Anchoring Iron Phthalocyanine on CNT/GO nanocomposites for Enhanced Oxygen Reduction Reaction Performance

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Abstract

The creation of highly efficient and stable non-precious metal electrocatalysts for the oxygen reduction reaction (ORR) is of utmost significance for future generations of energy conversion systems. In this work, iron phthalocyanine (FePc) is designed to be anchored to carbon nanotube/graphene oxide (CNT/GO) nanocomposites to form a synergistic hybrid electrocatalyst with superior ORR activity. The CNT/GO support structure offers a conductive and hierarchically interconnective platform that enables fast electron transfer and efficient mass diffusion, while the graphene oxide component provides an abundance of functional groups for the stable immobilization of FePc molecules. The strong interfacial interactions between FePc molecules and the CNT/GO support structure effectively modulate the electronic properties of the $Fe-N_4$ active sites, which enhances oxygen adsorption and reaction rates. The hybrid electrocatalyst displays outstanding ORR activity, as evidenced by its positive onset and half-wave potentials, high current density, and predominant four-electron reduction reaction. Moreover, the electrocatalyst displays exceptional operational stability and high methanol tolerance, surpassing those of pristine FePc and traditional carbon-supported electrocatalysts. This work presents an effective approach for improving the performance of molecular electrocatalysts through strategic support design and interfacial synergy.

References

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