Supporting Information

Pd and Au@Pd nanodendrites: one-pot synthesis and their superior catalytic properties

Yixuan Zhou, Dingsheng Wang*, and Yadong Li
Department of Chemistry, Tsinghua University, Beijing 100084, P. R. China
*E-mail: wangdingsheng@mail.tsinghua.edu.cn

Experimental Details

Synthesis: All the reagents used in this work, including $HAuCl_4 \cdot 4H_2O$, $Na_2PdCl_4 \cdot 4H_2O$, ascorbic acid, glucose, ODA, ethanol, cyclohexane, TiO_2, activated carbon, commercial Pd/C were of analytical grade from the Beijing Chemical Factory of China and were used without further purification.

In a typical synthesis of Pd nanodendrites: 0.3 ml of $Na_2PdCl_4 \cdot 4H_2O$ (0.1g/ml) aqueous solution was added into 3 g of ODA at 80 ˚C. Then, the system was heated to 160 ˚C and 0.1 g of ascorbic acid was added. After 60 min of magnetically stirring, the products were collected and washed with ethanol several times.

In a typical synthesis of Au@Pd nanodendrites: 0.03 ml of $HAuCl_4 \cdot 4H_2O$ (0.1 g/ml) aqueous solution and 0.02 g of glucose were added into 3 g of ODA at 120 ˚C. After 30 minute, 0.24 ml of $Na_2PdCl_4 \cdot 4H_2O$ (0.1g/ml) aqueous solution was added into this system. Then, the temperature was increased to 160 ˚C and 0.05 g of ascorbic acid was added. After 60 min of magnetically stirring, the products were collected and washed with ethanol several times.

Characterization: The powder XRD patterns were recorded with a Bruker D8-advance X-ray powder diffractometer with CuKα radiation (λ = 1.5406 Å). The size and morphology of as-synthesized samples were determined by using Hitachi model H-800 transmission electron microscope and JEOL-2010F high-resolution transmission electron microscope. Energy dispersive spectroscopy was recorded to determine the composition of the products.

Semi-hydrogenation of phenyl acetylene: The as-synthesized Pd nanodendrites were loaded on the active carbon with a mass ratio of 5% simply by magnetically stirring their mixture in cyclohexane for 1h. Then the cyclohexane was removed by rotary evaporation. 20 mg of the as-synthesized catalyst, 0.6 ml of phenylacetylene, and 50 ml of ethanol were placed in a 100 ml round-bottled flask. The air in the vessel was replaced by hydrogen and the reaction was conducted under atmospheric hydrogen balloon and 30 °C.

CO oxidation: The as-synthesized nanocrystals were loaded on the commercial TiO_2 with a mass ratio of 5% simply by magnetically stirring their mixture in cyclohexane for 1h. Then the cyclohexane was removed by rotary evaporation. The catalytic activities for CO oxidation were evaluated in a fixed-bed quartz tubular reactor. 0.1 g of catalysts was placed in the reactor. The samples were pretreated at 200℃ for

30min to remove the surfactants. The reactant gases (1.0% CO, 18% O_2, balanced with nitrogen and argon) went through the reactor at a rate of 50 ml/min. The composition of the gas exiting the reactor was monitored by gas chromatography.

Supplementary Figures

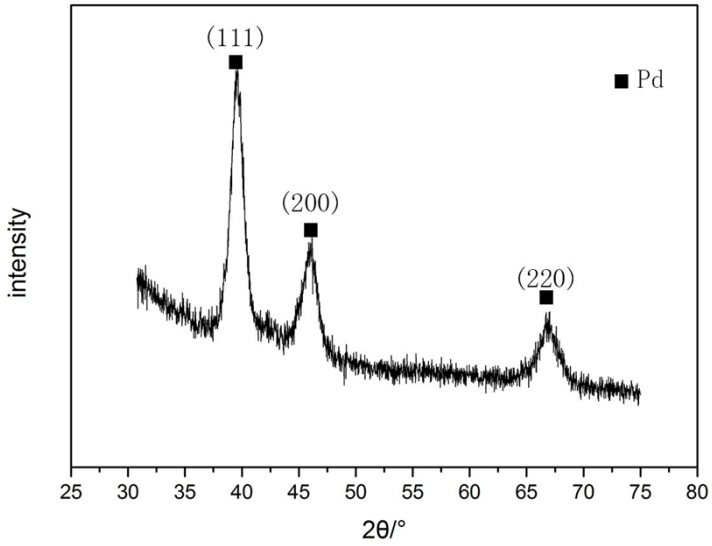

Figure S1. XRD pattern of Pd nanodendrites.

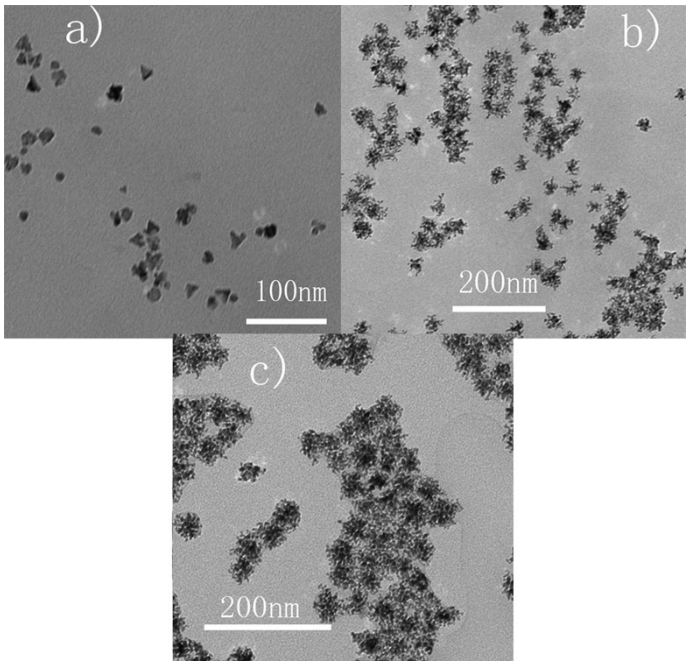

Figure S2. TEM images of Pd nanocrystals obtained when the reaction was performed at 160 ˚C and for different periods of time: a) 30 s; b) 10 min; c) 60 min.

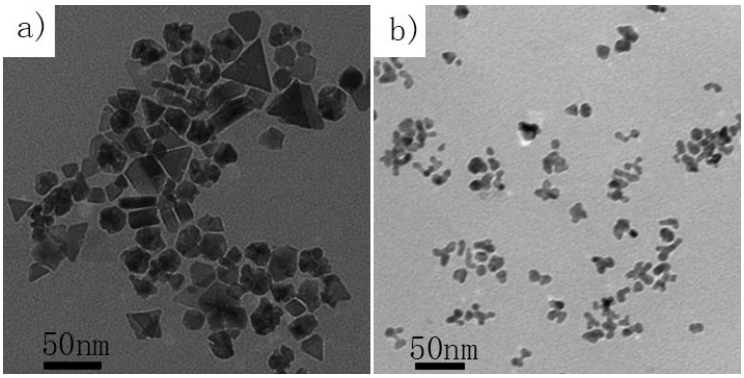

Figure S3. TEM images of Pd nanostructures synthesized at different temperature: a) 140 °C; b) 190 °C.

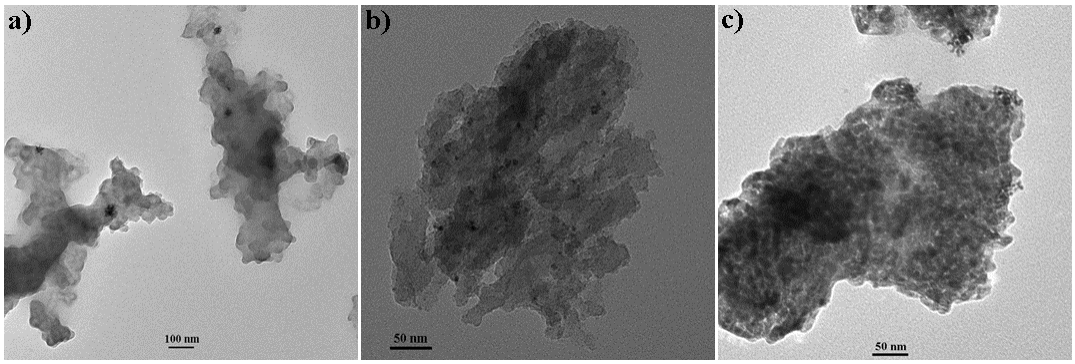

Figure S4. TEM images of catalysts: a) Pd (nanodendrites)/C (BET: 281.72 m^2/g); b) Commercial Pd/C (BET: 434.15 m^2/g); c) Au@Pd/TiO_2 (BET: 124.51 m^2/g).

Table S1. The catalytic performance of recycled Pd (nanodendrites)/C catalyst.

Pd (nanodendrites)/C	Conv. (%)	Sel. (%)
Cycle 1	98.1	94.7
Cycle 2	97.5	96.2
Cycle 3	98.4	95.4

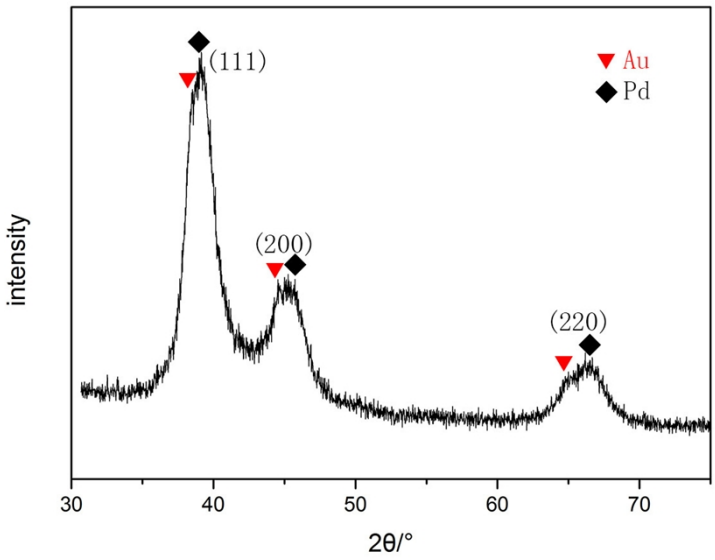

Figure S5. XRD pattern of Au@Pd nanocrystals.

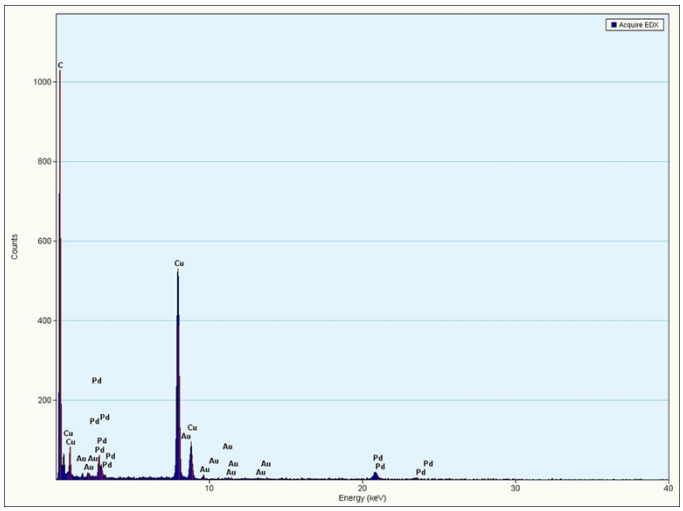

Figure S6. EDS spectrum of Au@Pd nanocrystals.

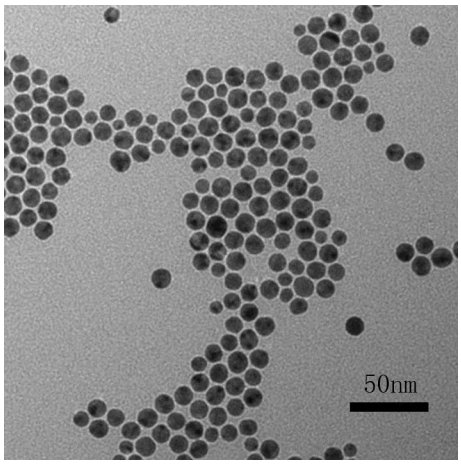

Figure S7. TEM image of Au nanoparticles.