Pyrolytic conversion of electrostatically enriched precursors into Pt_3Ni nanocatalyst on N-doped reduced graphene oxide for Low-overpotential HER in alkaline media

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Abstact

The Hydrogen Evolution Reaction (HER) plays a crucial role in advancing sustainable hydrogen production and clean energy conversion. Developing efficient catalyst to accelerate Hydrogen evolution reaction (HER) via electrochemical water-splitting reaction is critical for addressing global energy demand. In this work, a bimetallic Pt_3Ni alloy catalyst supported on nitrogen-doped graphene oxide (N–GO) was synthesized and evaluated for its HER activity in alkaline media. The N–GO support boosts the electronic interaction between the alloy and the carbon matrix, and thereby enhancing electrical conductivity. The incorporation of nitrogen doping facilitates stronger metal-support interactions, contributing to enhanced stability and active site exposure. The optimized Pt_3Ni/N–GO catalyst delivered an **overpotential of ≈ 8 mV at 10 mA cm^{-2} and a Tafel slope of 145 mV dec^{-1}** , and exhibited superior stability over 1000 cycles of continuous operation, outperforming commercial 20 wt% Pt/C. This study represents a cost-effective and efficient electrocatalyst for HER with superior activity and durability, which signifies a promising step towards scalable and affordable hydrogen fuel production, essential for a clean energy future.

References

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