Iron Nitride Supported by Nitrogen-doped Graphene and Carbon Nanotube Composite as Electrocatalysts for Oxygen Reduction Reaction

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It is extremely desirable but challenging to develop highly active, stable, and low-cost electrocatalytsts for oxygen reduction reaction (ORR) to replace Pt-based electrocatalysts in order to perform the commercialization of fuel cells. Here, we suggest a novel iron nitride/ nitrogen doped-carbon nanotubes (CNTs) and their graphene composite synthesized by a simple hydrothermal process. By a simple hydrothermal process, iron phthalocyanine is uniformly dispersed and anchored on graphene oxide (GO) and oxidized multiwall carbon nanotubes (Ox-MWCNTs) surface with the assist of Π-Π stacking and oxygen-containing functional groups.
A stable suspension, sonicated with GO, Ox-MWCNTs, and phthalocyanine (FePc), was hydrothermally treated. Then, as-prepared FePc/N-G-CNT was lyophilized and annealed in NH3 atmosphere. The Π-Π interactions during hydrothermal process among FePc, GO, and Ox-MWCNTs are capable of forming stable and 3 dimensional structured Fe_xN/ N-G-CNT composite electrocatalysts. Such interactions finally lead to a synergistic effect toward Fe-N-C active sites for ORR performance.