

## **Low-temperature CO oxidation over manganese, cobalt, and nickel doped CeO<sub>2</sub> nanorods**

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**Table S1** The Mn, Co, and Ni content of  $\text{Ce}_{0.9}\text{Mn}_{0.1}\text{O}_{2-\delta}$  (Mn-CeO<sub>2</sub>),  $\text{Ce}_{0.9}\text{Co}_{0.1}\text{O}_{2-\delta}$  (Co-CeO<sub>2</sub>), and  $\text{Ce}_{0.9}\text{Ni}_{0.1}\text{O}_{2-\delta}$  (Ni-CeO<sub>2</sub>) NRs determined from ICP-OES analysis.

Sample	Nominal metal content (%)	Calculated metal content (%)
Mn-CeO <sub>2</sub>	10	9.82
Co-CeO <sub>2</sub>	10	9.79
Ni-CeO <sub>2</sub>	10	9.87

**Table S2** The  $T_{50}$  values of  $\text{Ce}_{0.9}\text{Co}_{0.1}\text{O}_{2-\delta}$  (Co-CeO<sub>2</sub>), and  $\text{Ce}_{0.9}\text{Zr}_{0.1}\text{O}_{2-\delta}$  (Zr-CeO<sub>2</sub>) NRs.

Sample	$T_{50}$	Reference
Zr-CeO <sub>2</sub>	265 °C	9
Co-CeO <sub>2</sub>	145 °C	Current work

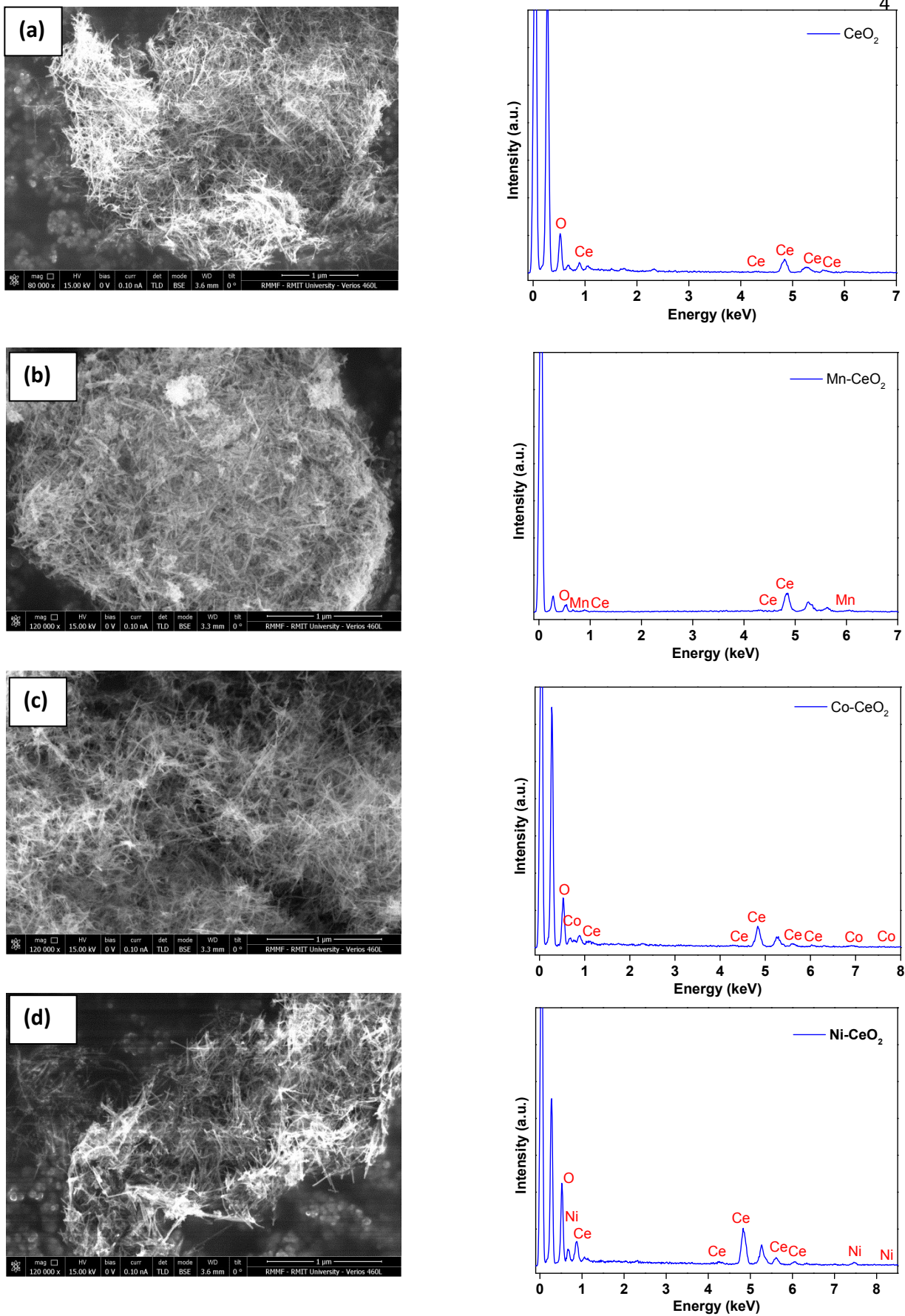


Fig. S1 SEM images of (a)  $\text{CeO}_2$ , (b)  $\text{Ce}_{0.9}\text{Mn}_{0.1}\text{O}_{2-\delta}$  (Mn-CeO<sub>2</sub>), (c)  $\text{Ce}_{0.9}\text{Co}_{0.1}\text{O}_{2-\delta}$  (Co-CeO<sub>2</sub>), and (d)  $\text{Ce}_{0.9}\text{Ni}_{0.1}\text{O}_{2-\delta}$  (Ni-CeO<sub>2</sub>). The corresponding EDX spectra of the NRs.

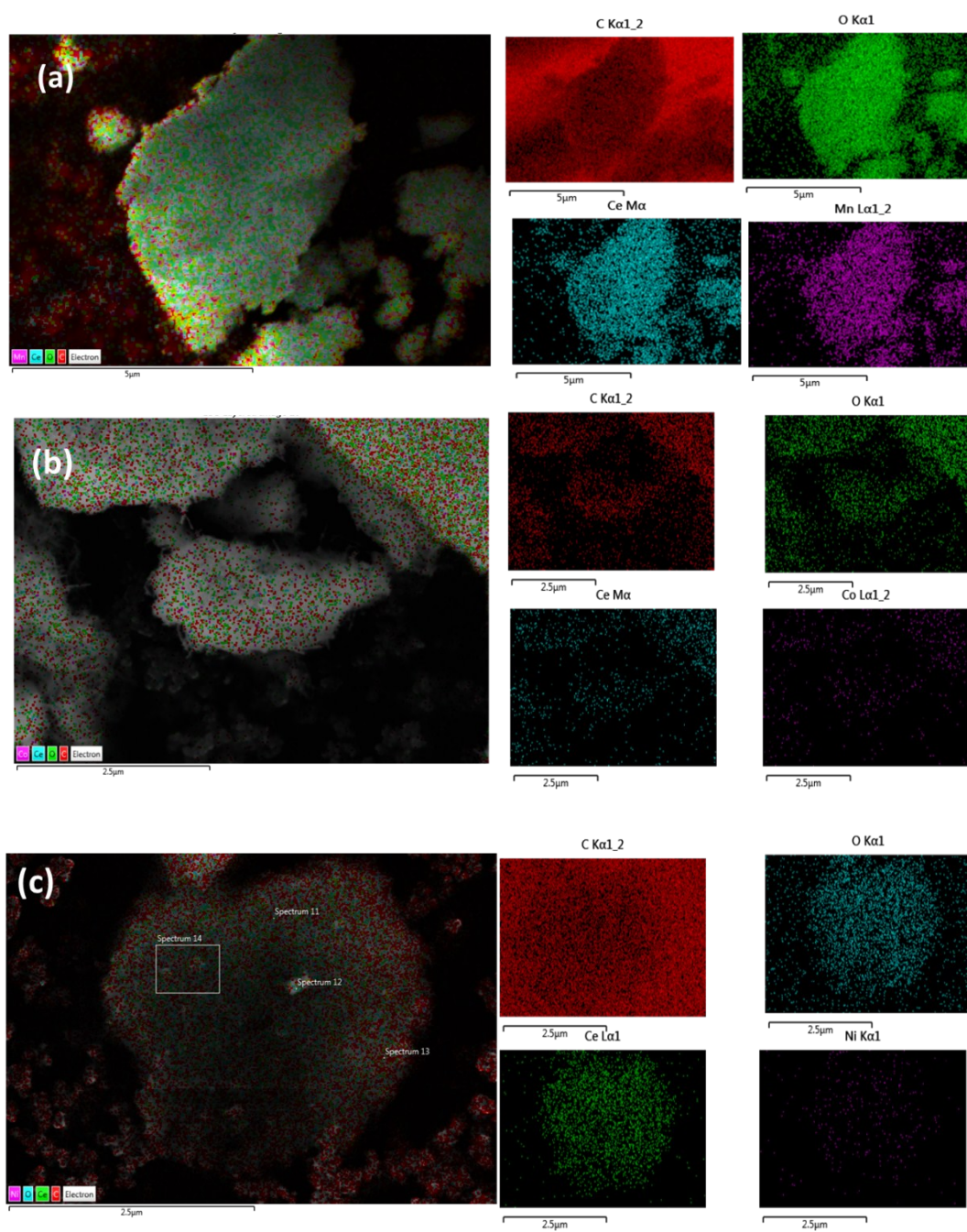


Fig. S2 EDX elemental mapping of (a)  $\text{Ce}_{0.9}\text{Mn}_{0.1}\text{O}_{2-\delta}$  (Mn-CeO<sub>2</sub>), (b)  $\text{Ce}_{0.9}\text{Co}_{0.1}\text{O}_{2-\delta}$  (Co-CeO<sub>2</sub>), and (c)  $\text{Ce}_{0.9}\text{Ni}_{0.1}\text{O}_{2-\delta}$  (Ni-CeO<sub>2</sub>) NRs.

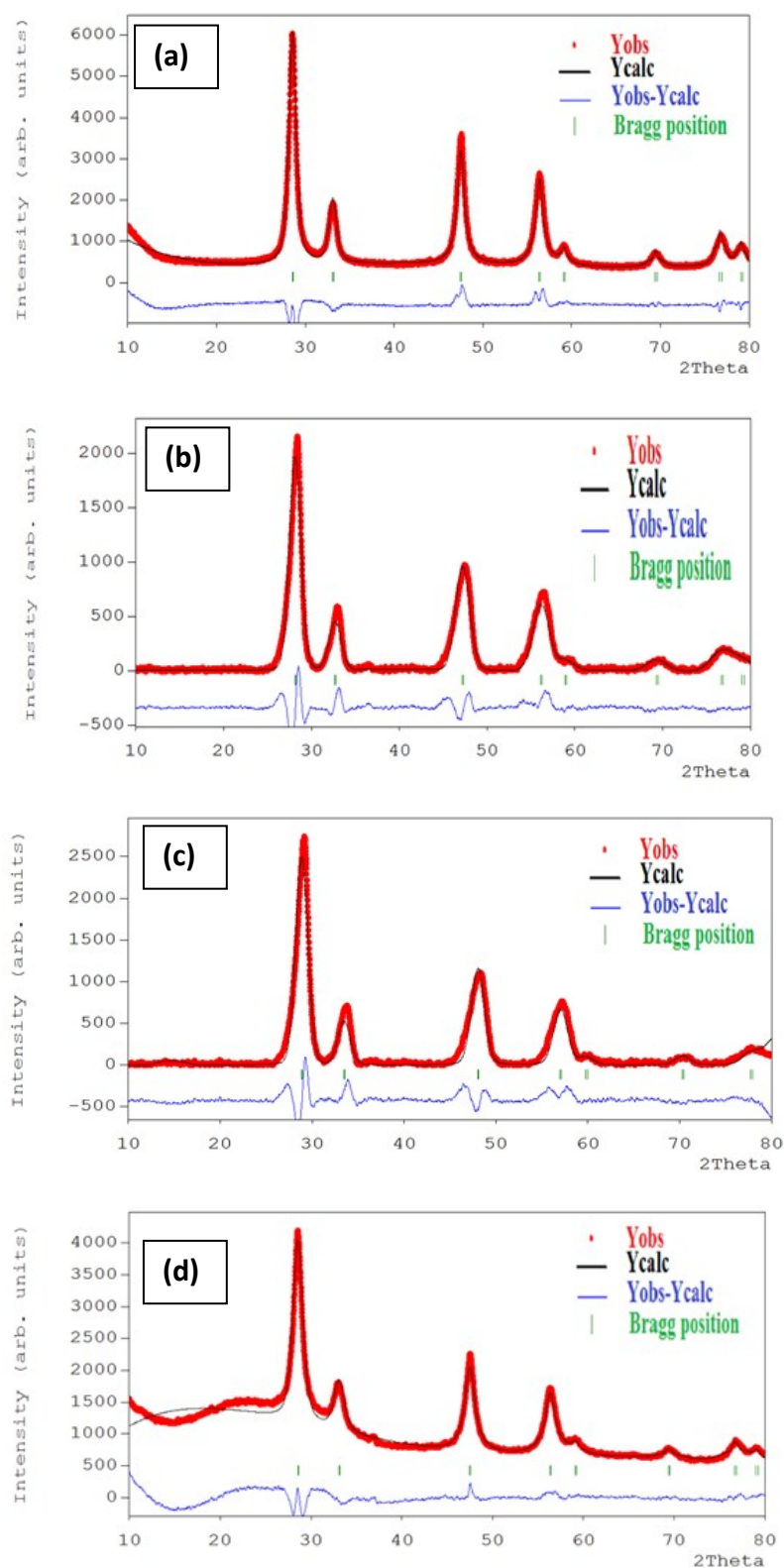


Fig. S3. Rietveld refinement of the XRD patterns of (a)  $\text{CeO}_2$ , (b)  $\text{Ce}_{0.9}\text{Mn}_{0.1}\text{O}_{2-\delta}$  (Mn- $\text{CeO}_2$ ), (c)  $\text{Ce}_{0.9}\text{Co}_{0.1}\text{O}_{2-\delta}$  (Co- $\text{CeO}_2$ ), and (d)  $\text{Ce}_{0.9}\text{Ni}_{0.1}\text{O}_{2-\delta}$  (Ni- $\text{CeO}_2$ ). Experimental data are indicated by red circles while the refined values form the continuous black line. The difference between the experimental and calculated curves is represented by the lowest blue line.



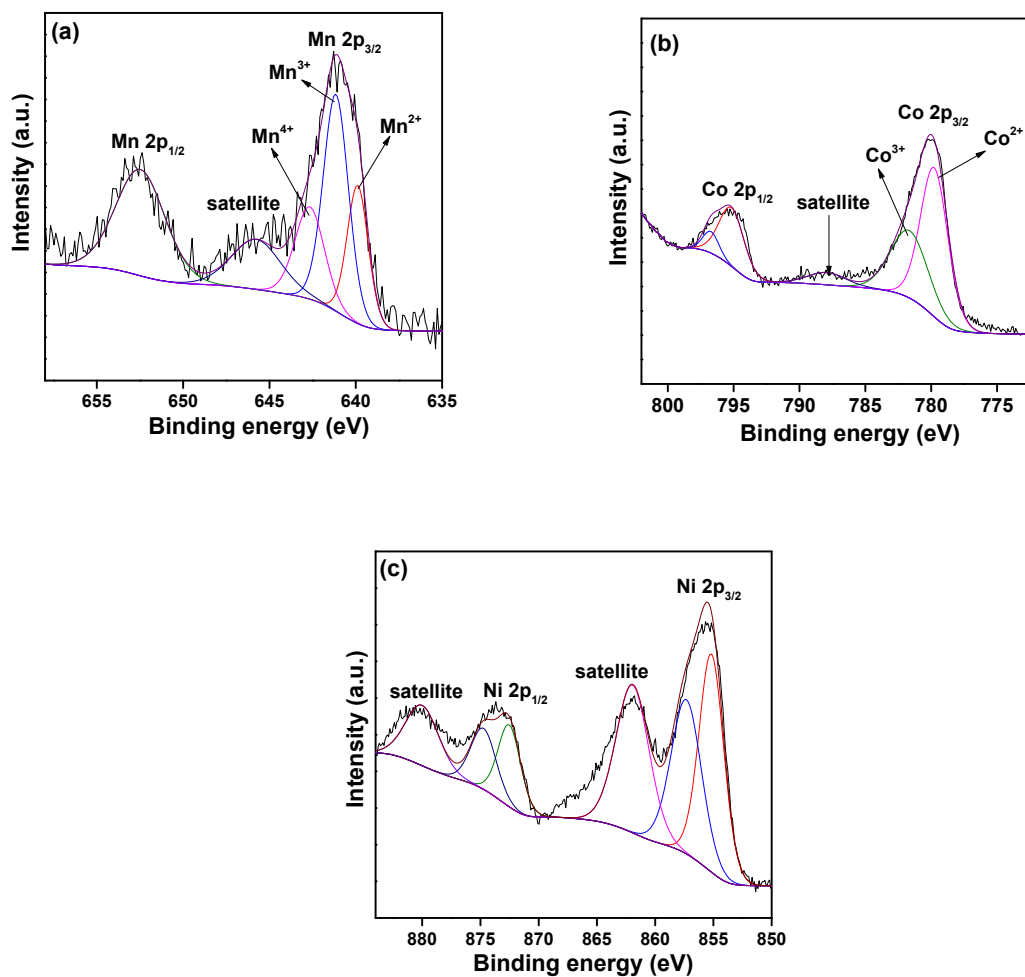


Fig. S4 XPS spectra of  $\text{Ce}_{0.9}\text{Mn}_{0.1}\text{O}_{2-\delta}$  (Mn-CeO<sub>2</sub>),  $\text{Ce}_{0.9}\text{Co}_{0.1}\text{O}_{2-\delta}$  (Co-CeO<sub>2</sub>), and  $\text{Ce}_{0.9}\text{Ni}_{0.1}\text{O}_{2-\delta}$  (Ni-CeO<sub>2</sub>) NRs; (a) Mn 2p, (b) Co 2p, and (c) Ni 2p.

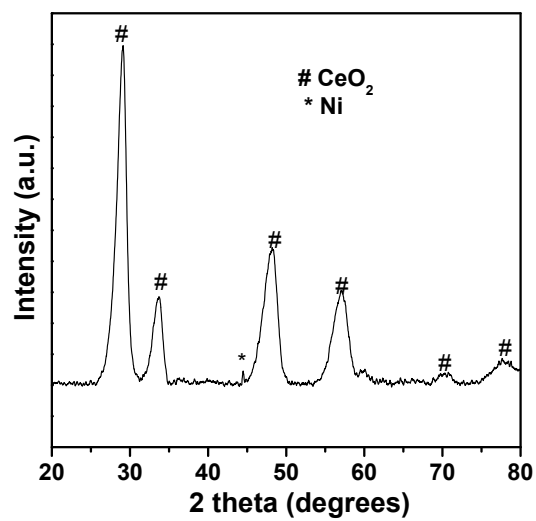


Fig. S5 XRD spectra of used  $\text{Ce}_{0.9}\text{Ni}_{0.1}\text{O}_{2-\delta}$  (Ni- $\text{CeO}_2$ ) NRs



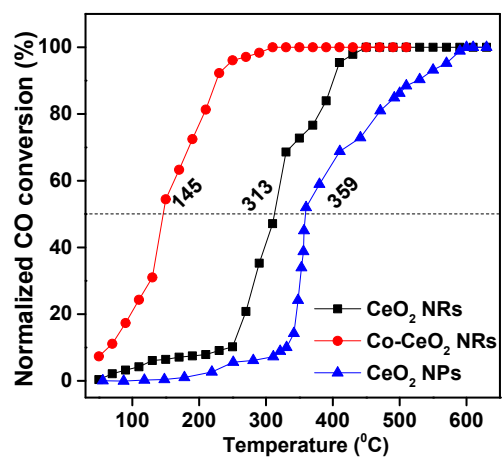


Fig. S6 Normalized CO conversions of CeO<sub>2</sub> NRs, Co-CeO<sub>2</sub> NRs, and CeO<sub>2</sub> NPs.

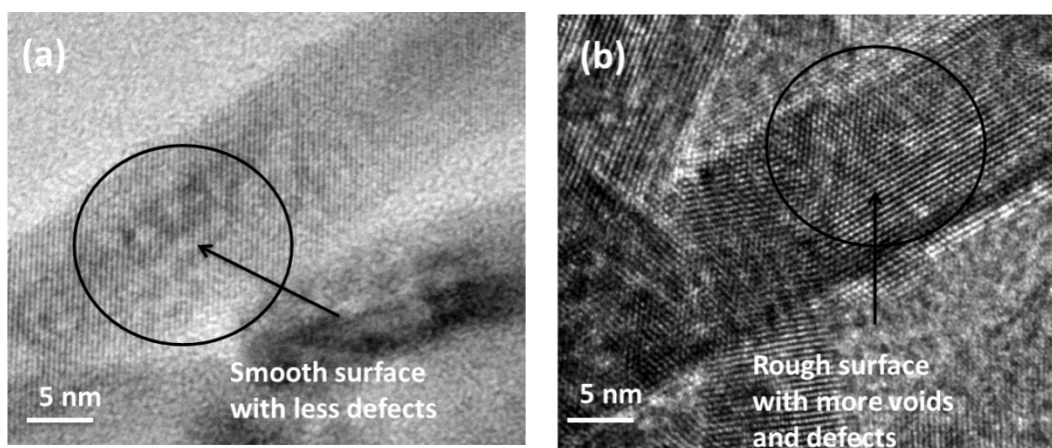


Fig. S7 HR-TEM images of (a) pure  $\text{CeO}_2$  and (b)  $\text{Co-CeO}_2$  NRs.