

Electronic Supporting Information

for

Mechanism of the Oxidation of Organic Dyes in the Presence of Nanoceria

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Nanoceria preparation. All chemicals were obtained from Sigma-Aldrich and were used as received. Nanoceria was prepared following a published procedure.^{S1} Briefly, 2.17 g Ce(NO₃)₃·6H₂O was dissolved in 5.0 ml de-ionized water. Under magnetic stirring, the solution was added to 30 ml 30% ammonium hydroxide. 0.50 M polyacrylic acid was added to the reaction mixture 60 s after the reaction and the resulting mixture was stirring for 3 h. Separation and purification was done by multiple centrifugation-decantation-dispersion cycles with water.

Transmission electron microscopic (TEM) test of nanoceria. Nanoceria was studied using TEM and high resolution transmission electron microscopy (HRTEM). Nanoceria was deposited on a carbon coated copper grid for HRTEM analysis by solvent evaporation method. The HRTEM images of the prepared particles were obtained with a Philips (Tecnai Series) transmission electron microscope operating at 300 keV. Figure S1 is a TEM micrograph of nanoceria, showing nearly spherical particles with a diameter of 3–6 nm. A series of diffraction rings in the selected-area electron diffraction (SAED) pattern (Figure S1 insert) indicated that nanoceria is essentially polycrystalline.

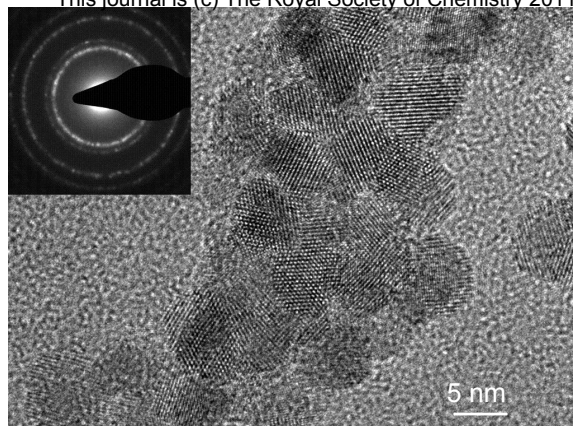


Figure S1. A TEM micrograph of nanoceria.
Insert: SAED pattern.

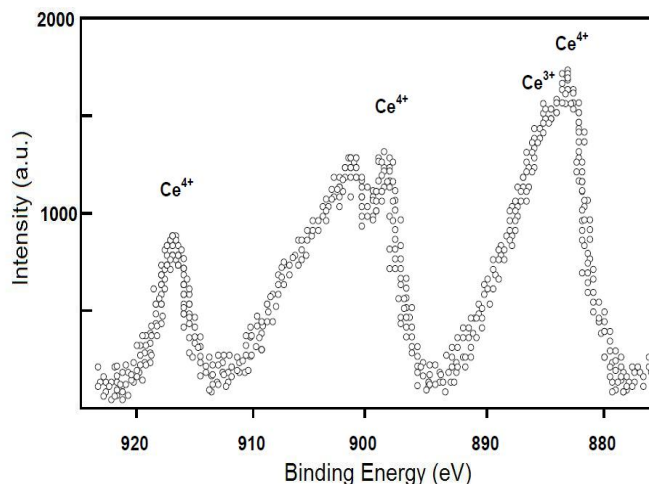


Figure S2. A XPS spectrum of nanoceria.

X-ray photoelectron spectroscopic (XPS) test. Composition of nanoceria was studied by XPS using a VG ESCALAB 220I-XL XPS system (Thermo VG Scientific Ltd., UK). The base pressure during XPS analysis was 10^{-9} Torr and Mg-K α X-ray radiation (1253.6 eV) at a power of 200 watts was used. The binding energy of the Au_{4f7/2} was used to calibrate the spectrometer. As shown in Figure S3, the peaks between 875–895 eV correspond to Ce 3d_{5/2}, between 895–910 eV correspond to Ce 3d_{3/2} and peak at 916 eV is a characteristic satellite peak indicating the presence of Ce⁴⁺. The peaks at 885.0, 899.5 and 903.5 eV are indicative of Ce³⁺ peaks and those at 882.1, 898.0, and 916.40 eV are indicating the presence of Ce⁴⁺. Deconvolution analysis showed that nanoceria is made of 40–45% CeO₂ and 55–60% Ce₂O₃, similar to those obtained earlier with nanoceria prepared under the same experimental conditions.^{S2}

References

S1. A. Asati, S. Santra, C. Kaittanis, S. Nath and J. M. Perez, *Angew. Chem. Int. Ed.*, 2009, **48**, 2308.

S2. J. M. Perez, A. Asati, S. Nath and C. Kaittanis, *Small*, 2008, **5**, 552.