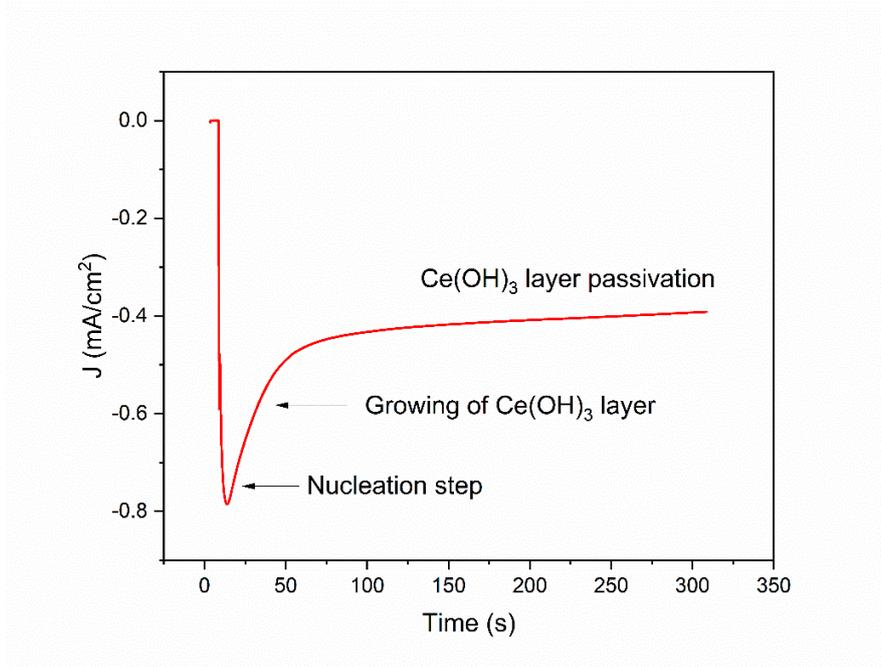
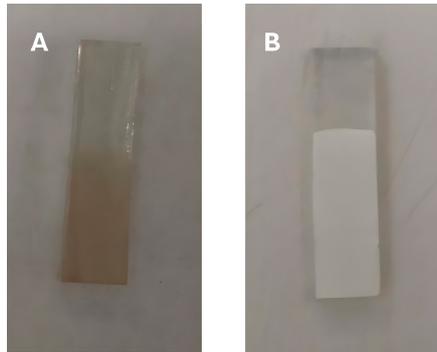


## Photoelectrochemical and Structural Insights of Electrodeposited CeO<sub>2</sub> Photoanodes

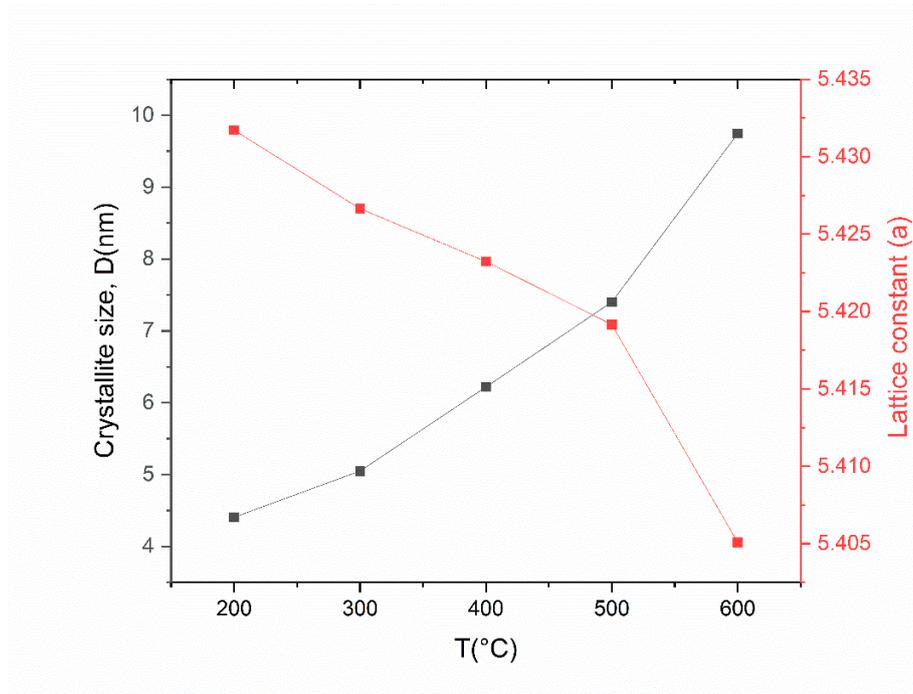
### Support information



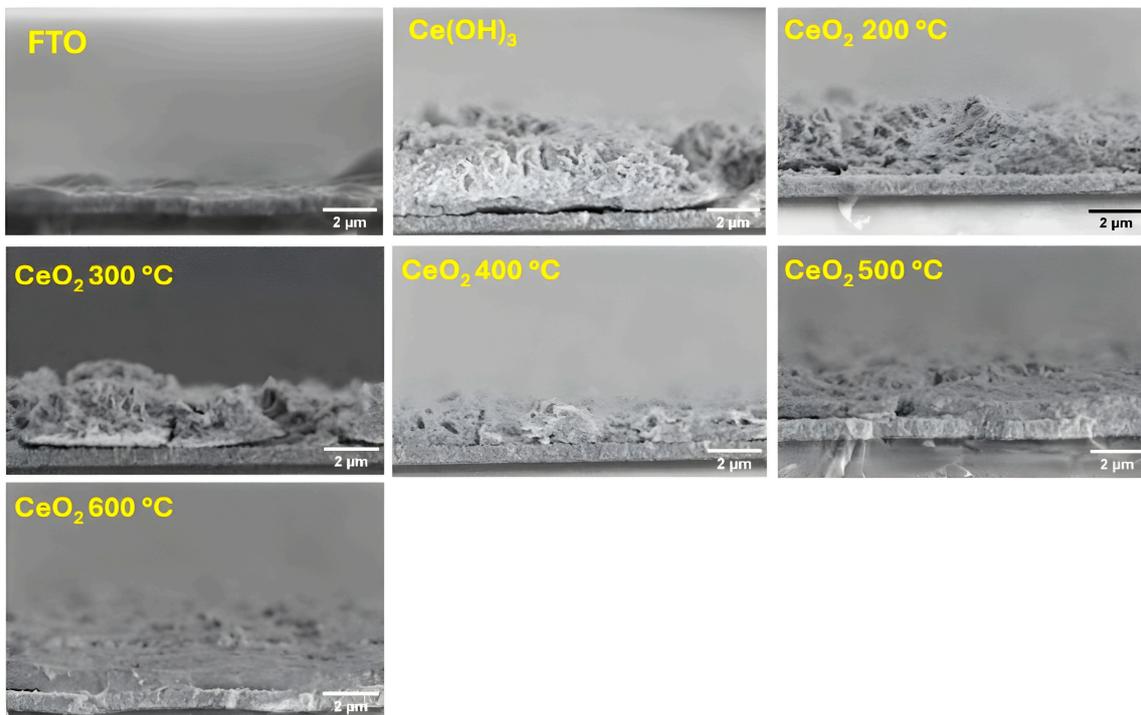
**Figure S1.** Chronoamperometry for the electrodeposition of Ce-based photoanodes (-1.2 V vs. Ag/AgCl). The synthesis solution was 25 mM CeCl<sub>3</sub> and 50 mM NaNO<sub>3</sub> at pH 4.5



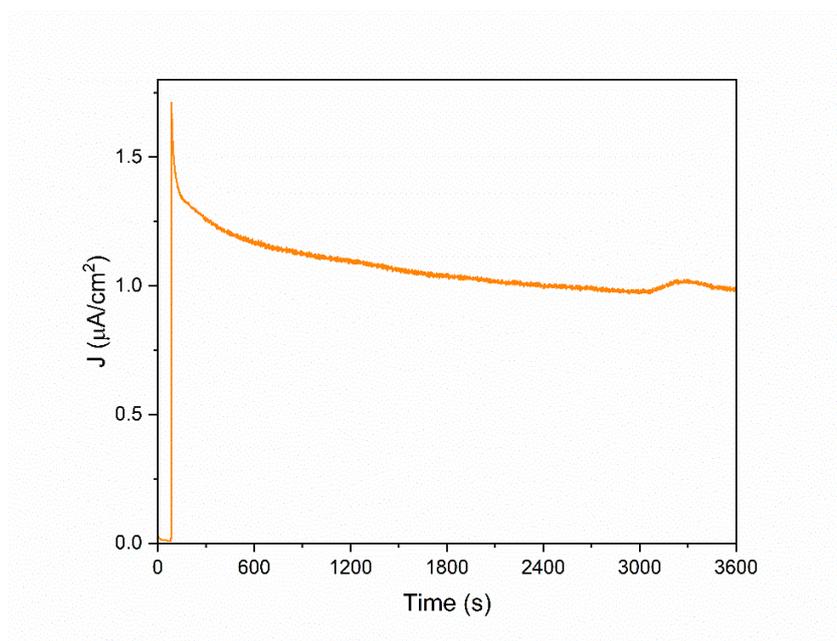
**Figure S2.** (A) Ce(OH)<sub>3</sub> electrodeposited on FTO substrate (immediately after electrosynthesis). (B) CeO<sub>2</sub> layer obtained after annealing at 600 °C.



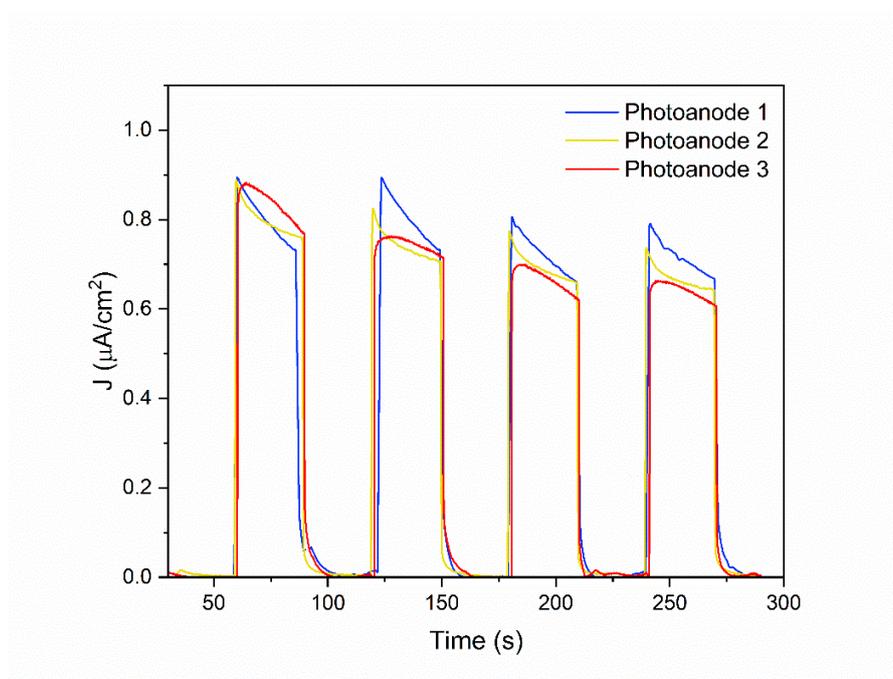
**Figure S3.** Change in crystallite size and lattice constant (*a*) with annealing temperature of electrodeposited CeO<sub>2</sub> layers on FTO.



**Figure S4.** SEM Cross-sectional images of coatings on FTO. Ce(OH)<sub>3</sub> layer was obtained by electrodeposition and CeO<sub>2</sub> was obtained from Ce(OH)<sub>3</sub> by annealing at different temperatures.



**Figure S5.** Curve I-t of CeO<sub>2</sub> photoanode annealed at 600 °C. The measurements were performed at 1.2 V (vs. Ag/AgCl) (1.8 V vs RHE) for 3600 s in a 0.1 M Na<sub>2</sub>SO<sub>4</sub> solution. (100 mW/cm<sup>2</sup>).



**Figure S6.** Chopped photocurrent produced by CeO<sub>2</sub> photoanodes annealed at 600 °C. The measurements were performed at 1.2 V (vs. Ag/AgCl) in a 0.1 M Na<sub>2</sub>SO<sub>4</sub> solution and 100 mW/cm<sup>2</sup>.

Photoelectrode	Average thickness $\pm$ SD ( $\mu\text{m}$ )
Ce(OH) <sub>3</sub>	2.9 $\pm$ 0.3
CeO <sub>2</sub> – 200 °C	2.4 $\pm$ 0.4
CeO <sub>2</sub> – 300 °C	2.3 $\pm$ 0.2
CeO <sub>2</sub> – 400 °C	1.6 $\pm$ 0.2
CeO <sub>2</sub> – 500 °C	0.84 $\pm$ 0.15
CeO <sub>2</sub> – 600 °C	0.84 $\pm$ 0.098

**Table S1.** Average thicknesses of CeO<sub>2</sub> coatings on FTO annealed at different temperatures. Each mean value and its standard deviation was calculated from ten measurements taken from the cross-sectional SEM image of the coating.

Photoanode	Step 1( $\Delta\text{J}$ ) ( $\mu\text{A}/\text{cm}^2$ )	Step 2( $\Delta\text{J}$ ) ( $\mu\text{A}/\text{cm}^2$ )	Step 3( $\Delta\text{J}$ ) ( $\mu\text{A}/\text{cm}^2$ )	Step 4( $\Delta\text{J}$ ) ( $\mu\text{A}/\text{cm}^2$ )	$\Delta\text{J}_{\text{total}}$ ( $\mu\text{A}/\text{cm}^2$ )
200	0.03	0.02	0.01	0.01	0.01
300	0.01	0.01	0.02	0.01	0.02
400	0.02	0.005	0.01	0.01	0.02
500	0.05	0.03	0.03	0.03	0.10
600	0.14	0.12	0.10	0.09	0.12

**Table S2.** Drops in the photocurrent ( $\Delta\text{J}$ ) during each stage of illumination (steps). The CeO<sub>2</sub> photoanodes were obtained at different annealing temperatures.