Supporting information

Synthesis of 1,3-diols from isobutene and HCHO via Prins condensation-hydrolysis using CeO_2 catalysts: effects of crystal plane and oxygen vacancy

Zhixin Zhang,[a] Yehong Wang,[a] Jianmin Lu,[a] Min Wang,[a] Jian Zhang,[a]

Xuebin Liu,[b] and Feng Wang*[a]

[a] State Key Laboratory of Catalysis, Dalian National Laboratory for Clean Energy, Dalian Institute of Chemical Physics, Chinese Academy of Sciences, Dalian 116023, P.R. China

[b] Energy Innovation Laboratory, BP Office (Dalian Institute of Chemical Physics), Dalian 116023, P.R. China

*Corresponding author. Tel: +86-411-84379762; Fax: +86-411-84379762; E-mail: wangfeng@dicp.ac.cn

Catalyst phase analysis by powder X-ray diffraction

Powder X-ray diffraction patterns were conducted with a PANalytical X-Pert PRO diffractometer using Cu-Kα radiation at 40 kV and 20 mA. Continuous scans are collected over a 2θ range of 5 to 80°.

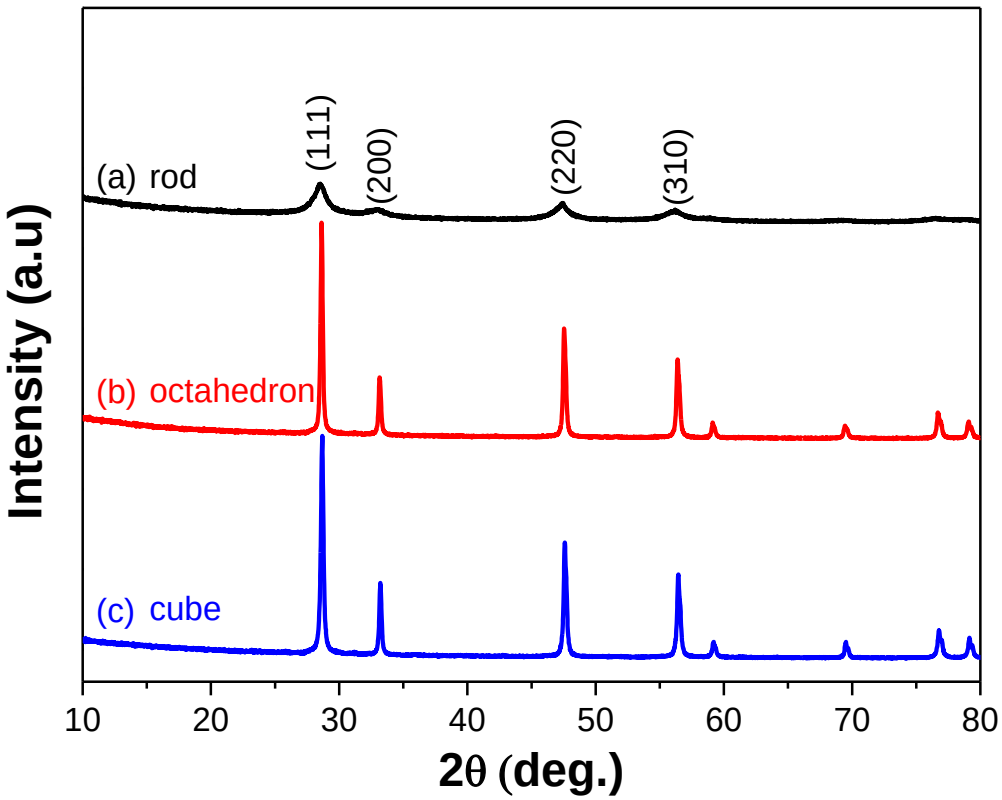

Figure S1. XRD patterns of CeO_2 with different morphologies

Catalyst morphologies observed by transmission electron microscopy (TEM) and high-resolution TEM (HRTEM) microscopy

TEM and HRTEM images were recorded on a JEOL-2100F electron microscopy operating at 200 kV.

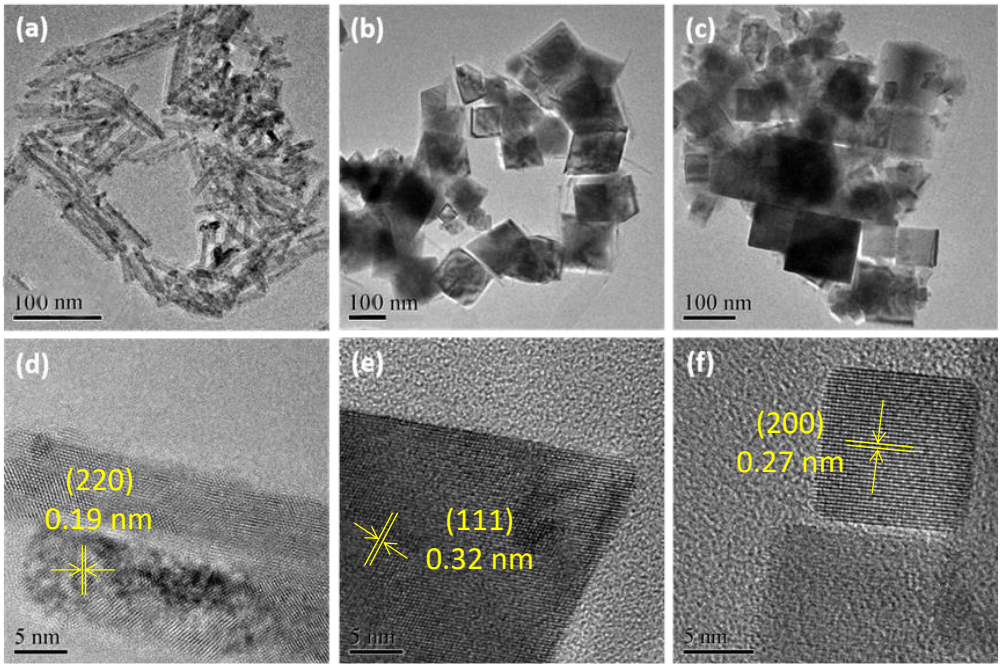

Figure S2. TEM of (a) CeO_2-rod, (b) CeO_2-octahedron, and (c) CeO_2-cube and HRTEM of (d) CeO_2-rod, (e) CeO_2-octahedron, and (f) CeO_2-cube.

Raman Characterization

Raman spectra were recorded on a micro-Raman spectrometer (Renishaw) equipped with a CCD detector using a He/Ne laser with a wavelength of 532 nm. The excitation laser was selected due to its preference for signals related to the surface layer species of the samples.

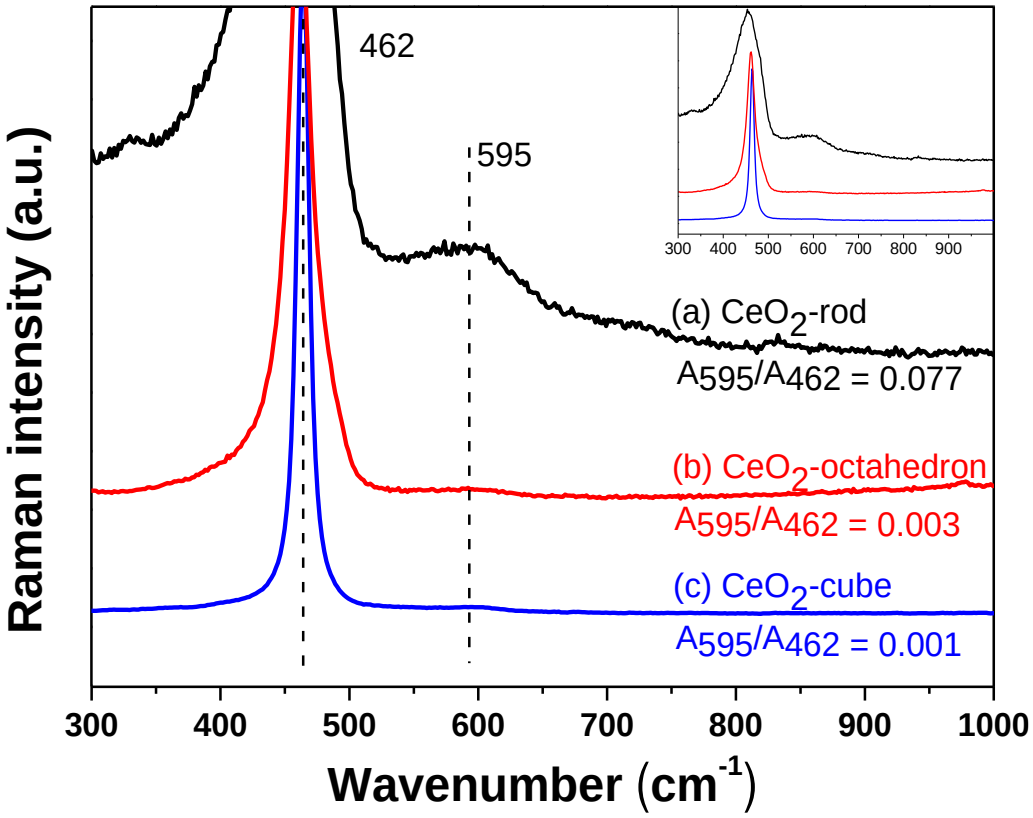

Figure S3. Raman spectra of (a) CeO_2-rod, (b) CeO_2-octahedron, and (c) CeO_2-cube

Table S1. Prins condensation-hydrolysis of isobutene with HCHO in water over CeO_2 with different morphologies

Entry	Catalyst	Conv. (%)	Sel. (%)		
			3	4	Others
1	CeO_2-rod	82	24	74	2
2	CeO_2-cube	82	25	74	1
3	CeO_2-octahedron	78	31	68	1
4	CeO_2	69	35	63	2

Reaction conditions: 50 mg catalyst, 1.5 mL H_2O, 0.21 mL HCHO (38 wt %), 3.0 g isobutene, 150 °C, 2 h.