Improving Photoelectrochemical Decomposition of Water Using Earth Abundant Metal Oxide Catalysts

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Given the current demand from the $100 billion hydrogen industry and the potential of hydrogen based fuels for a clean energy future, there is a critical need for more efficient and sustainable methods of hydrogen production. Using a biologically inspired method of converting sunlight into stored energy (photosynthesis), this project seeks to increase the efficiency of the photoelectrochemical decomposition of water using low cost, earth abundant, metal-oxide catalysts. Due to their potential catalytic properties, nickel-iron oxide and cobalt-iron oxide were selected to increase the rate of reaction for the decomposition of water. After electrochemical deposition (electroplating) of the chosen catalysts, a photovoltaic (PV) panel was used for the electrolysis of water. Compared with a control, nickel-iron oxide showed a 23.5% faster rate of reaction while cobalt-iron oxide had a 27.5% faster rate. Further, the 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. Experimental data indicates that the application of these catalysts increases the rate of reaction and lowers the energy demands of photoelectrochemical water splitting. Future research and experimentation will focus on catalyst development and fuel cell technology to contribute to both current processes and fuels stations for the cars of the future.

Awards Won:

University of Arizona: Tuition Scholarship Award