Supporting Information for RSC Advances:

Enhanced catalytic performance of a Pt-xCeO_2/Graphene catalyst for DMFCs by adjusting the crystal-plane and shape of nanoscale ceria

Weihua Wang[a], Mingda Zhu[a], Xiaolin Lu[a], Yanfang Gao*[a], Lijun Li*[1a], Zhenzhu Cao[a], Caihong Li[a], Jinrong Liu[a], Haitao Zheng[b]

[a] College of Chemical Engineering, Inner Mongolia University of Technology, Hohhot, P. R. China.
[b] Materials Science and Manufacturing, Council for Scientific and Industrial Research (CSIR).

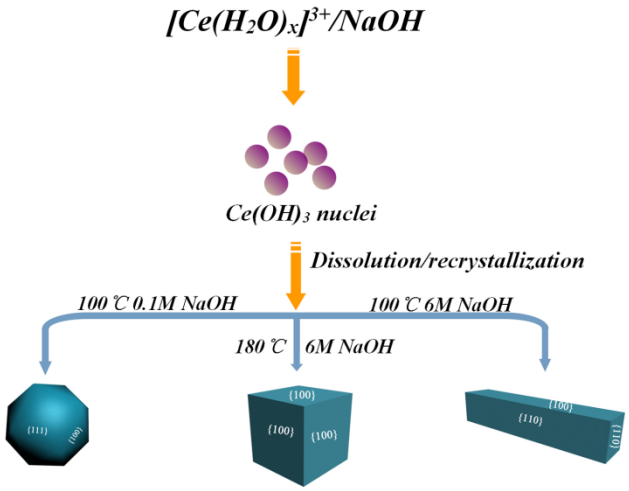

Figure S1. Schematic diagram for the shape-selective synthesis of CeO_2 nanopolyhedra, nanocubes and nanorods.

Figure S1 shows the shape-selective synthesis process of CeO_2 nanopolyhedra, nanocubes and nanocube. We use a simple hydrothermal method to synthesis different shape cerium oxide via adjusting hydrothermal temperature and NaOH concentration of the solution. According to the dissolution/recrystallization mechanism[2,4], when Ce^{3+} ions was mixed with NaOH solution, it formed anisotropic $Ce(OH)_3$ nuclei soon. At a low temperature of 100°C and low OH^- concentrations, the dissolution/recrystallization rate was slow, there might exist inadequately high chemical for driving the anisotropic $Ce(OH)_3$ nuclei growed into CeO_2 nanopolyhedras. When the

NaOH concentration was improved, it promoted the $Ce(OH)_3$ nuclei to grow anisotropically and formed CeO_2 nanorods. When the temperature rise to 180°C, the $Ce(OH)_3$ became unstable and was readily oxidized into CeO_2 nanocubes.

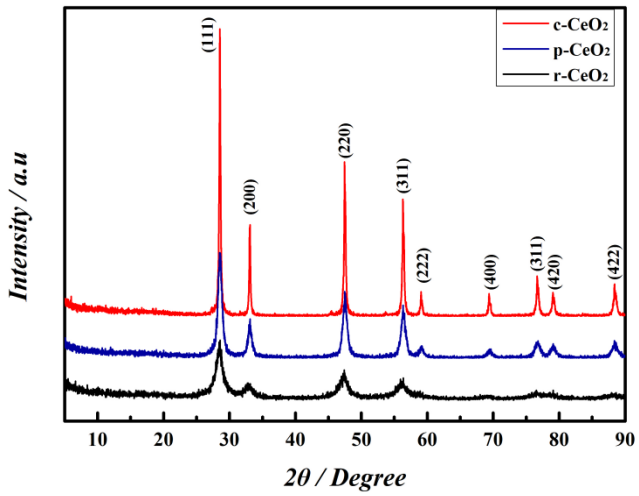

Figure S2. XRD patterns of rod-shaped CeO_2, cube-shaped CeO_2, polyhedra-shaped CeO_2.

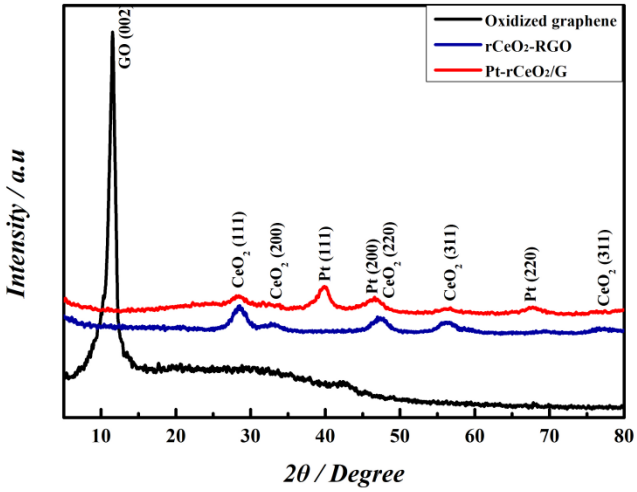

Figure S3. XRD patterns of graphene oxide (GO), $rCeO_2$/RGO, Pt-$rCeO_2$/Graphene composites.

The XRD patterns of rod-shaped CeO_2 ($rCeO_2$), cube-shaped CeO_2 ($cCeO_2$), polyhedra-shaped CeO_2 ($pCeO_2$) are shown in Figure S2. The sharpness in the diffracted peaks suggests a good crystallinity of the CeO_2 nanocrystals (JCPDS No. 34-0394). Figure S3 shows the XRD patterns

of graphene oxide (GO), $rCeO_2$/RGO, Pt-$rCeO_2$/graphene composites. Compared with the typical diffraction peak at ca. 10.06° in the XRD pattern of GO, the XRD pattern of the Pt-$rCeO_2$/Graphene shows a broad, low intensity peak at ca. 24.9° and it is hardly to find a diffraction peak below 25° in the XRD pattern of $rCeO_2$/RGO, indicating the reduction of oxidized graphene. The diffraction peaks at ca.39.8°, 46.2° and 67.5° in the Pt-$rCeO_2$/G catalysts correspond to the face-centered cubic phase of Pt (JCPDS No. 04-0802). The other peaks at ca. 28.6°, 33.1°, 47.5°, 56.4° and 77.7° in Pt-$rCeO_2$/G catalyst are consistent with the diffraction peaks of $rCeO_2$/RGO which corresponded to the diffraction peaks of CeO_2 (JCPDS No. 34-0394).[5,6]

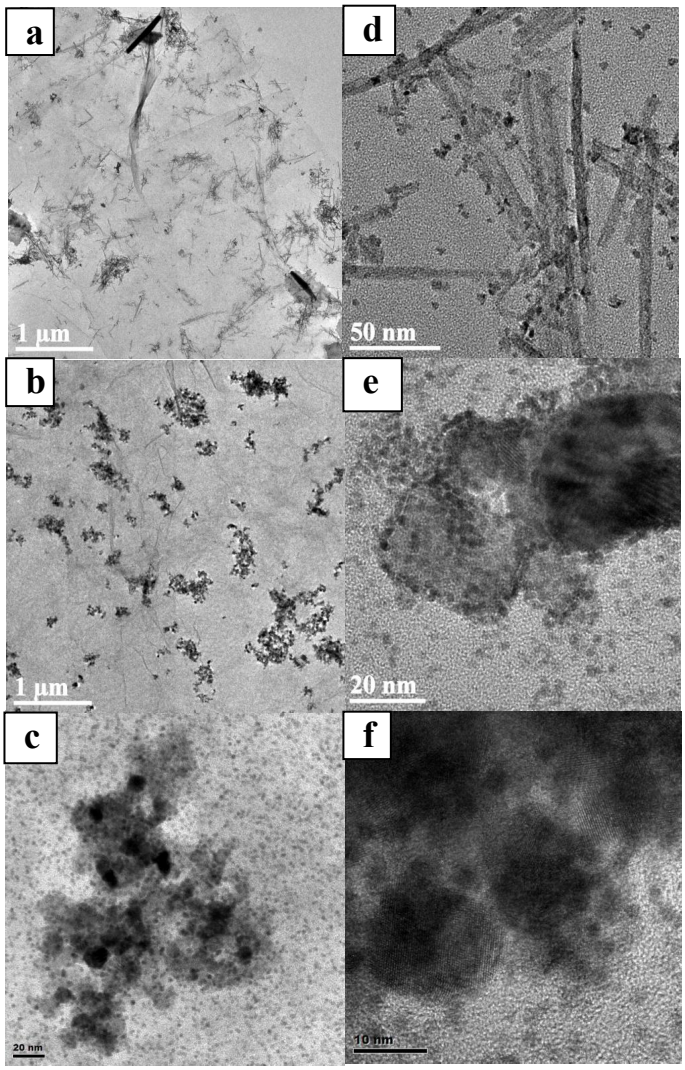

Figure S4. TEM images of Pt-rCeO2/Graphene (a, d), Pt-cCeO2/Graphene (b, e), and Pt-pCeO2/Graphene (c, f)

Reference

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