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Electronic Supplementary Information

Sm_{0.5}Sr_{0.5}Fe_{0.8}M_{0.2}O_{3-δ} (M=Co, Cu) perovskite oxides for efficient oxygen evolution reaction in alkaline electrolyte

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 $Sm_{0.5}Sr_{0.5}Fe_{0.8}Co_{0.2}O_3$ perovskite catalyst for electrochemical oxygen evolution reaction (OER) in 1 M KOH electrolyte.

Preparation of RuO₂

For comparison RuO_2 was used prepared according to a previous literature. 1.6 g of $RuCl_{3.X}H_2O$ dissolved in 100 ml of distilled water to that 30 ml of 1.0 M KOH were added slowly and stirred for 60 min. at 100°C. The resulting solution was centrifuged, and the precipitate washed with distilled water and continuously dried at 90 °C for 2 h, and then the resulting sample annealed at 350 °C in air for 3 hrs.

Fabrication of Sm_{0.5}Sr_{0.5}Fe_{0.8}Co_{0.2}O_{3-δ} working electrode

The FTO substrate was sequentially ultrasonicated using soap water, distilled water, and ethanol solution for 30 min each and then dried in hot air oven over night. The required amount of synthesized $Sm_{0.5}Sr_{0.5}Fe_{0.8}Co_{0.2}O_{3-\delta}$ electrocatalyst was mixed with 150 mg of ethyl cellulose dissolved in 1ml of acetic acid, to that 600 mg of alpha terpineol and 2.5 ml ethanol were added and stirred over night to form a homogenous paste. The catalyst ink paste was applied over the cleaned FTO substrate at the edges fixed with scotch tape, using doctor blade method. Then the catalyst coated FTO substrate was dried at 100 °C for 1hr and then annealed at 500 °C for 2hrs.



Fig. SI-1. FTIR spectra of SSFO; SSFCoO and SSFCuO samples in the range of 400-800 cm⁻¹.



Fig. SI-2. SEM images of (a) SSFO; (b) SSFCoO; (c) SSFCuO.



Fig. SI-3. Particle size distribution of (a) SSFO; (b) SSFCoO; (c) SSFCuO prepared by solid state method.



Fig. SI-4. N₂ adsorption and desorption Isothermal plots and specific surface areas determined by Brunauer-Emmett-Teller (BET) method for (a)SSFO, (b)SSFCoO, and (c)SSFCuO.



Fig. SI-5. EDAX of SSFCoO catalyst with the area of selection shown in insert.



Fig. SI-6. XPS survey spectra of the catalyst series.



Fig. SI-7. Cyclic voltammatry (CV) measurements in a non-faradic current region (1.07-1.17 V vs. RHE) at increased scan rates of 25,50,75,100,125,150,175, and 200 mV s⁻¹ of (a) SSFO; (b) SSFCoO; (c) SSFCuO.



Fig. SI-8. Cyclic voltammatry (CV) stability of SSFCoO catalyst of 500 cycles.