

Metal Alloys and Metal Sulfides as Efficient and Durable Electrocatalysts for the Alkaline Electrolyte Membrane Water Electrolyze

Pandian Ganesan, Prof. Naotoashi Nakashima

Post-doctoral Researcher

Electrochemical Energy Conversion Division

International Institute for Carbon-Neutral Energy Research (WPI-I2CNER)

Presently, the technologies that dominate hydrogen production include steam reforming of natural gas, gasification of coal and petroleum coke, as well as gasification and reforming of heavy oil. The electrochemical hydrogen production using renewable energy received tremendous importance due to its high energy density and not releasing pollutant gas. An alternative to the acid membrane water electrolyzers, alkaline electrolyte membrane (AEM) water electrolyzers can reduce the cost of catalyst and component. One of the important challenges in alkaline water electrolysis are to utilize a bifunctional catalyst for both hydrogen evolution (HER) and oxygen evolution (OER) reactions to increase the efficiency of water splitting devices for the long durable operations. The key objectives are to develop the commercial viable prototype technology based on the earth abundant and cost-effective materials for generating the hydrogen fuel. Here, we introduce metal chalcogenides supported on the various materials such as cobalt sulfides grown on nitrogen and sulfur doped graphene, CoS_2 supported on the TiO_2 , nickel iron sulfides deposited on nickel foam (NiFeS/NF) and nickel cobalt titanium (NCT) alloys were studied for the electrochemical water splitting of water into pure hydrogen. In order to qualify the alternative non-precious catalysts, the overpotentials of the electrochemical water splitting are measured for the prepared catalysts based on the solar to fuel device conversion scale. The obtained results suggest that the prepared catalysts for the alkaline water splitting can be easily commercially applicable in competition with the state-of-the-art catalysts in the market.

Keywords: Membrane Electrode Assembly, Electrodes, Alkaline water splitting, chalcogenides, Clean Hydrogen.