

Ultrasonics – Sonochemistry

Ultrasonic exfoliation of NiFe LDH/CB nanosheets for enhanced oxygen evolution catalysis

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Abstract

The oxygen evolution reaction (OER) is an important reaction in water splitting. Nickel-iron layered double hydroxide (NiFe LDH) has been considered a potential catalyst for OER. Herein, we report a simple/green approach to improve the oxygen evolution activity of NiFe LDH supported on carbon black (CB). Specifically, ultrasonic exfoliation (UIP500hd, 20 kHz, 500 W) in pure water has been applied to boost the activity of NiFe LDH/CB towards OER. The exfoliated NiFe LDH/CB nanosheets display significantly higher OER activity than their corresponding bulk NiFe LDH/CB in an alkaline solution, with an overpotential of 220 mV at a current density of 10 mA cm⁻², which is 60 mV lower than the 280 mV of the bulk NiFe LDH/CB. Notably, it is comparable with the current record overpotential (~200 mV) and superior than other non-precious catalysts. Additionally, after exfoliation, it possesses outstanding kinetics (Tafel slope of 35 mV dec⁻¹) for OER. Besides the improved activity, the exfoliated NiFe LDH/CB has shown a high stability with nearly a constant potential through 12 h electrolysis at a current density of 10 mA cm⁻². The characterization analysis reveal that the improved electrochemical performance is closely related to the synergistic effects of the Ni²⁺ and Fe²⁺ enriched surface of the exfoliated NiFe LDH/CB, as well as single/few layers structure after exfoliation.