

Supplementary Materials

Oxygen Vacancy Injection on (111) CeO_2 Nanocrystal Facets for Efficient H_2O_2 Detection

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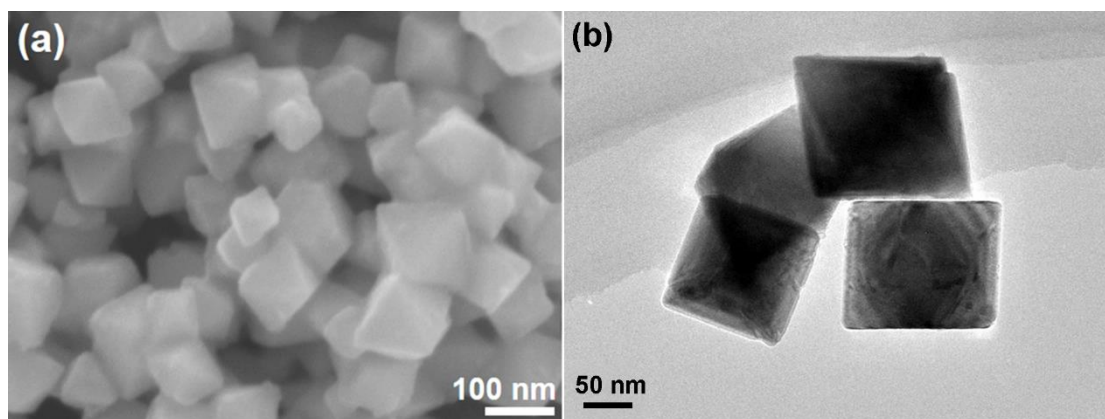


Figure S1. SEM and TEM images of R- $\text{CeO}_2\text{-O}$.

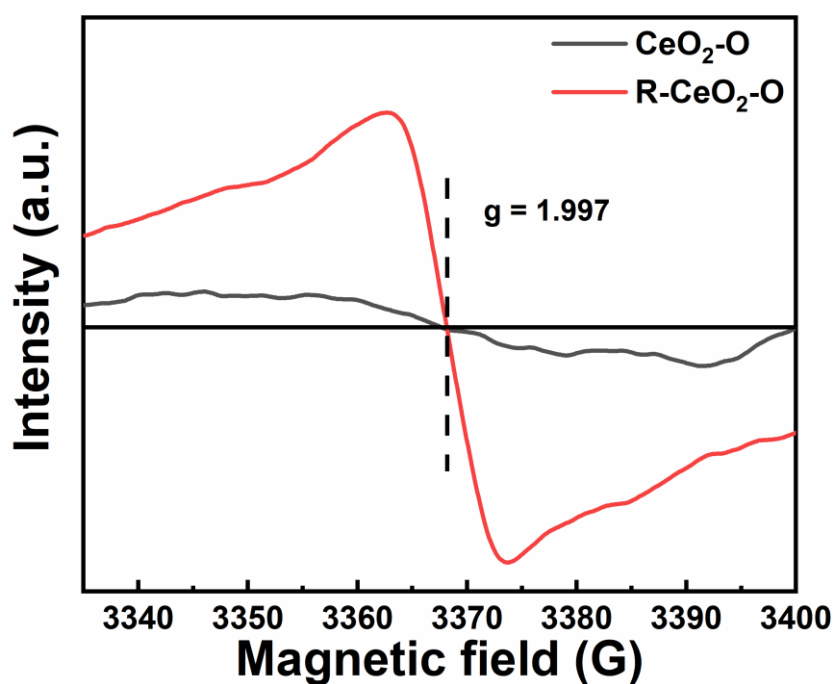


Figure S2. Electron paramagnetic resonance (EPR) spectra of $\text{CeO}_2\text{-O}$ and R- $\text{CeO}_2\text{-O}$.

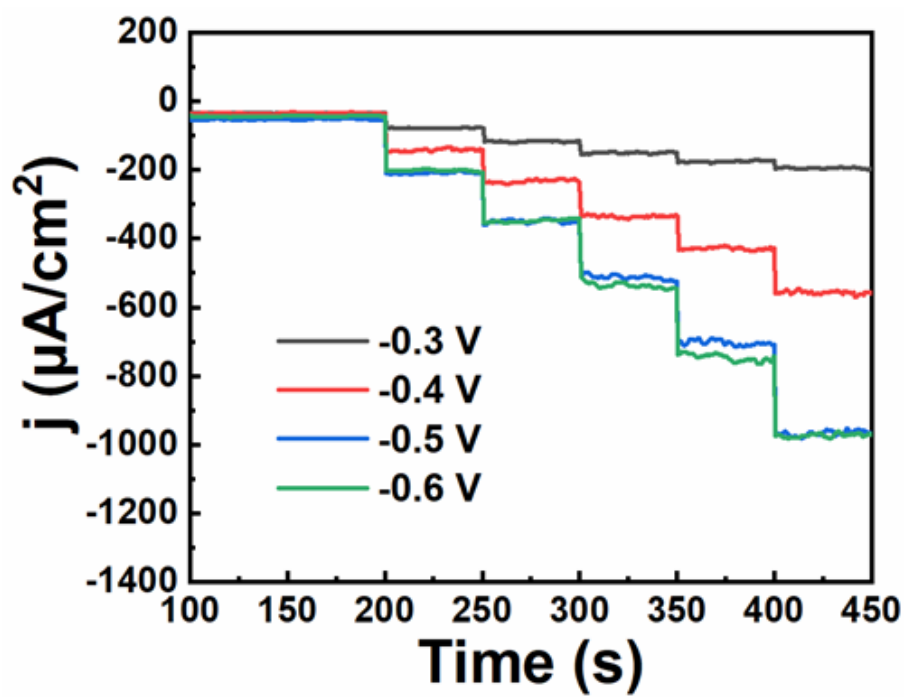


Figure S3. CA curves of R-CeO₂-O by continuously adding 1 mM H₂O₂ into 0.1 M PBS per 50 s at the bias voltage of -0.3 V, -0.4 V, -0.5 V and -0.6 V.

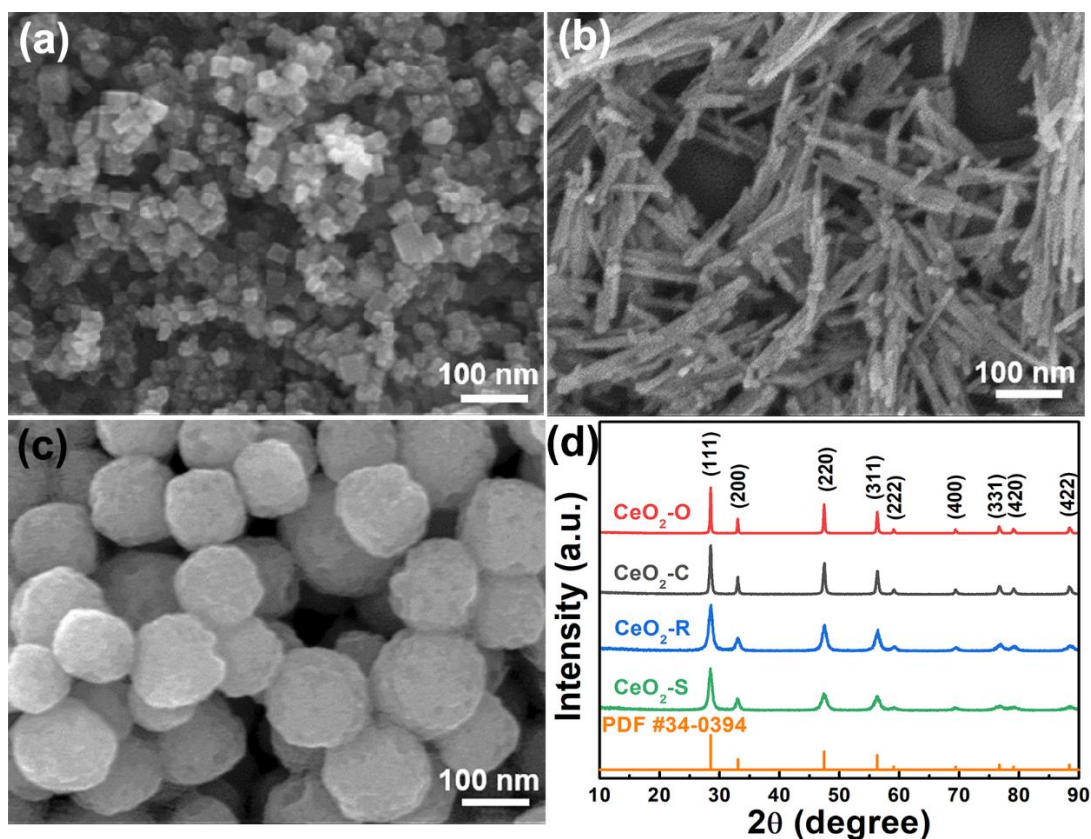


Figure S4. SEM images of CeO₂ catalysts with different morphologies: (a) CeO₂-C (cube), (b) CeO₂-R (rod) and (c) CeO₂-S (sphere). (d) XRD patterns of CeO₂ catalysts with different morphologies.

Figure S4a exhibits well-developed inhomogeneous cubes (CeO₂-C) with side length ranging from 10 nm to 40 nm. In Figure S4b, the diameter of the crisscross CeO₂-R is about 10 nm with a length of about 150 nm. Figure S4c shows uniform CeO₂-S with the diameter of 150 nm. Phase uniformity must be strictly disciplined to eliminate interference from basic crystallographic structure. The phase composition of CeO₂ catalysts with different morphologies was investigated by XRD. As shown in Figure S4d, all samples show identical diffraction pattern and match the standard card with no extra peak, which proves the high purity and good phase consistency. Based on the above discussion, CeO₂ catalysts with diverse exposed facets were fabricated, which successfully completed the groundwork for further study.

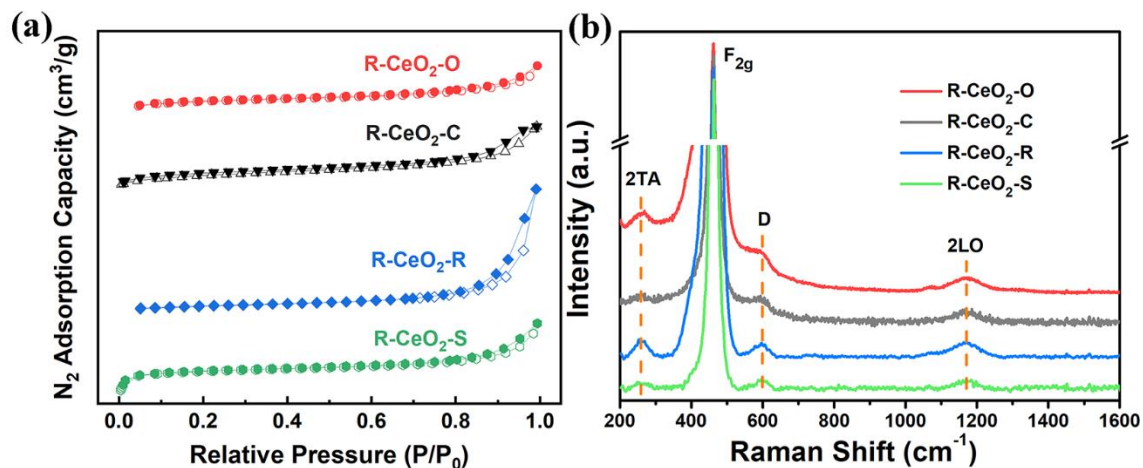


Figure S5. (a) N₂ adsorption-desorption isotherms and (b) Raman spectra of CeO₂ nanocatalysts.

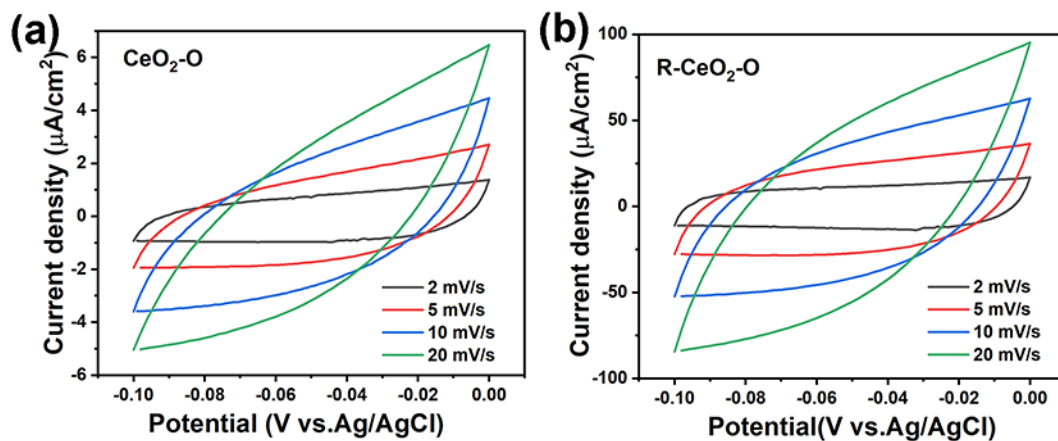


Figure S6. Cyclic voltammetry curves of (a) CeO₂-O and (b) R-CeO₂-O.

The EASA test is conducted on CeO₂-O and R-CeO₂-O electrode in N₂-saturated 0.1 M PBS.

The CV curves of CeO₂-O and R-CeO₂-O electrodes at different scanning rates in the non-faradic regions (-0.1 V-0 V) are shown in Figure S6. By taking the anode current density at -0.02 V and the cathode current density at -0.08 V, the slope was obtained after linear fitting, then the following formula can be used to calculate the electric double layer specific capacitance (C_{dl}):

$$C_{dl} = \frac{(\text{Slope1} - \text{Slope2}) * 1000}{2} = 500 * (\text{Slope1} - \text{Slope2})$$

It could be calculated that the C_{dl} of CeO_2-O and $R-CeO_2-O$ were $203.16 \mu F/cm^2$ and $3.39 mF/cm^2$, respectively. The electrochemical active surface area (EASA) can be calculated through the following formula

$$EASA = C_{dl} / C_s$$

It was assumed that, the specific capacitance of flat standard surface (C_s) with $1 cm^2$ of real surface which was assume the value around $40 \mu F/cm^2$. The calculated values of the corresponding samples are $5.08 cm^2$ (CeO_2-O) and $84.75 cm^2$ ($R-CeO_2-O$).

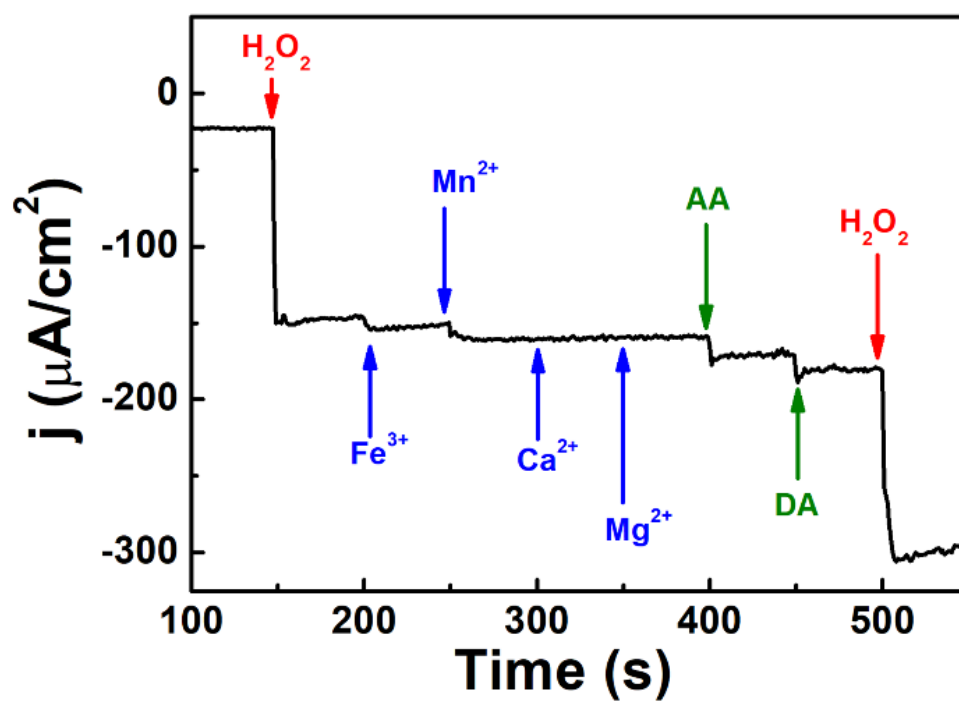


Figure S7. Amperometric response of R-CeO₂-O upon the successive addition of 1 mM H₂O₂, Fe(NO₃)₃, Mn(NO₃)₂, Ca(NO₃)₂, Mg(NO₃)₂, AA, DA and H₂O₂ in 0.1 M PBS at a bias voltage of -0.5 V.

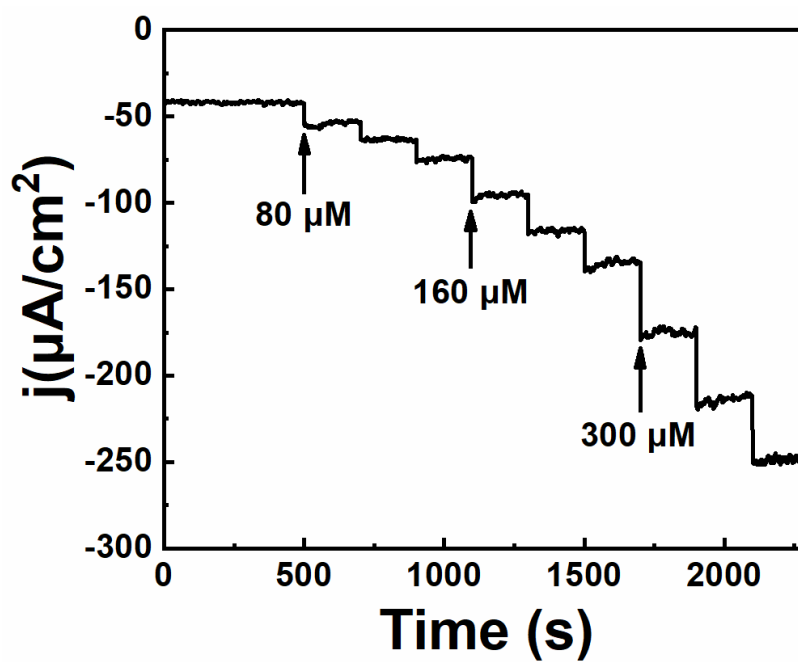


Figure S8. Amperometric response of R-CeO₂-O after continuous addition of H₂O₂ solution to medical disinfectant with a bias of -0.5 V.