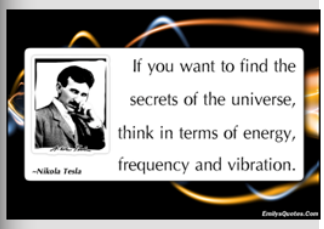
ALU Energy News

January & February 2017

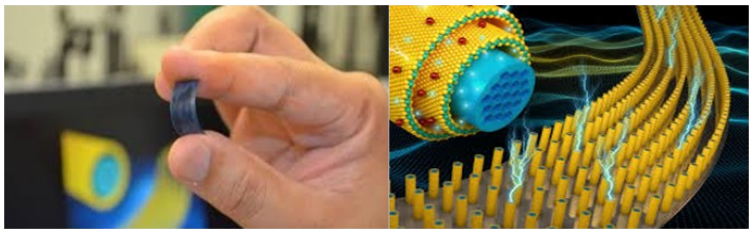
ALU Energy News



ALU ENERGY SOCIETY

New technology could charge your phone in seconds

Scientist from UCF post doctoral associate Mr. N Choudary says."You could charge your electronic gadgets in fraction of seconds and you don't need to charge for more than a week. Central Florida have created a super capacitor battery pro type that works like new even after being recharged 30,000 times. The research could yield high capacity ultrafast charging batteries that last over 20 times longer than a conventional lithium ion cell.



Super capacitors store electricity Illustration represents the novel design of the supercapacitor developed at the UCF, statically in the surface of the materials

Courtesy: University of Central Florida

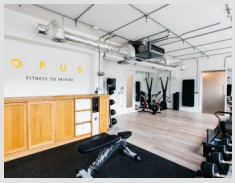
Hence they charge really prompt, and they don't have any chemical reaction like other batteries. However the research is in its new born and it's not ready yet for commercialization but looks challenging for small electronic gadgets, the materials are surpassing the conventional ones worldwide in

terms of energy density. Power density and cyclic stability. Still the car manufacturers (Tesla motors) putting their efforts with these super fast charging batteries to uplift the specification of the manufacturing. The chairman of tesla is making his effort to expand these super capacitor batteries for his tesla motors.

It is a challenge to integrate graphene with other materials used in super capacitors, though. That's why his team wrapped 2D metal materials (TMDs) just a few atoms thick around highly-conductive 1D nano wires, letting electrons move speedily from the core to the shell. That yield a quick charging material with high energy and power density that's relatively simple to produce. "We introduced a uncomplicated chemical synthesis method. so we can very nicely integrate the existing materials with the 2D material. More information available in ACS Nano.

Source: ACS Nano, 2016; DOI: 10.1021/acsnano.6b06111

"The client simply has to wear the heart rate belt whilst training and upload the results through their smartphone app – which we can see from anywhere in the world."

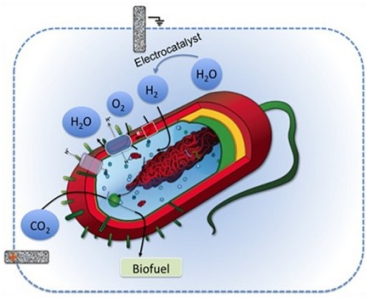


Sporteluxe— OPUS

Financial Times - wearable Technology

Artificial leaf turns CO_2 emission into Biofuels

Artificial photosynthesis of liquid fuels is a potential source for clean energy. Alcohols are particularly attractive products because of their high energy density and market value per amount of energy input. The major challenges in photo/ electrochemical synthesis of alcohols from sunlight, water and CO_2 are low product selectivity, high membrane fuel-crossover losses, and high cost of product separation from the electrolyte. Researchers at Harvard University- Chong Liu and his team (Science Volume 352 issue 6290, 2016) over comes the challenges by developing hybrid inorganic-biological system that mimic the functions of photo synthetic CO_2 fixation. Further, they were highly successful in developing highly combatable system, Cobalt phosphate Co-P (cathode) catalyze both hydrogen evolution reaction (HER) and oxygen evolution reaction (OER). The H_2 produced from water splitting reactions can be consumed by *R. eutropha* bacteria to synthesis biomass and fuels.



Source: Science, DOI: 10.1126/science.aaf5039

Extracting energy from multiple sources - wearable technology

Many forms of energy are around us, but all the energies are not being fully utilized. Just one form of energy is not enough and also not available. Eg. Solar energy is not surplus during winter days. So the researches focused on multiple forms of energy, and a device that harvest multiple form of energy.

Yang Bai and his colleagues from University of Oulu, saying that their research on a specific type of perovskite called KBNNO which may be used to harvest many forms of energy. It is a ferroelectric material, filled with tiny electric dipoles. When ferroelectric materials undergo changes in temperature; their dipoles misalign and induce an electric current and this current accumulates at the direction of the dipole point. Further, when the material deforms, attraction and repulsion of charges take place and leads to the more generation of current. Previously, there was no report on KBNNO's properties related to temperature or pressure. KBNNO is good at generating electricity from heat and pressure; The pyroelectric and piezoelectric properties can further be improved by modifying the composition of KBNNO. Bai hopes to build a prototype multi-energy harvesting device, which may push the development of the internet of things and smart cities where power consuming sensors and devices can be energy sustainable

Source: I.Connect007, Good for industry.

Bamboo can fuel your vehicles?

"It can efficiently produce ethanol and one of the pilot scale reports that one can able to produces 800% more gallons of ethanol per acre than the corn. It can be harvested three times a year"

There is continuous interest in making automotive fuel from nonfood crops, with a series of major new production plants opening in the India near North East. However, producing this so-called cellulosic ethanol remains considerably more expensive than gasoline. So researchers are always on the lookout for new ways to trim costs. Now they have a new lead, a microbe that can use abundant nitrogen gas as the fertilizer it needs to produce ethanol from plants.

Scientists have long eyed biofuels as a cleaner and more sustainable alternative to traditional fossil fuels. Instead of pumping oil from the ground, researchers harvest plants like cassava and sugarcane, grind them up, add enzymes to break down the plant matter, and sprinkle in yeast. The microbe ferments sugars in the plants to produce ethanol, a form of alcohol, which is now commonly mixed with gasoline and used in cars and buses around the world.

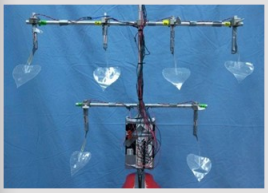
Bamboo, as one of the promising cellulosic alternatives, offers the most easily accessible source for alternative fuels. It is believed that bamboo may lower the ethanol production costs and costs to environment. It uses less resources and no harm to environment. It does not need to use any nutrients and fertilizers that will cause damage to environment and animal habitat.

Bambusa Edulis, this special variety of bamboo, grows a set of tamed roots that don't run wild underground threatening the quality of the land. It can efficiently produce ethanol and one of the pilot scale reports that one can able to produces 800% more gallons of ethanol per acre than the corn. It can be harvested three times a year. It does not take productive agricultural land out of cultivation for food sources. It is easily grown and less affected by weather.

Source: Numaligarh Refinery limited, India

Production of Electricity using Biomimeting principle

The group of scientists from Iowa State University (ISU) constructed a tool that mimics a cottonwood tree. This device produces electricity while its simulated leaves swing in the wind. ISU's genetics associate professor of Michael McCloskey, development and cell biology who designed the device, which is not resemblance of wind turbines and also it could not replace the wind turbines. But the developed device easily commercialized in the market because this unremarkable device can produce electricity from wind energy.



Courtesy: Iowa State University (ISU), journal of PLOS ONE.

Courtesy: of Iowa State University (ISU), DailyPost

Journalism of hope

"Michael McCloskey, development and cell biology who designed the device, which is not resemblance of wind turbines and also it could not replace the wind turbines"

McCloskey said "The possible advantages here are aesthetics and its smaller scale, which may allow off-grid energy harvesting". And also he said an idea to produce electricity from cell phone towers due to

they have been camouflaged as trees. These cell phone towers will build complete with leaves that drumming energy from those leaves would increase their functionality. The ISU research team investigated the world of biomimetics, or the mimic natural processes and who were published a research article in the journal *PLOS ONE*.

The research team developed an inspired concept of prototype mimics tree. Many scientist attempt to develop a prototype tree using features of device as a metallic trellis, which has a dozen plastic flaps in the shape like cottonwood leaves. In the current study, the leaf stalks assembled inside with small flooring of specialized plastic which can discharge an electrical charge when bent by moving air and these processes are called as piezoelectric effects. Cottonwood leaves were modelled due to their compressed leaf stalks compel blades to oscillate in a standard prototype that optimizes energy generation by flexible piezoelectric strips.

The novel concept of biomimeting trees help to control household appliances. Henderson said about the biomimetic technology, it could become market, limited amounts of wind energy sufficient to generate electricity without necessitate for obstructive turbines or towers. A practical device would be develop with highest efficiency said by McCloskey.

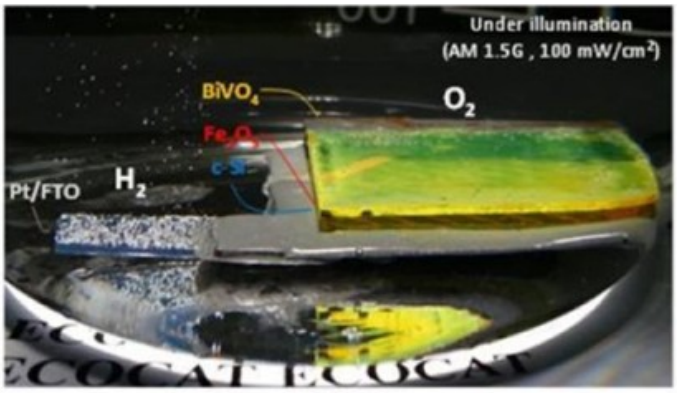
Source: *PLOS ONE*, 2017, DOI: 10.1371/journal.pone.0170022

Artificial leaf goes more efficient for hydrogen generation

Momentum Energy—Habitat

"New artificial leaf mimics a natural process of underwater photosynthesis of aquatic plants to split water into hydrogen and oxygen, which is harvested for fuel".

Recently, the research obtained a hetero-type dual photoelectrodes, in which two photoanodes of different bandgaps are connected within parallel designed for extended light harvesting (J.S.Lee group, Their new artificial leaf mimics a natural process of underwater photosynthesis of aquatic plants to split water into hydrogen and oxygen, which is harvested for fuel. About this study is expected to contribute very much to the reduction and treatment of carbon dioxide emissions in accordance among the recent Paris Agreement on climate change. Because using hydrogen produced by artificial leaf as fuel, does not generate carbondioxide emissions. Moreover it can be used as a cheap and stable hydrogen fuel for hydrogen fuel cell vehicles.Identical to any other plants or marine plants also generate energy from the sun through photosynthesis. Still, it is difficult to receive the full sunlight deep under the sea. So, they are subjected to various types of photosynthesis that selectively develop wavelengths reaching their depths.



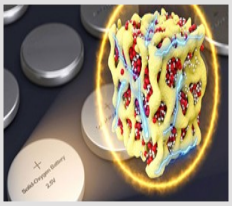
Courtesy: of Ulsan National Institute of Science and Technology (UNIST)

It may possible to achieve 10% light harvesting efficiency within three years. This technology resolve greatly contribute to the establishment of the renewable-energy-type hydrogen refueling station by supplying cheap fuel for hydrogen fuel cell vehicles.

Momentum Energy—Habitat

Source: Nature Communications, 10.1038/ncomms13380

Lthium ion air batteries are more safer and efficient!



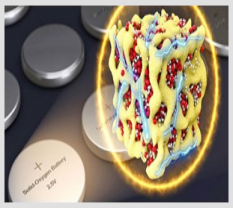
"The nanoparticle catalyst exhibited the highest hydrogen production efficiency using organosilanes, up to 99% conversation of silanol within 9 min at room temperature"

There is increasing interest in developing the Lithium-air batteries, it is new concept compared to commercial batteries. This is excellent technology and it is used in electric cars and portable electronic devices. Lithium-air battery is delivering a high energy output in proportion to their weight. The batteries' output voltage is more than 1.2 volts lower than the voltage used to charge them, which represents a important power loss incurred in each charging cycle.

Conventional lithium-air batteries draw in oxygen from the outside air to drive a chemical reaction with the battery's Li during the discharging cycle, and this oxygen is then released again to the atmosphere during the reverse reaction in the charging cycle. In the new alternative, the same type of electrochemical reactions take place between Li and O during charging and discharging, but they take place without ever letting the oxygen lapse to a gaseous form. Instead, the oxygen stays inside the solid and changes directly between its 3 redox states, while bound in the form of three kind solid chemical compounds, Li_2O, Li_2O_2, and LiO_2, which are diverse together in the form of a glass.

This reduces the voltage loss by a factor of five, from 1.2 volts to 0.24 volts, so only 8% of the electrical energy is turned to heat. "This means faster charging for cars, as heat exclusion from the battery pack is less of a safety concern, as well as energy efficiency benefits," Li says. Conventional lithium-air batteries are "really lithium-dry oxygen batteries, because they really can't handle moisture or carbon dioxide," so these have to be carefully cleaned from the incoming air that noshs the batteries.

Source: Massachusetts Institute of Technology, Feb 2017



Secure wireless chargers

Now a day peoples are expecting the environmentally with low cost device from Research and development section. In the last few years, portable electronics that can be recharged wirelessly have started coming to market. In an attempt to get ahead of the problem of counterfeit wireless chargers which could reason power surges that fry a device's circuitry researchers from MIT's Microsystems Technology Laboratories have make a chip that blocks attempts to wirelessly charge a device's battery unless the charger first give cryptographic authentication.

The similar technology also solves another problem with wireless chargers. When two devices divide a single charger, if they are different distances from the charger's electrical coil, their charging rates can vary enormously, to the scope that one device might charge fully while the other remains virtually uncharged. In the same way that the researchers' chip can block power transfer from an unauthorized charger, it can slow the power transfer to a device nearer the charging coil, ensuring more equitable charge rates.

> "They either have to block a very large voltage when they're off, or they have to carry a very large current when they're on, or in some cases both"

The researchers' chief innovation is a more compact and efficient circuit for tuning the frequency of the receiving coil. A standard tuning circuit connects the coil to a series of capacitors, electronic components that can store charge. Between each pair of capacitors is a switch, and switching capacitors on and off changes the receiver's frequency. Those switches have very severe requirements, Juvekar says. "They either have to block a very large voltage when they're off, or they have to carry a very large current when they're on, or in some cases both. If a switch needs to block a very big voltage, then it's very hard to put that on the chip. So it has to be a discrete component on the board, outside the chip. Or if it's on the chip, it requires a specialized process that might be very expensive." In the researchers' chip, one of the coils, the main coil is much larger than the other auxiliary coil. The main coil carries the chief responsibility for charging a device's battery.

When a current is flowing through the auxiliary coil, it produces a magnetic field that changes the tuning frequency of the main coil. The chip uses an authentication technique called elliptic curve cryptography, which is a "public-key" cryptographic technique. The chip doesn't need to store a secret key of its own. Elliptic curve cryptography is a well-established technique. But Chandrakasan's group has developed a battery of methods for reducing chips' power consumption, and the researchers found a way to simplify the encryption circuit so that it takes up less space on the chip and consumes less power.

Source: Larry Hardesty , MIT, February 2017

Courtesy-hydrogenfuel-news.com

A cleaner, more efficient car! New material designed to better store hydrogen fuel!

Scientists had already discovered that they needed to pressurize hydrogen to compact it and make it usable as a fuel for cars. But MendozaCortes wanted to take it one step further and make the process more efficient and economically viable.

"We still want to pressurize it, but we want to do it more efficiently," he said. "Right now, it's extremely costly to do this."

Using complex mathematical equations and computer simulations, MendozaCortes designed porous materials of transition metals compounds involving cobalt, iron or nickel that cause hydrogen to bond with it. This next generation design could then be placed in a tank of a car that uses hydrogen for fuel. These new materials are made of Earth abundant elements and therefore are easily available.

"You don't have to spend all that energy to get the same amount of storage"

The idea is that since hydrogen will bind to the actual device, more hydrogen could be packed in and condensed into a tank. Because the hydrogen easily sticks to the device, the tank would never actually reach empty. Additionally, he found it would take smaller energy expenditure to fill up the tank. "In other words, more hydrogen can be stored at lower pressures and room temperature, making some of these materials good for practical use," MendozaCortes said.

Currently, hydrogen can be made into liquid at 1 bar is the unit of measurement for atmospheric pressure and 20 degrees Kelvin or 423.67 Fahrenheit. At that rate, hydrogen can be stored at 71 grams per liter. While at 700 bar and 298 degrees Kelvin or 76.73 Fahrenheit, hydrogen can be stored at 37 grams per liter.

With MendozaCortes' proposed new materials, hydrogen could be stored at less than 200 bar to fill up the same tank at room temperature, creating a far more efficient system. "You don't have to spend all that energy to get the same amount of storage," he said.

MendozaCortes came to FSU by way of the Energy and Materials Strategic Faculty Hiring Initiative. He is a researcher at FSU's High Performance Materials Institute (HPMI), a multidisciplinary research institute dedicated to research and development of advanced materials and manufacturing technologies.

Source; Science Daily