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Supporting Information

Templated High-Yield Synthesis of Pt Nanorods Enclosed by High-Index {311} Facets for Methanol Selective Oxidation

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Experimental Section

Synthesis of SBA-15: The mesoporous silica SBA-15 was synthesized using a literature approach. Briefly, a solution of P123 : HCl : TEOS : H_2O = 2: 15 : 3.6 : 60 (mass ratio) was prepared, stirred for 24 h at 40 °C, and then heated at 100 °C for 2 days. The final products were washed, dried and calcined at 550 °C for 6 h.

Synthesis of Pt Nanorods and Nanoparticles: As to prepare Pt nanorods, 0.4 g of parent SBA-15 was dehydrated at 110 °C vacuum for 4 h. Then, a mixture of 2 ml aqueous solution thant contains

1ml ethylene glycol, 1 ml water, and 53 mg $H_2PtCl_6 \cdot 6H_2O$ was infiltrated in SBA-15 by incipient wetness impregnation at room temperature. The impregnated samples was quickly transported into the oven and allowed to react at 140 °C for 60 minutes. After that, the products were then washed, dried, and collected. Finally, Pt nanorods were found to be embedded in the SBA-15 host with 4% weight loading of Pt. 3-nm Pt nanoparticles were synthesized by the similar process, but substituting ethylene glycol with glucose as the reducing reagent. Free-standing Pt nanorods and nanoparticles can be further extracted from SBA-15 template by HF etching.

Characterization

The N_2 adsorption–desorption isotherms were recorded on an ASAP 2000 instrument. TEM images were obtained with a Philips CM 200 Transmission Electron Microscope equipped with a CCD camera. XRD patterns were collected on a Rigaku D/MAX 2400 diffractometer equipped with a CuKα X-ray source.

Catalytic Measurement

The selective oxidation of methanol to methylformate (MF) was carried out in a fixed-bed quartz flow reactor under atmospheric pressure. The feed gas composition is 2% Methanol, 4% O_2, He balance. 100 mg catalysts (SBA-15 supported Pt nanorods and nanoparticles) were used for the methanol selective oxidation. It was hold for 1 hr at each evaluating temperature. The typical gas hourly space velocity is 18000 $mlg^{-1}h^{-1}$. The products were analyzed by an on line gas chromatograph (Agilent 7890N) equipped with TCD and FID detectors.

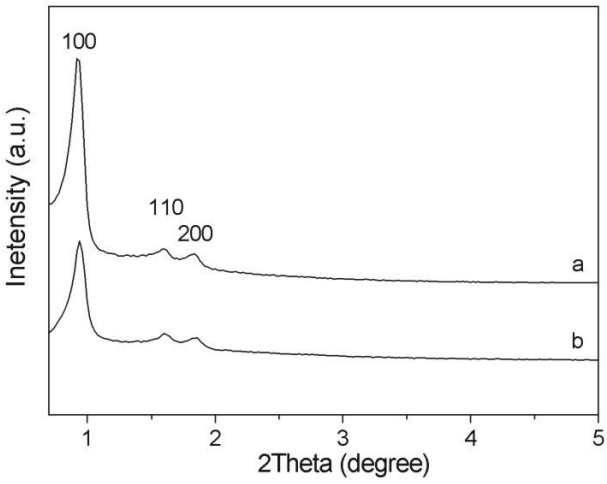

Figure S1. Small angle XRD patterns of (a) SBA-15 (a) before and (b) after embedding Pt nanorods.

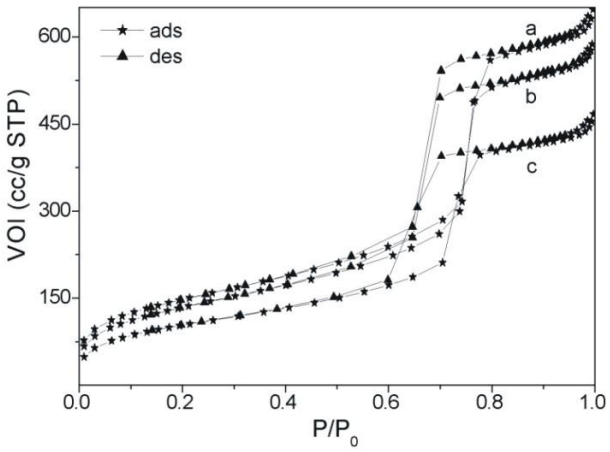

Figure S2. Nitrogen adsorption isotherms of (a) SBA-15, (b) Pt nanoparticles/SBA-15 and (c) Pt nanorods/SBA-15.

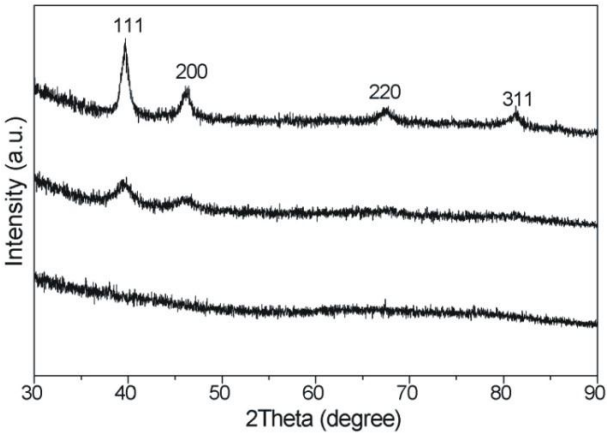

Figure S3. High angle XRD patterns of (a) SBA-15, and (b) Pt nanoparticles/SBA-15, (c) Pt nanorods/SBA-15.

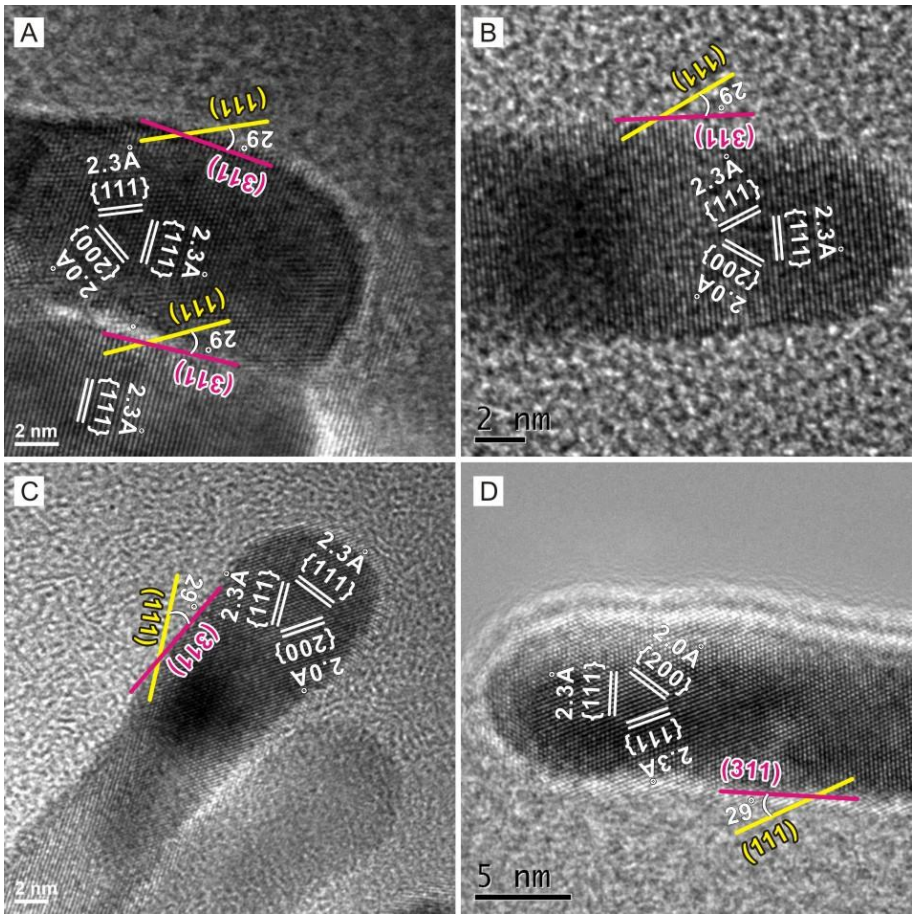

Figure S4. HRTEM images of Pt nanorods, all of the angles are 29º, corresponding to the calculated data (29.5º) of the angle between (111) and (311), illustrating the Pt nanorods are bounded by {311} facets.

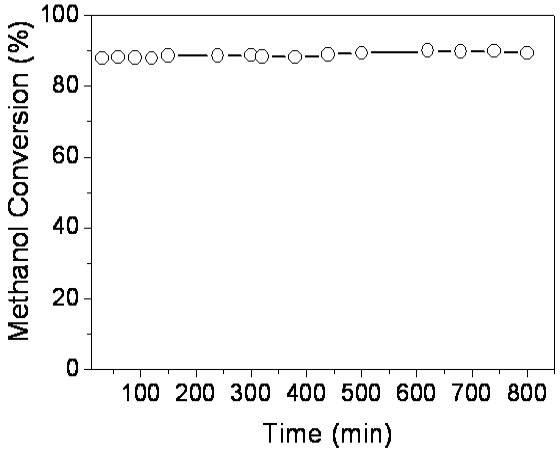

Figure S5. Reaction performance of SBA-15 supported Pt nanorods with time on stream.

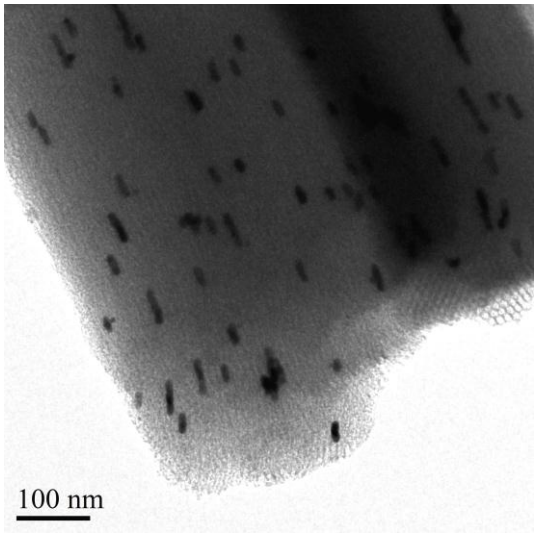

Figure S6, TEM image of SBA-15 supported Pt nanorods after catalytic reaction.

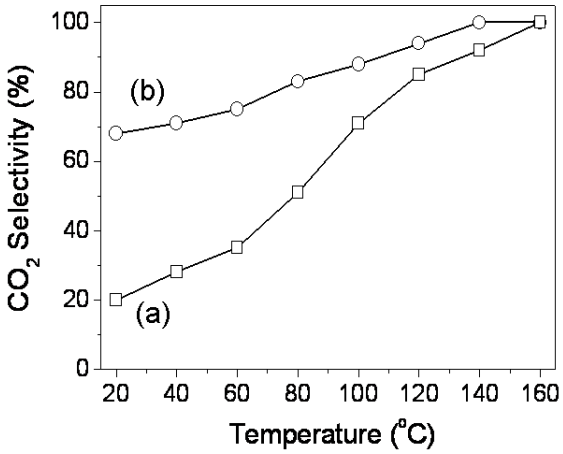

Figure S7. Selectivity of CO_2 over the SBA-15 supported Pt (a) nanorods and (b) nanoparticles catalysts.

Table S1. Physicochemical properties of selected samples.

Sample	S_{BJH}/m^2g^{-1}	Vt/m^3g^{-1}	Dpore/nm
SBA-15	702	0.92	6.1
Pt nanoparticles/SBA-15	620	0.82	5.8
Pt nanorods/SBA-15	582	0.78	5.5

S_{BJH}, BJH specific surface area; V_t, total pore volume; D_{BJH}, pore diameter calculated using BJH method.