



The Solar Hydrogen Activity Research Kit

Solar energy is the only option for producing the vast quantities of renewable carbon-free power needed to power the planet. The Achilles Heel of solar energy is that the sun does not shine at night and so a method to store the energy for night and transportation uses is needed. Producing hydrogen from sunlight and water is an ideal solution to the storage problem. The **Solar Hydrogen Activity research Kit (SHArK)** Project at the University of Wyoming was established in 2008 as a spin off of our basic research effort on solar water splitting. This project provides a unique approach to learning chemistry that engages young people to participate in actual research to help solve the global energy problem. The goal of this project is to discover metal oxide semiconductors that can split water into hydrogen and oxygen using sunlight. Currently, no known stable material is capable of efficiently and inexpensively photoelectrolyzing water with visible light. There are millions of compounds that need to be produced and tested for their ability to photoelectrolyze water. We developed inexpensive kits to enable young scientists to participate in this endeavor. The hardware and software was developed that uses an inkjet printer, laser pointer and LEGOs® allowing for virtually endless arrays of potential metal oxide semiconductors to be easily produced and tested.

For more details about the SHArK project we invite you to visit our website at:

<http://www.thesharkproject.org>

or contact us:

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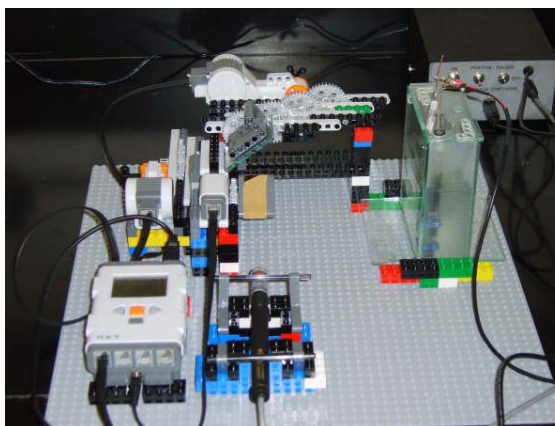
The SHArK Project

A SHArK Project Kit



- Lego Mindstorms® Kits
- Extra Lego® Parts
- Commercial Inkjet Printer
- Pipettes
- Commercial Green Laser Pointer
- USB Powered Data Acquisition Box
- Conductive Glass Substrates
- Etched Glass Electrochemical Cell
- Alligator Clips and Copper Wire
- Graphite (Counter Electrode)
- Laser Safety Goggles
- Software installed from website

Lego® Laser Scanning Station

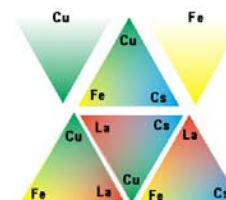


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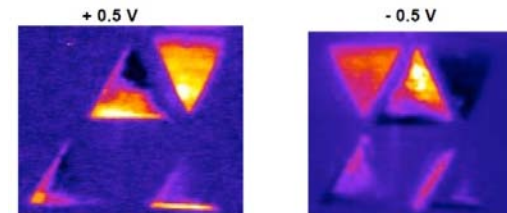
The SHArK project provides an avenue for researchers from all disciplines of science and engineering to collaborate to help solve the global energy crisis. In 2008, the Camille and Henry Dreyfus Foundation funded a seed proposal to create this project and currently 15 kits have been distributed to undergraduate institutions. Currently, we are part of an NSF-funded project entitled "Powering the Planet" that focuses on solar water splitting (www.ccisolar.caltech.edu).

Printing and Scanning Basics

Inkjet printers are used to print two internal standards (Fe and Cu) with 3 or 4 other metals in a combinatorial pattern so many different combinations and compositions of the metal oxides to be produced and screened at a time.



An example printing pattern to produce many material compositions. Four ternary gradients and two internal standards were printed using the provided template.



Subsequent screening of the compositions using the laser scanner at two different applied biases shows different photoelectrochemical properties for the different materials (false color photocurrent image with yellow indicating higher photocurrent activity).

The SHArK project is currently being coordinated by the University of Wyoming Chemistry Department in collaboration with the University of Wyoming's School of Energy Resources (SER) and the "Powering the Planet" NSF Center for Chemical Innovation. This project furthers the University of Wyoming's and the National Science Foundation's tradition of encouraging outreach research projects and active undergraduate research activity. Faculty and students currently conducting SHArK research include top undergraduate institutions such as Reed, Grinnell, SUNY, Lewis & Clark, and Ithaca Colleges. The UW School of Energy facilitates interdisciplinary academic and research programs in engineering and science, economics, and environment and natural resources policy to address critical energy-related issues faced by our society. This project accomplishes the SER mission of outreach by attempting to help solve the energy problem across the university, the state, and beyond. More information about the School of Energy Resources as well as the SHArK project can be found at www.uwyo.edu/ser.

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Solar Hydrogen Activity research Kit Project

Dedicated to Splitting Water with Sunlight