Functionalized Carbon Nanotubes-based Electrodes for Water Splitting

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Abstract (Arial 10)

This study explores the development of carbon nanotube (CNT)-based electrodes as efficient, metal-free electrocatalysts for the hydrogen evolution reaction (HER) in water splitting applications. The research utilizes multi-walled CNTs synthesized via chemical vapor deposition and modified through acid treatment to enhance their electrocatalytic performance [1-3]. Acid functionalization introduces oxygen-containing functional groups, increasing wettability and the density of active sites, while maintaining the structural integrity of CNTs. Electrochemical characterizations demonstrate a significant reduction in overpotential, with a treated electrode achieving 696 mV at 10 mA/cm², compared to 938 mV for untreated samples. The optimized electrodes also exhibit faster electron transfer kinetics, reflected by a reduced Tafel slope of ~495 mV/dec [4-6]. Comprehensive material analyses, including Raman spectroscopy, XRD, and SEM, validate the enhancement in surface properties and structural modifications. These findings highlight the potential of scalable CNT-based electrodes as a sustainable alternative for green hydrogen production, contributing to advancements in renewable energy technologies. Further functionalization strategies are recommended for enhancing catalytic efficiency and scalability [6].

References

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