Correlation Between OER Activity, Nanostructure and Composition of Copper-doped Cobalt-based Catalysts for Alkaline Electrolyzers

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The development of efficient catalysts for the oxygen evolution reaction (OER) is crucial to enhance the performance of alkaline water electrolyzers. In this study, we investigate the OER activity of nanostructured catalyst based on copper-doped cobalt hydroxides ($Cu_xCo_{1-x}(OH)_2$), focusing on their structural design and electrochemical properties. Copper doping was employed with varying molar fractions (Cu :Co = 1:0.5, 1:1, 1:2, 1:3, and 1:5) to modify the brucite-type cobalt hydroxide ($Co(OH)_2$) phase via a co-precipitation method in alkaline media, followed by heat treatment to form a copper-doped cobalt oxide ($Cu_xCo_{3-x}O_4$) with a spinel-like structure. To validate this hypothesis, XRD data will be presented to show the presence of all Cu-Co mixed phases, CuO and Co_3O_4 at various Cu-doped fractions. The Cu-doped catalysts exhibited significantly enhanced OER activity compared to the undoped counterpart. Electrochemical characterization was performed using the rotating disk electrode (RDE) technique in a three-eletrode setup. We observed a strong correlation between the electrochemical active surface area (ECSA) and OER activity, highlighting the impact of nanostructure design in optimizing catalytic performance. This work demonstrates that copper doping in Co-based OER catalysts is a promising strategy for designing high-performance catalysts for alkaline electrolyzers, contributing to the advancement of efficient hydrogen production technologies.

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