

Self-assembled graphene/carbon nanotube composite and its oxygen reduction activity in acid media

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Since its discovery, graphene has enabled significant advancement of energy conversion and storage technologies due to its superior electrical and mechanical properties originating from the two-dimensional layered structure of sp<sup>2</sup>-hybridized carbon. However, as a non-noble metal catalyst for oxygen reduction reactions (ORRs) in acid media, graphene-derived materials reveal no outstanding catalytic activity compared with those of other carbon-derived catalysts. Therefore, to improve the ORR activity of graphene materials, a graphene/CNT self-assembly was prepared by the electrostatic interaction between graphene and CNTs, and was doped with nitrogen by pyrolysis of dicyandiamide. In acid media, prepared catalyst shows 2.13 mA/mg of ORR activity at 0.75 V, which is more than six-fold higher than that of N-doped graphene. In addition to high activity, prepared catalyst displays high stability in acid media with an enhanced 4-electron pathway in ORRs.