Abstract

The escalating global energy demand and consumption are primarily driven by factors such as overpopulation and rapid industrialization. Addressing the need for energy calls for economically viable techniques to store non-renewable resources while harnessing renewable ones. One notably cleaner energy source is the generation of hydrogen through water splitting. This process necessitates a catalyst of superior efficiency to facilitate the reaction. Transition metals offer a readily available option for crafting cost-effective catalysts, ideally suited for water splitting.

One such catalyst is a bi-metallic selenide, WNiSe, which is synthesized and further enhanced in activity by loading it onto copper foam (CF) through an in-situ synthesis method using the reflux technique. The catalyst synthesis is carried out under controlled conditions at a temperature of 160°C. Composites are formulated using varying proportions of tungsten and nickel. Among these compositions, the one containing 40% tungsten and 60% nickel (W40Ni60Se/CF) stands out as the most effective catalyst, based on prior research.

Potentiostatic analysis of the prepared samples reveals that it exhibits the highest onset potential in linear sweep voltammetry (LSV), producing hydrogen (H2) through water splitting at a rate of 0.2 mA/cm2, along with a maximum current density of 440 mA/cm2. Cyclic Voltammetry (CV) exhibits distinct reduction peaks, while the catalyst displays minimal resistance in Electrochemical Impedance Spectroscopy (EIS), which is a promising characteristic for efficient water splitting.

The Powdered X-ray Diffraction results confirm the successful synthesis of the bi-metallic selenide composite on copper foam, as evidenced by sharp peaks. Transition metals, including tungsten, nickel, and selenide, demonstrate their effectiveness as conductors for water splitting, thereby serving as a reliable means to generate H2 as an energy source. Notably, the diffractogram of nickel selenide displays peak values at 32.41, 33.70, 45.13, and 50.66 angles, while tungsten exhibits a peak at 33.7 degrees..