Abstract

The current transportation and energy system, relying on fossil fuels, is unsustainable due to population growth and industrialization, causing exhaustion and environmental hazards. High regional concentrations, import dependency on unstable states, and greenhouse gas emissions drive the search for alternative fuels.

Experts recommend hydrogen as a future fuel due to its lower tailpipe emissions and efficiency in fuel cells. H_2 is over three times as efficient as petroleum in fuel cells. Hydrogen only creates water when used in fuel cells, one of its main benefits lies in the fact that it is an ecologically benign fuel. A viable method for producing H_2 that is sustainable, pollution-free, and eventually reduces the dependency on fossil fuels is electrochemical water splitting.

Because MOFs have enormous interior surface areas, reaching beyond 6000 m^2/g, and a high level of pores (over 90% free volume), they have evolved into a diversified family of crystalline materials. Due to these properties, MOFs have the potential to be used in clean energy, particularly as high-capacity adsorption agents that can meet a variety of separation requirements and as a medium for storing gases such as hydrogen and methane. Here, we describe the efficient hydrothermal production of a new electrocatalyst with high activity on nickel foam formed of the schiff base 4-[(E)-(4-carboxybenzylidene) amino] benzoic acid and cerium, the most common rare earth element.

We synthesized Ce-MOF in three different molarities on the Nickel Foam. Electrocatalytic efficiency towards HER and OER was tested in electrolytic cells having three electrodes in the -0.4 to 1.0 and 0.8 to 2.0 potential ranges, respectively, in an electrolytic solution of 1 M KOH. At a current density of 10 $mAcm^{-2}$, the catalyst Ce-MOF-0.24 mmol had an overpotential of 50 mV towards HER and 550 mV at 20 $mAcm^{-2}$ towards OER. More notably, even after 48 hours of continuous water splitting, Ce-MOF kept up its electrocatalytic activity. This electrocatalyst is effective for generating oxygen and hydrogen.