Efficient and Durable Electrocatalysts for Sustainable Hydrogen Energy

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ABSTRACT

The increasing demand for the energy and environmental concerns has induced global efforts to find and explore alternative energy sources for fossil fuels. As an ideal candidate, hydrogen produced from water splitting is an attractive next generation energy conversion device. The oxygen electrode plays a vital role in the successful commercialization of renewable energy technologies, such as fuel cells and water electrolyzers. Water electrolyzers require metal-rich oxygen electrocatalysts to maintain stable and high electrocatalytic activities. The noble metals are the most active in catalyzing the water electrolysis to produce pure hydrogen, but the high cost and elemental scarcity greatly hinder their widespread applications.

The development of low-cost, efficient, and robust electrocatalysts (both oxygen evolution (OER) and hydrogen evolution (HER) catalysts) for water splitting is a crucial step toward the conversion and storage of sustainable energy resources such as solar energy. We have investigated the inexpensive synthesis of depositing the metal sulfides (MSx) on nickel foam for the highly efficient bi-functional water splitting to meet the current demand[1]. This catalyst shows robust durability about 200 h. The MSx/NF catalyst for large scale with highly efficient and durable bi-functional catalyst for water splitting outperform the noble metals such as IrO_2, RuO_2 electrocatalysts[2,3]. I will also discuss on non-Pt based nitrogen-doped, nanocarbon layer-trapped, cobalt-rich, core-shell nanostructured electrocatalysts (core-shell Co@NC) derived from a Prussian blue analogue. This electrode exhibited an improved oxygen evolution activity and stability compared to that of the commercial noble electrodes.

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