ENERGY TRENDS

Solar energy and nanotubes take hydrogen from water

Water, solar energy, and nanotube diodes that absorb the entire spectrum of the sun's light have reportedly been developed to produce hydrogen cost effectively, according to researchers at Penn State University, University Park. The process splits water into hydrogen and oxygen, and collects the products separately with commonly available titanium and copper, at a photo-conversion efficiency of 0.30%.

Two different groups of nanotubes are placed in a photoelectrochemical diode. One side is a nanotube array of titanium dioxide, and the other is a nanotube array of a cuprous oxide-titanium dioxide mixture. The titanium dioxide nanotubes soak up the ultraviolet between 300 and 400 nanometers. The light then passes to the copper-titanium side of the diode, where visible light from 400 to 885 nanometers is absorbed, covering the light spectrum.

The photoelectrochemical diodes function the same way that green leaves do, only not quite as well. They convert the energy from the sun into electrical energy that then breaks up water molecules. The titanium dioxide side of the diode produces oxygen and the copper-titanium side produces hydrogen.

For more information: Craig Grimes, Penn State University, University Park, PA 16802; tel: 814/865-9142; cag14@psu.edu; www.psu.edu.

Energy storage module based on lithium-polymer accumulator

An energy storage module based on lithium-polymer accumulator technology that is suitable for vehicles is said to be under development at three Fraunhofer Institutes in Germany, together with industrial partner Volkswagen, in a project called the Electromobility Fleet Test.

A specially developed battery management system makes the energy storage device more durable and reliable. The experts are also researching concepts that will enable large amounts of energy to be stored in a small space. To do this, they integrate mechanical and electrical components in a single module, devising systems for temperature control, performance data registration, and high-voltage safety.

The tasks involved are distributed between the three Fraunhofer Institutes according to their skills: The ISIT experts, who have long experience in developing and manufacturing lithium accumulators, are manufacturing the cells. Their colleagues at IIS are responsible for battery management and monitoring. The scientists from IISB are contributing their know-how on power electronics components to configure the accumulator modules.

The development and configuration of the new energy storage module is expected to be finished by mid-2010. Volkswagen AG – the industrial partner in this project – will then carry out field trials to test suitability for everyday operation in the vehicles.

For more information: Dr. Gerold Neumann, Fraunhofer Institute, Germany; tel: 49 4821 17-4219; fax: 04821 / 17-4250/ 4251; www.fraunhofer.de.

Biomimetic nanostructures to build cheap solar energy cells

Biomimetic optical structures that copy the nanostructures seen in nature to build solar cells for efficient light-trapping are being investigated at the University of Southampton, England. The Nano Group at its School of Electronics and Computer Science has conducted extensive research into how nanotechnologies can contribute to the design of solar cells that can be manufactured on cheap flexible substrates rather than expensive silicon wafers. One type of structure is based on an anti-reflective technique exploited by moth eyes. Others are based on metallic nanoparticles that form plasmonic structures.

"It is essential that a solar cell absorb all of the light that is available," says Prof. Darren Bagnall. "Thicker devices absorb more light, and unfortunately the need to use thick layers (particularly in the case of silicon) drives up the cost and often degrades the electronic properties of devices. Effective light-trapping will allow many alternatives and systems to be considered and will allow lower-quality (cheaper) material."

For more information: Joyce Lewis, School of Electronics and Computer Science, University of Southampton, England; tel: 023 8059 5453; jkl2@ecs.soton.ac.uk; http://www.ecs.soton.ac.uk/people/dmb.

BRIEFS

The 3M Co. announces that **Chongqing Electric Power Corp**., China, has become the second major utility in the People's Republic of China to install the 3M Aluminum Conductor Composite Reinforced cable to boost transmission capacity on a key line without the need to build larger transmission towers. www.3m.com

Composite Technology Corp. announces that its **DeWind** subsidiary has signed an agreement for the sale of ten advanced DeWind D9 two-megawatt wind turbines to **Energy Farming Ontario LLC**. The D9 turbine is the advanced version of the D8.2 synchronous power turbine, which incorporates a 90-meter rotor for greater energy capture. www.compositetechcorp.com

Eden Energy Ltd. announces the formation of **Eden Hydrogen Inc**., an integration of two Eden Energy U.S. subsidiaries: **Hythane Company** of Denver, and **HyRadix** of Des Plaines, Illinois. The new company will be headquartered in Des Plaines. www.edenhydrogen.com

First Solar Inc. plans to expand manufacturing operations for its advanced thin film solar module manufacturing technology at its facility in Perrysburg, Ohio. This expansion will add a fourth production line and bring the manufacturing facility to the same four-line configuration as the five other plants located in Germany and Malaysia. www.firstsolar.com

Hexcel Corp. will set up a glass prepreg plant in Colorado to support the emerging North American wind turbine blade industry. The plant will begin production in the second half of 2009. www.hexcel.com

PowerGenix, a manufacturer of rechargeable nickel-zinc batteries, has been certified as an official licensee by the **Rechargeable Battery Recycling Corp.**, a nonprofit public service organization dedicated to recycling rechargeable batteries. www.powergenix.com

Pratt & Whitney Canada is leading an aerospace industry-university research effort to investigate the potential use of biofuels for small and medium size engine applications. P&WC is evaluating the feasibility of second generation biofuels that originate from sources that do not compete with human food sources. www.pwc.ca

Rolls-Royce is establishing a new business unit to address the global market for civil nuclear power. The company estimates that this worldwide market could be worth $92.6 billion a year in 15 years. www.rolls-royce.com

Siemens Energy will test two 3.6-megawatt wind turbines with direct drive technology at a site in west Denmark. Siemens will subject the turbines to comprehensive testing for a minimum of two years. The purpose is to assess whether direct drive technology is competitive with geared machines for large turbines. www.siemens.com

Solar Thin Films Inc. has agreed to build an amorphous solar module manufacturing plant in Ulster County, New York, its first in the United States. The plant will utilize machinery produced by **Kraft Electronikai Srt**., based in Budapest, Hungary, a subsidiary of Solar Thin Films. The facility will be able to establish six lines of equipment capable of producing 36 megawatts of module power. www.solarthinfilms.com

Xunlight Corp. has been awarded $4.9 million from the State of Ohio's Research Commercialization Program to develop an improved, advanced thin-film solar-cell fabrication technology, an advanced flexible solar module manufacturing process, and advanced photovoltaic products. www.xunlight.com

Ten cost-shared projects are to develop hydrogen storage

Ten cost-shared hydrogen storage research and development projects will receive up to $15.3 million over five years, according to an announcement by the U.S. Dept. of Energy. The DOE and U.S. Department of Transportation are sponsoring the Hydrogen Road Tour, which traveled from Portland, Maine, to Santa Monica, Calif., during August. Demonstration hydrogen vehicles from nine manufacturers participated in the tour, which included 31 stops in 18 states.

The projects include development of novel hydrogen storage materials, development of efficient methods for regeneration of hydrogen storage materials, and approaches to increase hydrogen binding energies to enable room-temperature hydrogen storage. These projects will be part of DOE's National Hydrogen Storage Project, which also includes three Centers of Excellence and other independent projects. DOE's hydrogen storage activities for vehicles focus primarily on enabling a driving range of greater than 300 miles, within packaging and cost constraints.

The organizations selected for negotiation of awards are: Los Alamos National Laboratory, Northwestern University, Ohio State University, Pennsylvania State University, U.S. Borax Inc., University of Missouri, University of Oregon, University of California at Los Angeles, and Sandia National Laboratories.

For more information: Clarence Albright, U.S. Dept. of Energy, Washington, DC 20585; tel: 202/586-4940; www.hydrogen.energy.gov.

The city of **Ottawa, Ontario**, has approved a new waste-to-energy facility that will turn 400 metric tons of garbage per day into 21 megawatts of net electricity, enough to power about 19,000 homes. Rather than burning trash to generate heat, as with an incinerator, the facility proposed by Ottawa-based **PlascoEnergy Group** is based on electric-plasma torches that gasify the municipal waste and burn the gas to generate electricity. www.plascoenergygroup.com

Highly efficient catalyst takes oxygen from water

A catalyst that produces oxygen gas from water while another catalyst produces hydrogen has reportedly been discovered at Massachusetts Institute of Technology, Cambridge. The new catalyst consists of cobalt, phosphate, and an electrode, all placed in water. When electricity runs through the electrode, the cobalt and phosphate form a thin film on the electrode, and oxygen gas is produced.

Combined with another catalyst such as platinum, which can produce hydrogen gas from water, the system can duplicate the water-splitting reaction of photosynthesis. The new catalyst works at room temperature, in neutral pH water, and is easy to set up. Within ten years, homeowners may be able to power their homes in daylight through photovoltaic cells, while excess solar energy produces hydrogen and oxygen to power a household fuel cell at night.

For more information: Daniel Nocera, Massachusetts Institute of Technology, Cambridge, MA 02139; tel: 617/253-5537; fax: 617/253-7670; nocera@mit.edu; www.mit.edu.

Colorado School of Mines to partner for nuclear energy

Under a research partnership between the Advanced Test Reactor National Scientific User Facility (ATR NSUF) at Idaho National Laboratory and the Massachusetts Institute of Technology, a Colorado School of Mines nuclear materials irradiation experiment will be the first test conducted in the MIT Reactor (MITR), a five-megawatt research nuclear re-

actor. The Colorado experiment is called "Advanced Nondestructive Assessment Technology to Determine the Aging of Silicon-Containing Materials for Generation IV Nuclear Reactors."

"This project on the nondestructive electronic property measurements of high-temperature structural materials to assess radiation-induced aging has a high potential of introducing advanced assessment tools to the nuclear industry," says Prof. David Olson in the Department of Metallurgy and Materials Engineering at the Colorado School of Mines.

NSUF test space at both reactors is made available at no cost to external users whose projects are selected through a peer review process. The partnership with MITR is the first in an expected series of national partnerships designed to enhance the NSUF infrastructure and capability.

For more information: David Olson, Colorado School of Mines, Golden, CO 80401; tel: 303/273-3955; dolson@mines.edu; www.mines.edu.

Advanced turbine systems to run on syngas

Technologies for advanced turbines that operate cleanly and efficiently when fueled with coal-derived synthesis gas and hydrogen fuels are to be developed in four projects selected by the DOE Office of Fossil Energy's University Turbine Systems Research Program.

The overall goal of the program is to provide high-efficiency, near-zero emissions, and lower-cost turbines for coal-based stationary power systems. Developing turbine technology to operate on high hydrogen-content (HHC) fuels derived from coal synthesis gas is critical to the development of advanced, near-zero-emission integrated gasification combined-cycle power plants that separate and capture carbon dioxide.

The selected universities will direct their efforts toward enabling technologies for high-hydrogen-fueled turbines, conducting basic research to help define and address HHC fuels issues believed to impact the design of robust turbines for HHC power plants.

The researchers will study specific DOE Turbine Program topics in combustion, aerodynamics, heat transfer, and materials, focusing on sub-topic areas including mixing processes, dynamic stability, hot gas path design, and degradation of turbine thermal barrier coatings from deposits.

The universities selected are University of California-Irvine, Pennsylvania State University, and two projects at Ohio State University.

For more information: Mike Jacobs, U.S. Dept. of Energy, Washington, DC 20585; tel: 202/586-0507; www.fe.doe.gov.