$Ni(OH)_2$-WP hybrid nanorods for active and durable hydrogen evolution reactions in alkaline atmosphere

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The development of efficient non-noble hydrogen evolution electrocatalysts in alkaline atmosphere is crucial for sustainable, ecofriendly production of H_2 via water electrolysis. An alkaline hydrogen evolution reaction (HER) catalyst composed of $Ni(OH)_2$-decorated tungsten phosphide (WP) nanorods on carbon paper was synthesized through thermal evaporation and electrodeposition. This hybrid catalyst displayed outstanding HER activity and required a low overpotential of only 77 mV to obtain a current density of 10 mA/cm^2 and a Tafel slope of 71 mV/dec. The hybrid catalyst also showed long-term electrochemical stability, maintaining its activity for 24 h. This improved HER efficiency was attributed to the synergetic effect of WP and $Ni(OH)_2$: $Ni(OH)_2$ effectively lowers the energy barrier during water dissociation and also provides active sites for hydroxyl adsorption, whereas WP adsorbs hydrogen intermediates and efficiently produces H_2 gas. This interfacial cooperation offers not only excellent HER catalytic activity but also new strategies for the fabrication of effective non-noble-metal-based electrocatalysts in alkaline media.