Name(s)

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Project Number

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Project Title

Catalyst Efficiency for Producing Energy Fuels by Water Splitting

Abstract

Objectives

Renewable energies, such as solar and wind, are intermittent sources of energy. For renewable energy to become practical, we need a cost-effective method for storing energy so it can be supplied at all times. One way to transform and store solar energy is by water splitting.

The objective of this study is to find the effect of temperature and different types of electrodes on the efficiency of water splitting.

Methods

Different types of electrodes, Iron, Nickel, Graphite, and Copper, were tested with and without a cobalt catalyst. The electrodes were put in a sodium phosphate buffer solution and connected to a voltmeter, which read the voltage required to split water into oxygen and hydrogen. I recorded this data and calculated the overall efficiency for each electrode. The effect of temperature was also tested by heating the buffer up to 75 degrees Celsius, and the overall voltage was taken at 5 degree increments.

Results

The test results show that heated solution was more efficient, saving 700 millivolts than the energy cost at 9° C. The graphite electrode performed the best, outperforming another three electrodes I tested: copper, nickel, and iron. The graphite electrode had the highest net efficiency gain after the catalyst had been added, with an overall improved efficiency by 18 percent relative to the baseline efficiency. The final voltage with the cobalt catalyst for each electrode is as follows:

Graphite about 1.238v

Copper about 1.495v

Nickel about 1.565v

Iron about 1.836v

Conclusions

The original hypothesis was that the nickel electrode would perform the best out of the four electrodes tested. My hypothesis was rejected by the data. The graphite electrode performed the best,

Summary Statement

A carbon-based electrode with nano structures that creates large surface area has high water splitting potential when paired with a cobalt-based catalyst.

Help Received

The circuit was made by myself. Professor Chun-Ta Lai of the Biology Department from San Diego State University assisted in the conducting of the experiment.