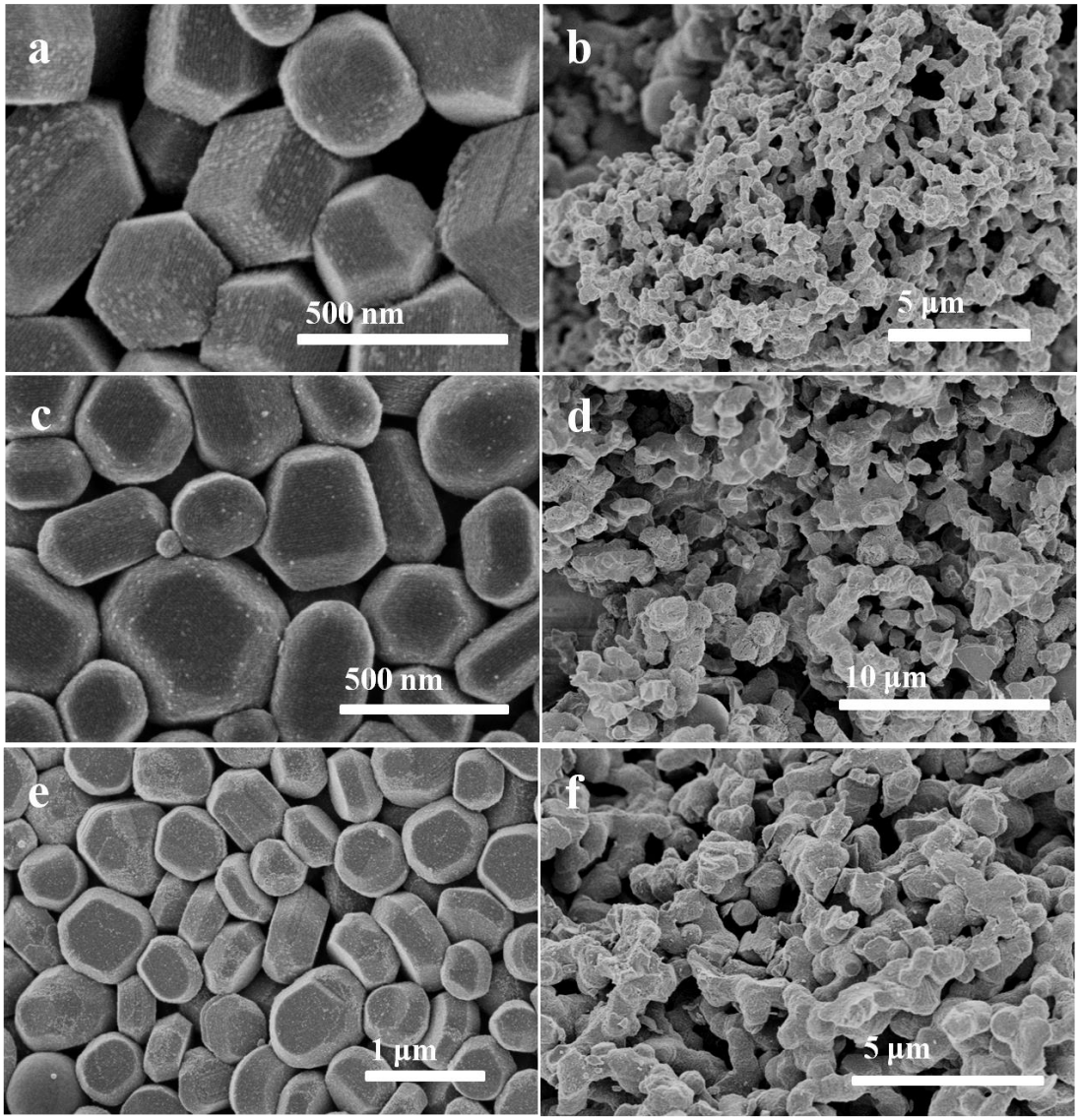

Fig. S3 SEM images of the mesoporous noble metal/C catalysts prepared *via* a hydrothermal method with different amount of metal precursors added into this synthesis process: (a) Pt/C-0.7 (0.7 mL), (b) Pt/C-1 (1.0 mL), (c) Au/C-0.8 (0.8 mL), (d) Au/C-2 (2.0 mL), (e) Pt-Au/C-0.5-0.3 (0.5 mL of Pt precursors + 0.3 mL of Au precursors), (f) Pt-Au/C-0.5-0.5 (0.5 mL of Pt precursors + 0.5 mL of Au precursors), respectively.

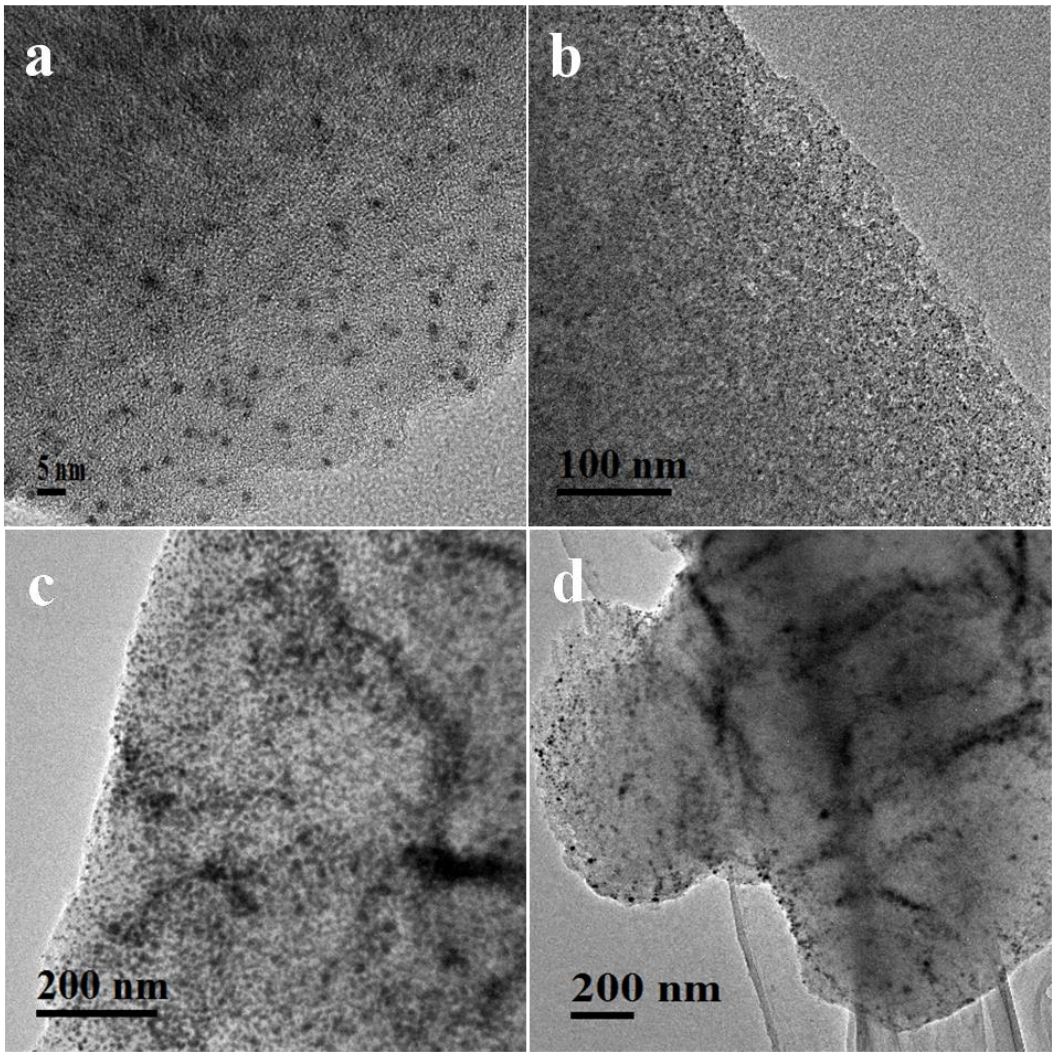

Fig. S4 TEM images of the mesoporous noble metal/C catalysts prepared *via* a hydrothermal method with different amounts of metal precursors: (a) Pt/C (0.5 mL), (b) Pt/C-1 (1.0 mL), (c) Au/C-2 (2.0 mL), (d) Pt-Au/C-0.5-0.5 (0.5 mL of Pt precursors + 0.5 mL of Au precursors), respectively.

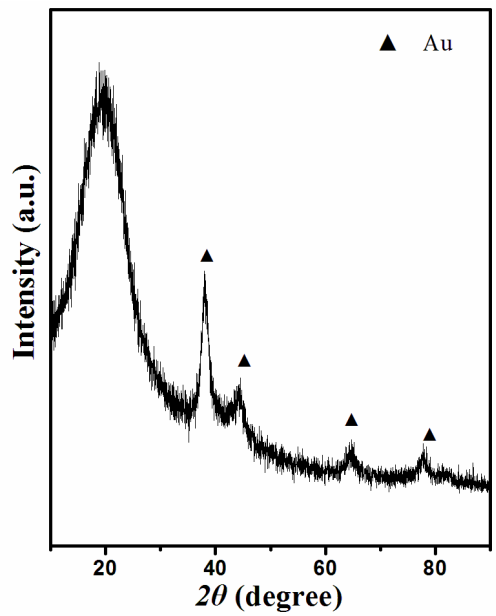

Fig. S5 The wide-angle XRD pattern of the as-made mesoporous Au/C catalyst without calcination. The sample was prepared *via* a hydrothermal method with the addition of 0.5 mL of $HAuCl_4$ aqueous solution.

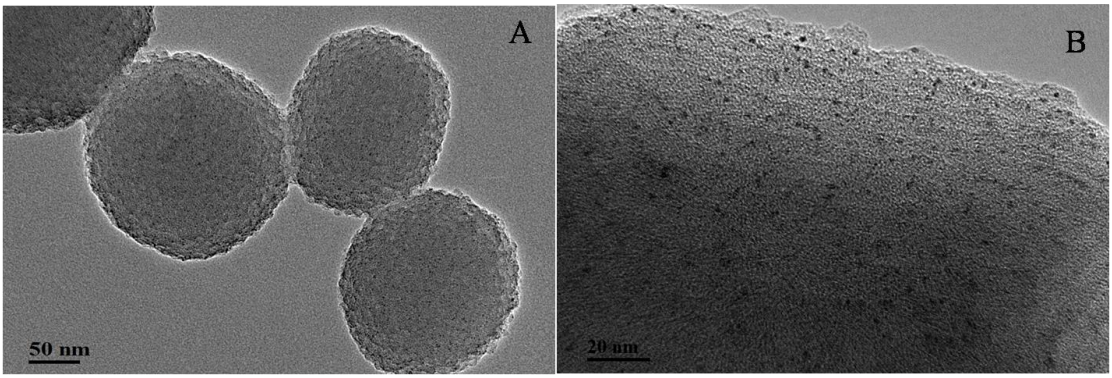

Fig. S6 TEM images of the as-made mesoporous Pt/C catalyst without calcination. The sample was prepared *via* a hydrothermal method with 0.2 mL of H_2PtCl_6 aqueous solution added.

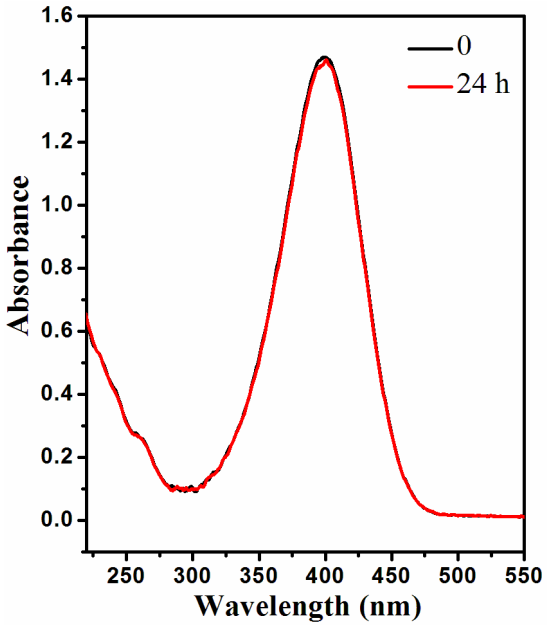

Fig. S7 UV-vis absorption spectra of 4-nitrophenol after the addition of $NaBH_4$ solution for 0 and 24 h.

Table S1 Rate constants for the catalytic reduction of 4-NP to 4-AP by the mesoporous noble metal/C catalysts obtained *via* a hydrothermal method at different temperatures.

Temperature	Pt/C	Au/C	Pt-Au/C
(°C)	K (min^{-1})	K (min^{-1})	K (min^{-1})
25	0.19	0.31	0.39
35	0.26	0.40	1.03
45	0.43	0.78	2.23

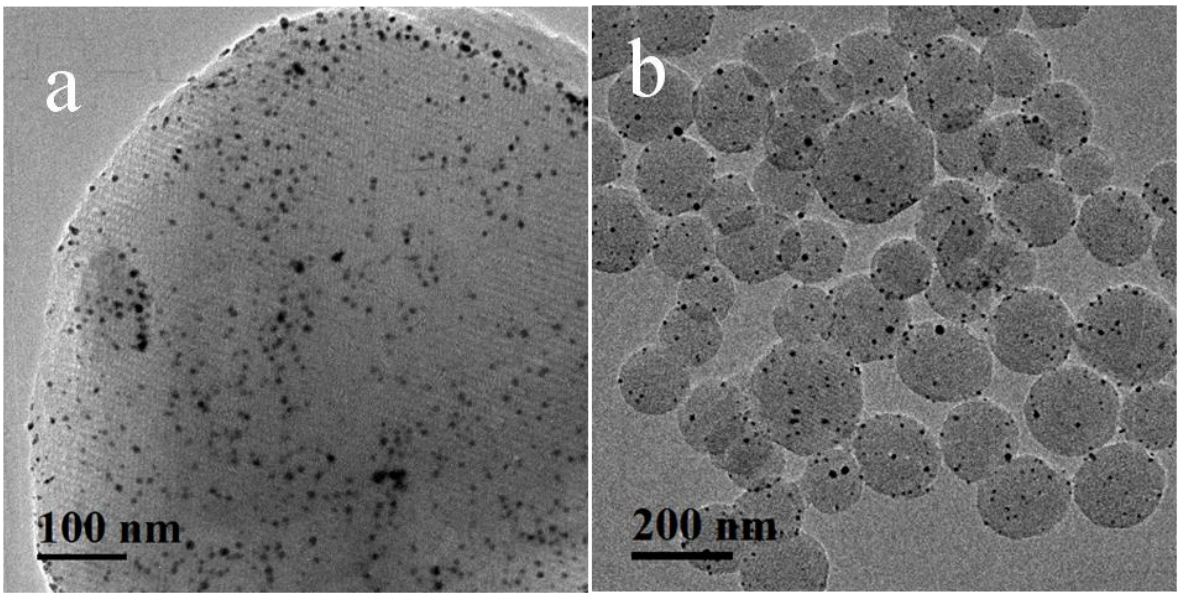

Fig. S8 TEM images of the reused mesoporous noble metal/C catalysts after 5 cycles of catalytic hydrogenation and oxidation of benzyl alcohol: (a) Pt-Au/C, (b) Au/C.