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Copper/Nickel Sulfide Catalyst Electrodeposited on Nickel Foam for Efficient Water Splitting

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Abstract : Biphasic electrodes featuring CuSx/NiSx electrodeposited on nickel foam have been investigated for their electrocatalytic activity in water splitting. The study investigates the impacts of an S-vacancy induced biphasic design on the overpotential and Tafel slope. According to the findings, the NiSx/CuSx/NF electrode with S-vacancy defects displays stronger oxygen evolution reaction (OER) and hydrogen evolution reaction (HER) activity with lower overpotential and a steeper Tafel slope than the non-defect sample. NiSx/CuSx/NF exhibits the lowest overpotential value of 212 mV vs reversible hydrogen electrode (RHE) for OER and −109 mV vs RHE for HER at 10 mA cm−2. Tafel slope of 25.4 mV dec−1 for OER and −108 mV dec−1 for OER found of that electrode. The electrochemical surface area (ECSA) and diffusion impedance of the electrode is calculated. The maximum ECSA, lowest series resistance and lowest charge transfer resistance are found in the *NiSx/CuSx/NF sample with S-vacancy defects, showing increased electrical conductivity and quick charge transfer kinetics. The *NiSx/CuSx/NF electrode was found to be stable for 80 hours in pure water splitting and 20 hours in sea-water splitting. The investigation comes to the conclusion that the enhanced water splitting activity and electrical conductivity of the electrode are caused by S-vacancy defects resulting in improved water splitting performance.

Keywords : water splitting, electrocatalyst, biphasic design, electrodeposition
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