Dual Functional Catalyst for Green Hydrogen Production

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This study presents a novel approach to fabricate dual-functional catalysts with 3D hierarchical nanoarray structures for efficient urea-oxidation reaction and hydrogen evolution reaction involved in hybrid water electrolysis for green hydrogen production. CuxNi1–xS2-based catalysts were prepared through alkaline oxidation of Cu foam to develop 1D Cu(OH)2 nanoarrays, followed by hydrothermal treatment with nickel precursor and thiourea. The resulting catalysts exhibited exceptional performance for both reactions, enabling efficient charge transport and stability, with lower overpotentials, smaller Tafel slopes, and higher TOF values. The hydrogen production rate was about 0.365 mmol hr?¹ in urea-assisted hybrid water electrolysis at 1.80 V, with a coulombic efficiency of 67.3%. This rare-earth element-free CuxNi1–xS@Cu nanoarrays offer a promising and cost-effective electrocatalyst for solar-driven urea-assisted hydrogen production via hybrid water electrolysis.

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