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Nitrogen and carbon functionalized cobalt phosphide as efficient non-precious electrocatalysts for oxygen reduction reaction electrocatalysis in alkaline environment

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Abstract

The performance polymer electrolyte membrane fuel cells (PEMFCs) and alkaline fuel cells (AFCs) relies on the kinetics of oxygen reduction reaction at the cathode side of the fuel cell. Efficient electrocatalyst with high activity and selectivity are of great importance to achieve ORR with four-electron reaction pathway. Targeting robust and cost-effective alternatives to noble metal electrocatalysts, we skillfully fabricated nitrogen doped carbon supported cobalt phosphide (N-C@CoP) nanorod arrays as an earth abundant material for catalyzing ORR. The obtained N-C@CoP composite with relatively high surface area and favorable mesoporous features exhibits intriguing ORR catalytic performances in alkaline conditions due to ease mass diffusion, fast charge transport, and abundance of electroactive sites as a result of doped nitrogen moieties. In addition, the composite catalyst exhibits remarkable durability through an 80,000 s test compared to benchmark Pt catalyst, demonstrating excellent structure stability. The enhanced ORR performances of N-C@CoP catalyst suggest it as a potential non-Pt containing electrocatalyst for efficient ORR.

Keywords: N-C@CoP composite, ORR, nitrogen moieties, long durability

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