CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

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Project Number

S0606

Project Title

Improving Photoelectrochemical Decomposition of Water Using Earth Abundant Metal Oxide Catalysts

Abstract

Objectives/Goals

Electrochemical deposition (electroplating) of earth abundant, metal-oxide catalysts to electrodes will increase the hydrogen production during photoelectrochemical decomposition of water, by increasing the rate of reaction.

Methods/Materials

Nickel-iron oxide and cobalt-iron oxide were selected, due to their potential catalytic properties, to increase the rate of reaction of the decomposition of water. After electrochemical deposition of the chosen catalysts, a photovoltaic (PV) panel was utilized for the PV/electrolysis of water.

Results

The nickel-iron oxide catalyst allowed for a 23.5% faster rate of reaction than the control and the cobalt-iron oxide catalyst allowed for a 27.5% faster rate. Energy required for a chemical reaction to occur was 13.5% less with the nickel-iron oxide and 16% less with the cobalt-iron oxide than that of the control.

Conclusions/Discussion

Given the current demand from the $100 billion hydrogen industry and the potential of the hydrogen based fuels of a clean energy future, the need for more efficient methods of hydrogen production, using renewable energy sources, are vital. Experimental data suggests that the application of low cost, earth abundant catalysts increases the rate of reaction and lowers the energy demands of photoelectrochemical water splitting. Research and development in the area of artificial photosynthesis provides effective hydrogen production techniques to support the growing hydrogen economy using renewable energy sources.

Summary Statement

Using a biologically inspired method of converting sunlight into stored energy, this project seeks to increase the efficiency of photoelectrochemical decomposition of water using earth abundant, metal-oxide catalysts.

Help Received