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**Enhanced Oxygen Evolution Activity of  $\text{Co}_{3-x}\text{Ni}_x\text{O}_4$  compared to  $\text{Co}_3\text{O}_4$  by low Ni doping**Aditi Singhal<sup>1\*</sup> Anuj Bisht<sup>2</sup> and Silvia Irusta<sup>3</sup>

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**Abstract:**

We herein report a series of nanocrystalline Ni-doped  $\text{Co}_3\text{O}_4$ :  $\text{Co}_{3-x}\text{Ni}_x\text{O}_4$  ( $0.0075 \leq x \leq 0.30$ ) with a nickel doping percentage from 0.25 to 10 atomic percent synthesized using solution combustion method. These oxides are characterized by XRD and show pure nanocrystalline phase of  $\text{Co}_3\text{O}_4$  with no separated peaks related to Ni/ $\text{NiO}_x$  and confirms that Ni has been substituted in the lattice. TEM results indicate that the morphology and size of all the compounds are similar. Electrochemical measurements indicate that  $\text{Co}_3\text{O}_4$  and  $\text{Co}_{3-x}\text{Ni}_x\text{O}_4$  are active for oxygen evolution reaction (OER) and also shows that that low amount of nickel doping in  $\text{Co}_3\text{O}_4$  can remarkably enhance OER activity in neutral, alkaline and buffer (pH-7) electrolytes. Out of all compositions, 0.5% Ni-doped  $\text{Co}_3\text{O}_4$  ( $\text{Co}_{2.985}\text{Ni}_{0.015}\text{O}_4$ ) seems to be more active than  $\text{Co}_3\text{O}_4$  in terms of both current density and onset potential in  $\text{K}_2\text{SO}_4$  medium. The enhancement in terms of OER activity, however, decreases until the doping concentration reaches beyond 0.5%. Phosphate buffer solution (PBS) studies reveal that  $\text{Co}_3\text{O}_4$  and 0.5% Ni-doped  $\text{Co}_3\text{O}_4$  show OER at near thermodynamic potential. Detailed x-ray photoelectron spectroscopy (XPS) studies have indicated that surface oxygen (lattice oxygen) concentration is an important factor in deciding the OER activity which is highest for 0.5% Ni doped  $\text{Co}_3\text{O}_4$  ( $\text{Co}_{2.985}\text{Ni}_{0.015}\text{O}_4$ ) and hence gives the highest OER activity.

**Introduction**

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