Synthesis of Fe-C-N Hybrid via Direct Pyrolysis of EDTA Ferric Sodium as Effective Electrocatalyst for Oxygen Reduction Reaction

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Fe-N-C materials are believed to have potential to replace expensive platinum-based catalysts for cathodic oxygen reduction reaction in fuel cells. Without any template or carbon support, iron and nitrogen co-doped Fe-N-C materials were prepared by direct pyrolysis of a single precursor containing C, N and Fe atoms from inorganic-organic EDTA ferric sodium. The obtained EDTAFeNa-HT2 with partial graphitization, mesopore size, large surface area, a degree of nitrogen doping and magnetism was electrochemically measured for oxygen reduction reaction (ORR) in 0.1 M KOH; the onset and half-wave potentials were 0.93 and 0.80 V, respectively, which were comparable to those of Pt/C catalyst. It was also found that acid-leaching could drastically enhance electrocatalytic activity and facilitated transferring the ORR process from two-electron to four-electron pathway. Furthermore, the second heat-treatment further improved ORR activity and maintained the four-electron pathway.

Keywords: Fe-N-C hybrid; Direct pyrolysis; EDTA ferric sodium; Electrocatalytic oxygen reduction; Acid-leaching

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