Effect of copper introduction to Fe-N-C catalyst for oxygen reduction reaction in alkaline medium

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As a cheap and effective electrocatalyst for oxygen reduction reaction (ORR) in alkaline and acidic medium, Fe-N-C has been vigorously studied in a recent decade. The activity and stability of Fe-N-C are superior to Pt-based catalysts in alkaline medium at half-cell test. To improve the performance of Fe-N-C, the introduction of non-metals or transition metals has been studied. Among them, copper is anticipated to enhance the ORR activity. It could reduces oxygen effectively.

In this study, Fe-N-C was synthesized by nano-replication by using ordered mesoporous silica (SBA-15) as a template, iron trichloride and 1,10-phenanthroline as precursors. The effect of Cu was studied by introducing different copper precursors, for instance, copper chloride, sulfate, and nitrate. For physical characterization, X-ray photoelectron spectroscopy (XPS) and nitrogen adsorption/desorption techniques were used. Activity for ORR was tested at 0.1 M KOH solution with a sweep rate of 10 mV/s from 1.2 V to 0.1 V using Hg/HgO as a reference electrode. The half-wave potential of $CuCl_2$ introduced catalyst shifted 10 mV than Fe-N-C without copper.