

Science News

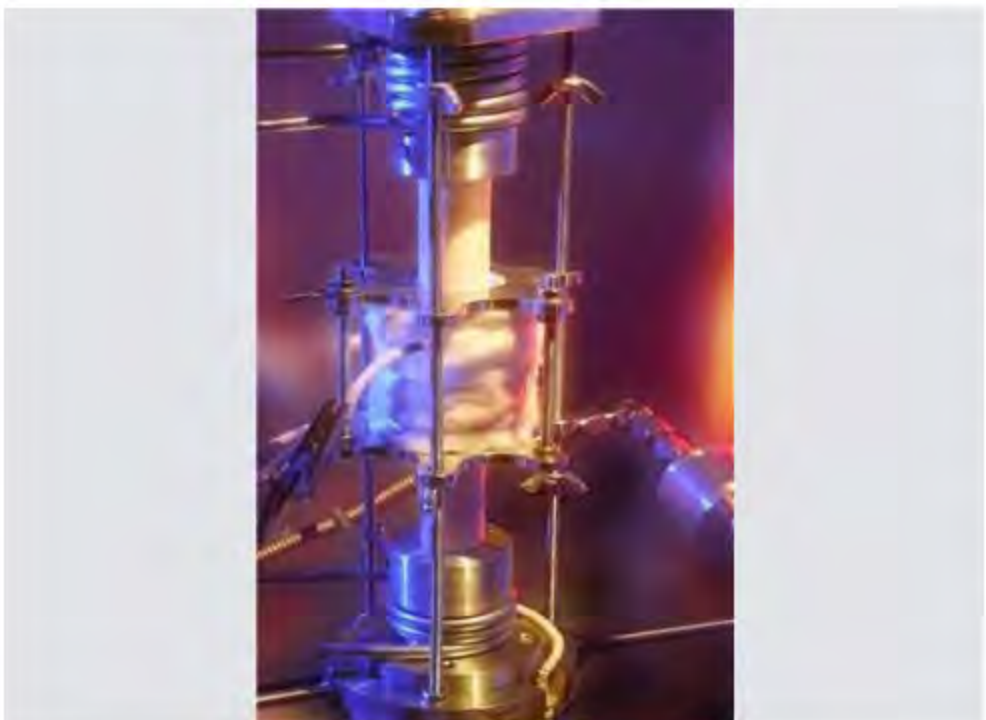
from research organizations

Print Email Share

Chemically storing solar power

Date: February 22, 2016
Source: Vienna University of Technology, TU Vienna
Summary: A photo-electrochemical cell has been developed that can chemically store the energy of ultraviolet light even at high temperatures.
Share:

FULL STORY



Heated reactor.
Credit: TU Wien

A photo-electrochemical cell has been developed at TU Wien (Vienna). It can chemically store the energy of ultraviolet light even at high temperatures.

Nature shows us how it is done: Plants can absorb sunlight and store its energy chemically. Imitating this on large industrial scale, however, is difficult. Photovoltaics convert sunlight to electricity, but at high temperatures, the efficiency of solar cells decreases. Electrical energy can be used to produce hydrogen, which can then be stored - but the energy efficiency of this process is limited.

Scientists at TU Wien (Vienna) have now developed a new concept: By combining highly specialised new materials, they have managed to combine high temperature photovoltaics with an electrochemical cell. Ultraviolet light can be directly used to pump oxygen ions through a solid oxide electrolyte. The energy of the UV light is stored chemically. In the future, this method could also be used to split water into hydrogen and oxygen.

Special Materials for High Temperatures

As a student at TU Wien, Georg Brunauer started pondering possible combinations of photovoltaics and electrochemical storage. The feasibility of such a system depends crucially on whether it is able to work at high temperatures. "This would allow us to concentrate sunlight with mirrors and build large-scale plants with a high rate of efficiency," says Brunauer. Common photovoltaic cells, however, only work well up to 100°C. In a solar concentrator plant, much higher temperatures would be reached.

While working on his doctoral thesis, Brunauer managed to put his ideas into practice. The key to success was an unusual choice of materials. Instead of the ordinary silicon based photovoltaics, special metal oxides -- so-called perovskites -- were used. By combining several different metal oxides, Brunauer managed to assemble a cell which combines photovoltaics and electrochemistry. Several research partners at TU Wien contributed to the project. Georg Brunauer is a member of Prof. Karl Ponweiser's research team at the Institute for Energy Systems and Thermodynamics, Prof. Jürgen Fleig's group (Chemical Technologies and Analytics) and the Institute for Atomic and Subatomic physics were involved as well.

Creating Voltage and Pumping Ions

"Our cell consists of two different parts - a photoelectric part on top and an electrochemical part below," says Georg Brunauer. "In the upper layer, ultraviolet light creates free charge carriers, just like in a standard solar cell." The electrons in this layer are immediately removed and travel to the bottom layer of the electrochemical cell. Once there, these electrons are used to ionize oxygen to negative oxygen ions, which can then travel through a membrane in the electrochemical part of the cell.

"This is the crucial photoelectrochemical step, which we hope will lead to the possibility of splitting water and producing hydrogen," says Brunauer. In its first evolution step, the cell works as a UV-light driven oxygen pump. It yields an open-current voltage of up to 920 millivolts at a temperature of 400°C.

The photoelectrochemical cell has now been presented in the journal "Advanced Functional Materials," but the research project continues. "We want to understand the origin of these effects by carrying out a few more experiments, and we hope that we will be able to improve our materials even further," says Brunauer. If the electrical power can be increased a slightly, the cell will be able to split water into oxygen and hydrogen. "This goal is within reach, now that we have shown that the cell is working," says Georg Brunauer. The concept is not only useful for the production of hydrogen, as it could also split carbon dioxide into carbon monoxide. The produced energy carried in the form of hydrogen and carbon monoxide can be used to synthesize fuels.

To make the leap from the university lab to an industrial prototype, Georg Brunauer has founded the startup company NOVAPECC. Together with TU Wien, he has filed several patents; Brunauer was supported by the University's Research and Transfer support, by the startup-support programme INITs and the Austrian Research Promotion Agency (FFG).

Story Source:

The above post is reprinted from materials provided by **Vienna University of Technology, TU Vienna**. Note: Materials may be edited for content and length.

Journal Reference:

1. Georg Christoph Brunauer, Bernhard Rotter, Gregor Walch, Esmaeil Esmaeili, Alexander Karl Opitz, Karl Ponweiser, Johann Summhammer, Juergen Fleig. **UV-Light-Driven Oxygen Pumping in a High-Temperature Solid Oxide Photoelectrochemical Cell**. *Advanced Functional Materials*, 2016; 26 (1): 120 DOI: 10.1002/adfm.201503597

Cite This Page:

MLA APA Chicago

Vienna University of Technology, TU Vienna. "Chemically storing solar power." ScienceDaily. ScienceDaily, 22 February 2016. <www.sciencedaily.com/releases/2016/02/160222091011.htm>.

Share This Page:

Related Stories

New Method for Converting Solar Energy Into Electrical Power Using Photo-Bioelectrochemical Cells
Jan. 19, 2016 — A new paradigm for the development of photo-bioelectrochemical cells has been ... [read more »](#)

Artificial Leaf: New Efficiency Record for Solar Hydrogen Production Is 14 Percent

Sep. 15, 2015 — An international team has succeeded in considerably increasing the efficiency for direct solar water splitting with a tandem solar cell whose surfaces have been selectively modified. The new record ... [read more »](#)

New Storage Cell for Solar Energy Storage, Nighttime Conversion

July 1, 2015 — A materials science and engineering team has developed a new energy cell that can store large-scale solar energy even when it's ... [read more »](#)

Solar Panels Light the Way from Carbon Dioxide to Fuel

July 1, 2014 — Researchers have devised an efficient method for harnessing sunlight to convert carbon dioxide into a potential alternative fuel known as formic acid. The transformation from carbon dioxide and water ... [read more »](#)

Strange & Offbeat

PLANTS & ANIMALS

Bat 'Super Immunity' Could Help Protect People

Fish of Dinosaur Era With Unique 'Hook-Shaped Sail' on Its Back

Taste Sensors in Fly Legs Control Feeding

Ancient Lone Star Lizard Lounged in Lush, Tropical Texas

EARTH & CLIMATE

'Ice Age Blob' of Warm Ocean Water Discovered South of Greenland

Florida's Monkey River

Dangerous Fishing May Be Endangered

Puzzling Asteroid Observations Explained by Destruction of Asteroids Close to Sun

FOSSILS & RUINS

The 'Ugliest Fossil Reptiles' Who Roamed China

Easter Island Not Destroyed by War, Analysis of 'Spear Points' Shows

Jawless Fish Brains More Similar to Ours Than Previously Thought

Sex With the Other Species: Tree Frogs With Foreign Sex Chromosomes Are Less Fit

In Other News

from NewsDaily

SCIENCE

Ancient armored mammal from Argentina was a huge armadillo

Scientists find how 'superbugs' build their defences

Latest in smart textiles – a musical tablecloth

Branson's Virgin Galactic unveils new passenger spaceship

HEALTH

Bill Gates says Zika response better than for Ebola

Female genital 'nicks' should be legal: gynecologists

Parents' anxiety, depression may lead to kids being fussy eaters

Brazil to fight Zika by sterilizing mosquitoes with gamma rays

ENVIRONMENT

Peru pipeline leaks in Amazon; two rivers polluted, agency says

Remote Fijian areas still cut-off days after super cyclone

Could an African become the new U.N. climate chief?

Two Pennsylvania families who say fracking fouled water take case to trial

TECHNOLOGY

U.S. government, Apple take encryption case to court of public opinion

Samsung Elec aims to sell its stake in Samsung Medison – ChosunBiz

DOJ seeks to force Apple to extract data from dozen other iPhones: WSJ

Google is shuttering Google Compare – WSJ

Print Email Share

Earth & Climate News

February 23, 2016



Low-Carbon Policies Could Prevent Many Deaths



Antarctic Ice Sheet More Vulnerable to ...



The Day Atlantic City Blew Away



New Evidence About the Gulf of Mexico's Past

Latest Headlines

updated 12:56 pm ET



Species Groups Follow Patterns Reacting to Climate Change on US Northeast Shelf

- > Patterns of Species Reacting to Climate Change
- > Remote Predictions of Fluid Flow in Fractures
- > Deep-Ocean Turbulence May Drive Circulation
- > Night Charging of Electric Vehicles Causes Harm?
- > Ecosystems Are Vulnerable to Climate Warming
- > Mysteries of Deep-Sea Ecosystems Unlocked
- > US Forests Threatened by Drought, Climate Change
- > Tough Emission Controls Only Cut Some Health ...
- > Multiple Cosmic Impacts 790,000 Years Ago
- > GPS Helps Map Sea Level from Space

Feb. 22, 2016 — Researchers studying groups of species with similar depth and temperature distribution have found that those groups have ... [read more »](#)

more stories >

Latest Videos

from news services



Experts Say Flint Has More Than 8,000 Lead Pipes



Fiji Cleans Up After 'strongest Ever' Cyclone



Raw: Grass Fire & High Winds Form 'Fire Tornado'



Raw: Search for Missing Lions in Kenya

more videos >

Free Subscriptions

Get the latest science news with ScienceDaily's free email newsletters, updated daily and weekly. Or view hourly updated newsfeeds in your RSS reader:

- Email Newsletters
- RSS Feeds

Follow Us

Keep up to date with the latest news from ScienceDaily via social networks:

- Facebook
- Twitter
- Google+
- LinkedIn

Mobile Apps

Get the latest news from ScienceDaily via our free mobile apps, available for download on the following platforms:

- iPhone/iPad
- Android

Have Feedback?

Tell us what you think of ScienceDaily -- we welcome both positive and negative comments. Have any problems using the site? Questions?

- Leave Feedback
- Contact Us