

Electronic Supplementary Information

**Crystal Plane Effects of Nano-CeO₂ on its Antioxidant
Activity**

Yan Zhang^a, Kebin Zhou^a, Yanwu Zhai^a, Fei Qin^a, Lulu Pan^b and Xin Yao^{a*}

^a School of Chemistry and Chemical Engineering, University of Chinese
Academy of Sciences, Beijing, China. Tel: 86-10-88256980;

E-mail: yaox@ucas.ac.cn

^b Beijing ENTE Century Environmental Technology Co., Beijing, China.

1. Surface area of all the samples

Table 1 the specific surface area of nano-CeO₂ with different morphology

materials	nanoparticles	nanobars	Nanowires
ssa/(m ² ·g ⁻¹)	51.3	99.4	102.9

2. Comparison of nanobars and nanowires in the morphology

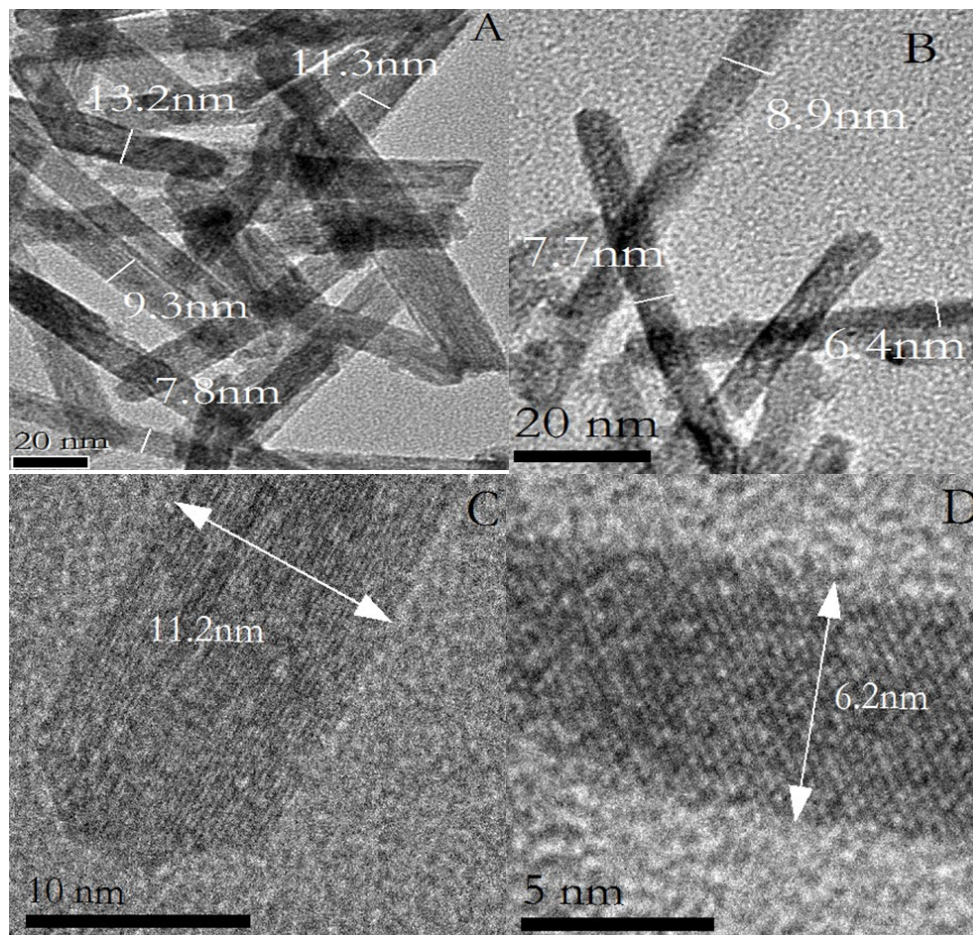


Fig. 1 TEM and HRTEM of nanobars (A and C) and nanowires (B and D)

3. Temperature-programmed reduction

The result in the whole range of temperature shows as follows:

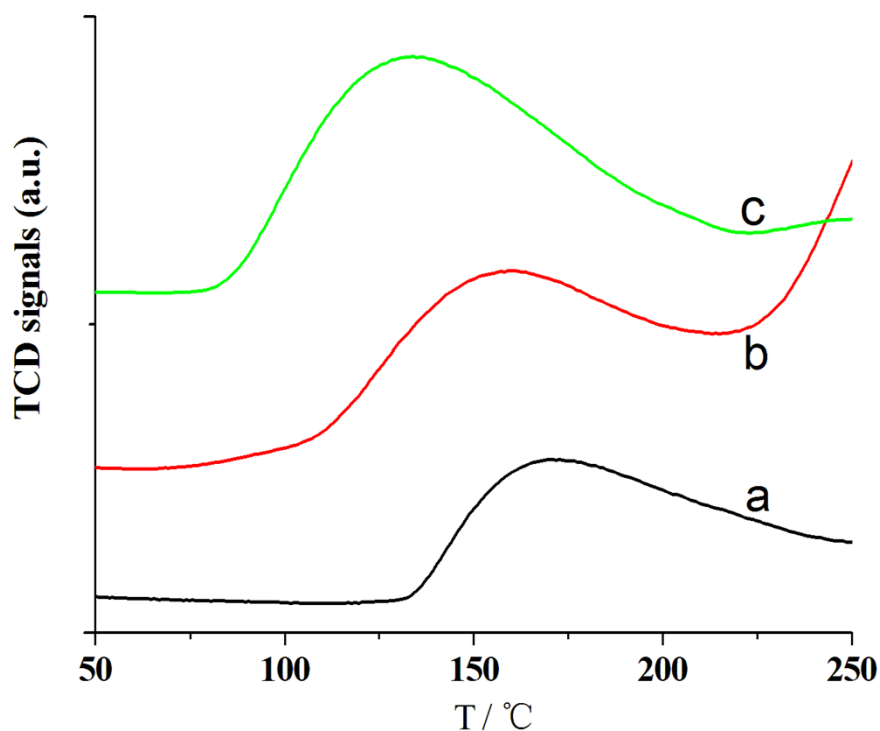


Fig. 2 CO Temperature-programmed reduction profiles of nano-CeO₂ with different morphologies. Considering the condition of the SWV scan experiment, we selected the temperature range from 50°C to 280°C, in which the reduction of Ce⁴⁺ only occurred on the surface of the materials.

4. The contents of Ce³⁺ on the surface of nano-CeO₂

The Ce 3d spectra are composed of two multiplets (v and u) corresponding to the spin-orbit splitting of 3d_{5/2} and 3d_{3/2} core holes.¹ Each spin-orbit component of Ce³⁺ is dominated by four components: peaks u' and v' are respectively located at 904.3±0.1eV and 886.1±0.1eV; peaks u₀ and v₀ are respectively located at 899.9±0.1eV and 881.8±0.1eV. For Ce⁴⁺ states, each spin-orbit component is dominated by other six components (v + v'' + v''' + u + u'' + u''').² The peak area can be

obtained by the PeakFit 4.0 software, and the ratio of Ce^{3+}/Ce^{4+} can be calculated from the following equations:³

$$A_{Ce^{3+}} = A_{v0} + A_{v'} + A_{u0} + A_u$$

$$A_{Ce^{4+}} = A_v + A_{v''} + A_{v'''} + A_u + A_{u''} + A_{u'''}$$

$$C_{Ce^{3+}} = \frac{A_{Ce^{3+}}}{A_{Ce^{4+}} + A_{Ce^{3+}}}$$

5. Morphology of nano-CeO₂ materials after the SWV experiment

In order to explore the morphology and crystal planes of nano-CeO₂ after the antioxidant process, we examined the morphology of nanobars by TEM after antioxidant reaction in pH 7.4 Tis-HCl solution. Nano-CeO₂ was added to pH 7.4 Tis-HCl and then redundant H₂O₂ was added. After ultrasonic process, the materials were washed with ultrapure water and alcohol for 3 times separately. The TEM result shows as Fig. 3.

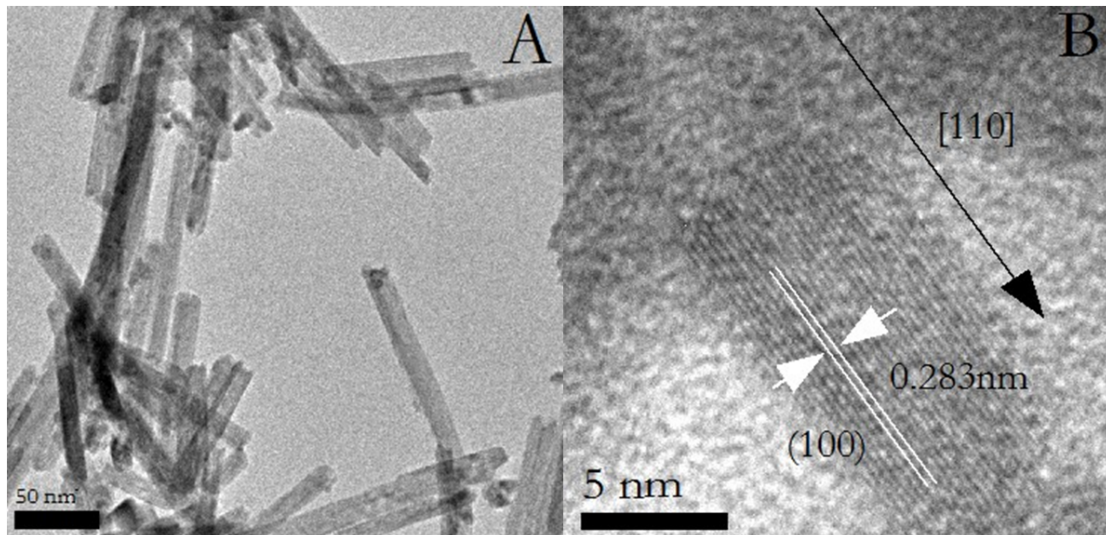


Fig. 3 TEM (A) and HRTEM (B) of nanobars after SWV

Preference

1. A. Fujimori, *Phys. Rev. B*, 1983, **28**, 4489-4499.
2. C. Anandan and P. Bera, *Appl. Surf. Sci.*, 2013, **283**, 297-303.
3. E. Beche, G. Peraudeau, V. Flaud and D. Perarnau, *Surf. Interface Anal.*, 2012, **44**, 1045-1050.