

## Electronic Supplementary Information

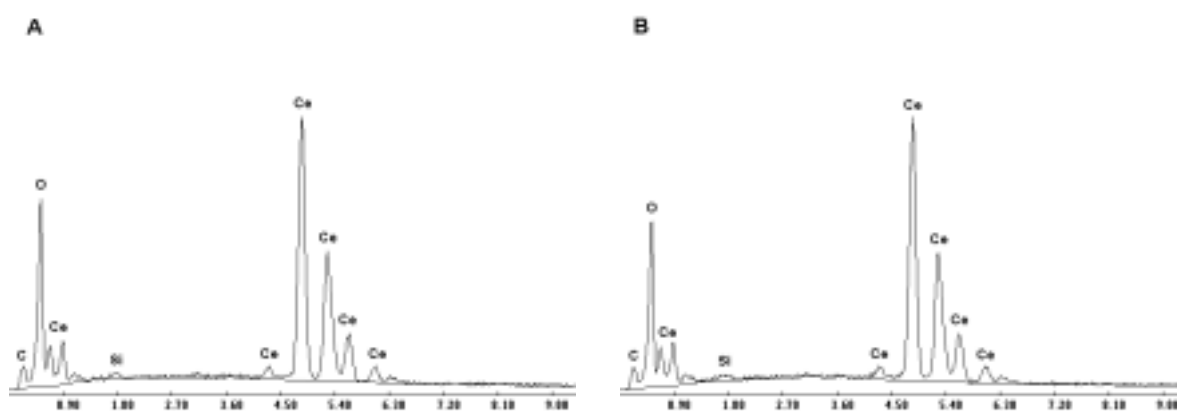


Figure 1: EDX profile of selected area of cubic  $Ia3d$  (A) and 2D hexagonal (B) cerium oxides after removal of the silica template by NaOH solution.

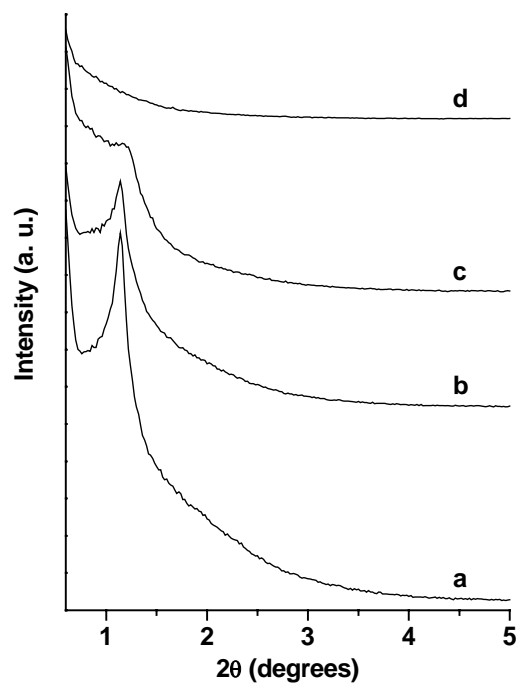


Figure 2: Powder XRD patterns of template-free 2D hexagonal CeO<sub>2</sub> in low-angle region (curve a). The CeO<sub>2</sub> sample was calcined to 773 (curve b), 973 (curve c) and 1073 K (curve d) for 4 h (heating rate of 1.5° min<sup>-1</sup>). The same sample was repeatedly calcined to compare the thermal stability. The wide-angle X-ray reflections of the calcined samples are similar to that of cubic *Ia3d* CeO<sub>2</sub>. The XRD patterns were obtained using CuK $\alpha$  X-ray source on Rigaku D/MAX-III (2 kW).

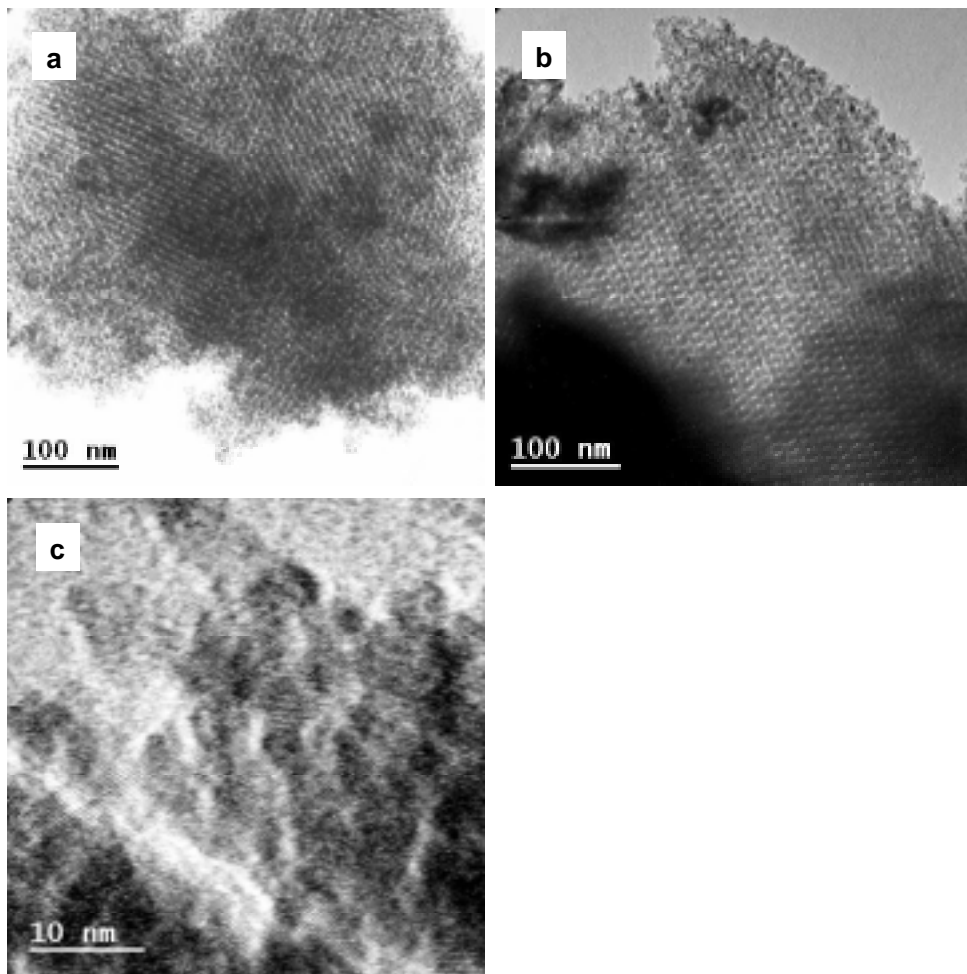


Figure 3: TEM images of cubic  $Ia3d$  CeO<sub>2</sub> taken along the (a) [111], (b) [311] direction; (c) HRTEM image of 2D hexagonal CeO<sub>2</sub> taken along [100] direction using Philips F20 Tecnai instrument, operated at 160 kV.

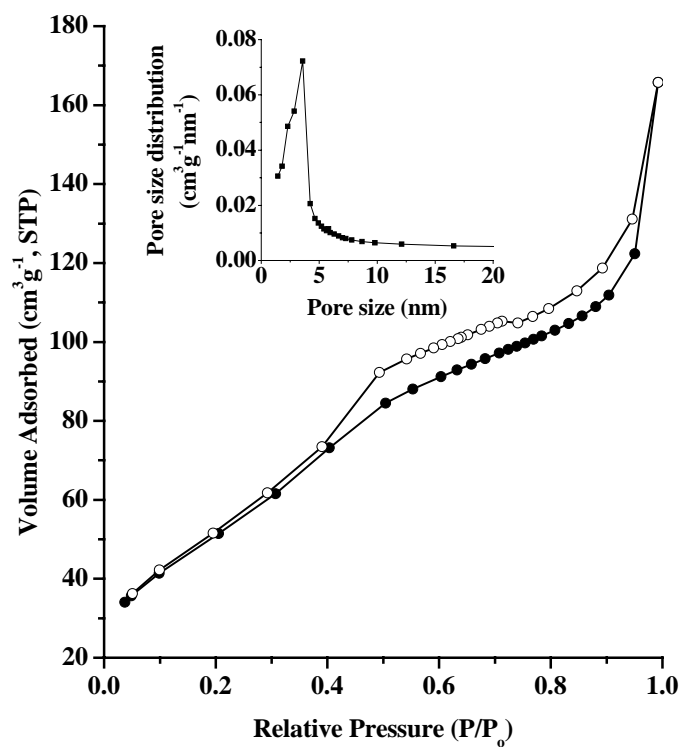


Figure 4: N<sub>2</sub> adsorption-desorption isotherm at 77 K for 2D hexagonal cerium oxide (Quantachrome Autosorb-1) and pore size distribution (inset) calculated using BJH method.