OZONE

EDITION 6.0 **July-Dec 2021**

A MAGAZINE BY
IIChE-GVPCE(A) STUDENT CHAPTER

DEPARTMENT OF CHEMICAL ENGINEERING
GAYATRI VIDYA PARISHAD COLLEGE OF ENGINEERING
(AUTONOMOUS)

TEAM OZONE

Prathyusha.B
(literary Head)

J.V.Anudeep
(vice literary head and editor)

M.Sahid Afrid
(article contributor)

Y.Sharmila
(article contributor)

OFFICE BEARERS

2022-2023

Convenor

Dr.B.Sreenivasulu, Professor & Head of the department (Chemical Engineering)

Faculty Coordinators :

1. Dr. C. V. Nageswara Rao, Associate Professor
2. Mr. G. Naga Chaitanya, Assistant Professor

Executive Committee :

1. P.Tejaswini - 4rd Year (President)
2. V.S.Vishnu Vardhan - 4th Year (Secretary)
3. V.Akash - 4th Year (Treasurer)
4. B.Lalitha Devi - 3rd Year (Vice - President)
5. G S N Amrutha - 3rd Year (Joint - Secretary)

Literary and public relation:

1. B.Prathyusha - 4th Year (Literary coordinator)
2. V.Anudeep Junjuri (vice-coordinator and editor)
3. Y.Sharmila - 2nd Year (Article - contributor)
4. M.Shahid Afrid - 2rd Year (Article - contributor)

Events division :

1. S.Vijay Kumar - 3rd Year (Co-ordinator)
2. L.Yamuna - 2rd Year (Co-ordinator)
3. B.Sivani - 2nd Year (Co-ordinator)

Technical services division:

1. M.Vani Sudheera- 3rd Year (Technical Coordinator)
2. M.D.Deepak - 2nd Year (Website editor)
3. V.S.Charan - 2nd year (Website editor)
4. K.Lathisha - 2nd year (social media representative)

Design and creatives division:

1. B.Akhila - 3rd Year (Newsletter Editor)
2. G.Srinivas - 2nd Year (Graphics Editor)

Table of CONTENTS

FRITZ HABER

Born on 9 December 1868, was a German chemist who received the Nobel Prize in Chemistry in 1918 for his invention of the Haber–Bosch process, a method used in industry to synthesize ammonia from nitrogen gas and hydrogen gas. This invention is essential for the large-scale synthesis of fertilizers and explosives. It is estimated that one-third of annual global food production uses ammonia from the Haber–Bosch process, supporting nearly half of the world's population. Haber and Max Born proposed the Born–Haber cycle as a method for evaluating the lattice energy of an ionic solid.

Lorem Haber, a known German nationalist, is also considered the"father of chemical warfare" for his years of pioneering work developing and weaponizing chlorine and other poisonous gases during World War I. He first proposed using heavier-than-air chlorine gas as a weapon to breakthe trench deadlock during the Second Battle of Ypres.

Lorem After the Nazi rise to power in 1933, Haber was forced to resign from his positions because he was Jewish. Already in poor health, he spent time in various countries, before Chaim Weizmann invited him to become the director of the Sieff Research Institute (now the Weizmann Institute) in Rehovot, Palestine. He accepted the offer but died of heart failure mid-journey in a Basel hotel on 29 January 1934, aged 65.

Haber has been called one of the most important scientists, if not the most important, in human history and possibly the greatest industrial chemist who ever lived

JULY 2022 | VOL. 6.0

A PAINT THAT KILLS COVID-19 WITH CU+

What's inside this issue:

A PAINT THAT KILLS COVID-19

BY KATHERINE WHELAN

An innovative self-decontaminating copper coating that can be applied to work surfaces, doors, and handrails can almost completely kill Coronavirus in under four hours. Lab results show that when the recycled copper-based material is exposed to SARS-CoV-2, the virus activity is reduced by up to 99.95% within two and four hours.

Copper is a powerful antibacterial agent, harmless to humans, and particularly suitable for the eradication of bacteria, microbes, germs, and other viruses. MetalSkin medical, developed by French scientists and patented for use around the world, is the first permanent bacterial coating to enter the market. The technology was created in 2007 and combines polymers and metals to create composites with antibacterial properties.

Prior to the coronavirus pandemic, MetalSkin was widely used in a variety of settings from hospitals to commercial kitchens to ensure a safe, germ-free environment. Scientists at France's National Center for Scientific Research laboratory have now tested its efficacy as a deterrent for covid19 spreading on surfaces in public places. They tested the SARS-Cov2 strain under normal environmental conditions, including light, temperature and moisture. They found Metalskin to be unique in its ability to halt the evolution of the virus' activity.

Laboratory tests have found that SARS-Cov-2 can survive for two to three days on banknotes and glass, and up to six days on plastic and stainless steel, although results vary. More recent research from the Australian agency CSIRO found the virus was "extremely robust" and—under lab conditions—it can survive for 28 days on smooth surfaces such as glass on mobile phone screens and both plastic and paper banknotes. In comparison, the flu virus can survive for 17 days under the same circumstances.

Now, more than ever, it is vital to maintain the most stringent hygiene standards in shared spaces. In public buildings, the bacterial risk is everywhere and MetalSKin can be used to prevent transmission. The 3 Michelin-starred Chef Gilles Goujon is a champion of MetalSkin and uses it for the treatment of all the grip and supporting elements in his kitchen.

Metal skin is a self-decontaminating surface, not a disinfectant, which means it is less powerful but its effects are permanent. It was used at the Clinique St-Jean L'Ermitage in Melun, France during the first wave of the Coronavirus pandemic. During this time there were zero infections of healthcare staff. At a separate hospital in the same building that did not have MetalSkin on at-risk surfaces, 20 cases of Covid-19 were diagnosed.

Philippe Cosson, president of the St-Jean L'Ermitage clinic, said:

"This is not a clinical study—to be precise—but this is true empirical data that is undoubtedly linked to the implementation of MetalSkin."

FUN FACT: Solar Panel Splits Water to Produce Hydrogen. A research team in Belgium says its prototype panel can produce 250 liters of hydrogen gas per day!

SOLAR PANELS SPLIT WATER TO PRODUCE HYDROGEN

Solar panels are multiplying on rooftops and in gardens worldwide as communities clamor for renewable electricity. But engineers in Belgium say the panels could do more than keep the lights on—they could also produce hydrogen gas on-site, allowing families to heat their homes without expanding their carbon footprints. Hydrogen, unlike fossil fuels, doesn't produce greenhouse gas emissions or air pollution when used in fuel-cell-powered vehicles or buildings. Yet nearly all hydrogen produced today is made using an industrial process that involves natural gas, and this ultimately pumps more emissions into the atmosphere. A small but growing number of facilities are producing "green" hydrogen using electrolysis, which splits water molecules using electricity—ideally from renewable sources such as wind and solar. Other researchers, including the team in Belgium, are developing what's called direct solar water-splitting technologies. These use chemical and biological components to split water directly on the solar panel, forgoing the need for large, expensive electrolysis plants.

A team at Katholieke Universiteit Leuven, or KU Leuven, says it has developed a solar panel that converts sunlight directly into hydrogen using moisture in the air. The prototype takes the water vapor and splits it into hydrogen and oxygen molecules. Professor Johan Martens and his team at the Centre for Surface Chemistry and Catalysis announced their prototype could produce 250 liters of hydrogen per day on average over a full year, which they claim is a world record. A family living in a well-insulated Belgian house could use about 20 of these panels to meet their power and heating needs during an entire year, they predict.

Dr. JOHAN MARTENS
center for surface chemistry and catalysis

The solar panel measures 1.65 meters long—roughly the height of a kitchen refrigerator, or this reporter—and has a rated power output of about 210 watts. The system can convert 15 percent of the solar energy it receives into hydrogen, the team says. That's a significant leap from the 0.1 percent efficiency they first achieved 10 years ago. (Separately, international researchers last year said they achieved 19 percent efficiency in producing hydrogen from direct solar water splitting.)

"The most difficult part is getting the water out of the air."

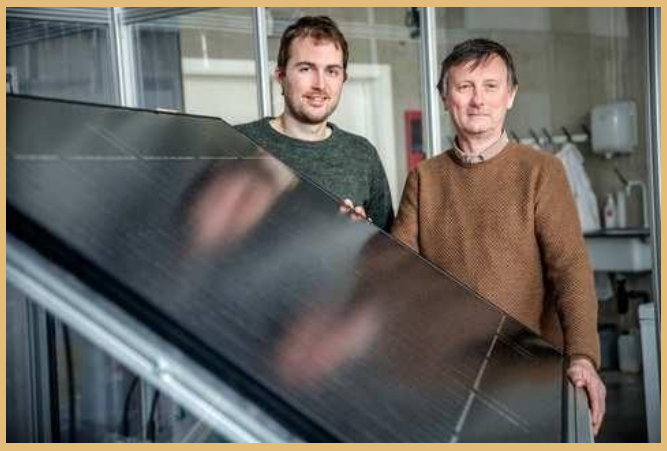
Martens says generally that his team is using "cheap raw materials" in lieu of precious metals and other expensive components. "We wanted to design something sustainable that is affordable and can be used practically anywhere," he told VRT, a public broadcasting network in Belgium.

However, Martens's lab was tight-lipped about its technology. Tom Bosserez, a post-doctoral researcher, declined to disclose any specifics, citing intellectual property concerns. He says only that the lab specializes in "catalysts, membranes, and adsorbents."

"Using our expertise in this area, we were able to develop a system that is very efficient in taking water from the air and splitting it into hydrogen by using solar energy," Bosserez wrote in an email. Asked about some of the engineering challenges they faced during a decade of development, he says, "The most difficult part is getting the water out of the air."

Academic papers offer scattered clues about the technology, though Bosserez says their research "goes beyond what we publish."

In recent years, engineers have studied the efficacy of a variety of materials, including porous, multi-junction silicon solar cells with "micrometer-scale pore dimensions"; thin-film catalysts made from manganese (III) oxide; and poly (vinyl alcohol) anion exchange membrane involving a potassium hydroxide solution and nickel-based catalysts.



OZONE 6.0

ISRO,TATA MOTORS DEVELOPE INDIAS' FIRST FUEL CELL BUS

For the first time in the country, a Hydrogen-powered automobile bus has been developed by Tata Motors and Indian Space Research Organisation after several years of research.

It's a CNG-type bus. Hydrogen in bottles at high pressure is stored at the top of the bus and there would be zero pollution. The hydrogen cells were a spin-off of the cryogenic technology that ISRO had been developing for the last few years, the Bangalore-headquartered ISRO officials said.
"That's not exactly the cryogenic technology... (It's) liquid hydrogen handling and that's where ISRO has some expertise," they said.

How the technology works

The fuel cell technology makes it a clean and silent bus on-road. Hydrogen is stored in compressed form, which combines with oxygen from the air to generate electricity, and gives water vapour as the only emission.

ISRO team generated technical specifications

An ISRO team generated technical specifications for all the elements andgeneral specifications for the bus. ISRO and TML entered into an MoU in 2006 to design and develop an automobile bus using hydrogen as fuel through a fuel cell route.

The team ensured all safety measures for handling hydrogen on the bus.

Design and development

Tata Motors Research Centre (TMRC)premises were used for the design and development of fuel cell power system in cooperation with ISRO and DSIR support. TMLhad set-up a fuel cell power system test lab with all safety measures recommended by safety committee of ISRO at Bangalore and later on at LPSC

Mahendragiri.

OZONE 6.0

Fuel Cell Power System

TML successfully completed design and development of Fuel Cell Power System (FCPS) for bus application starting from 20Kw to 120Kw with co-operation of ISRO.

Earlier, several trials have been completed and generated high quality power up to 120Kw without any untoward incident. Periodic technical and progress monitoring committee formed of TML and ISRO team guided the project continuously.

Fuel Cell Power System

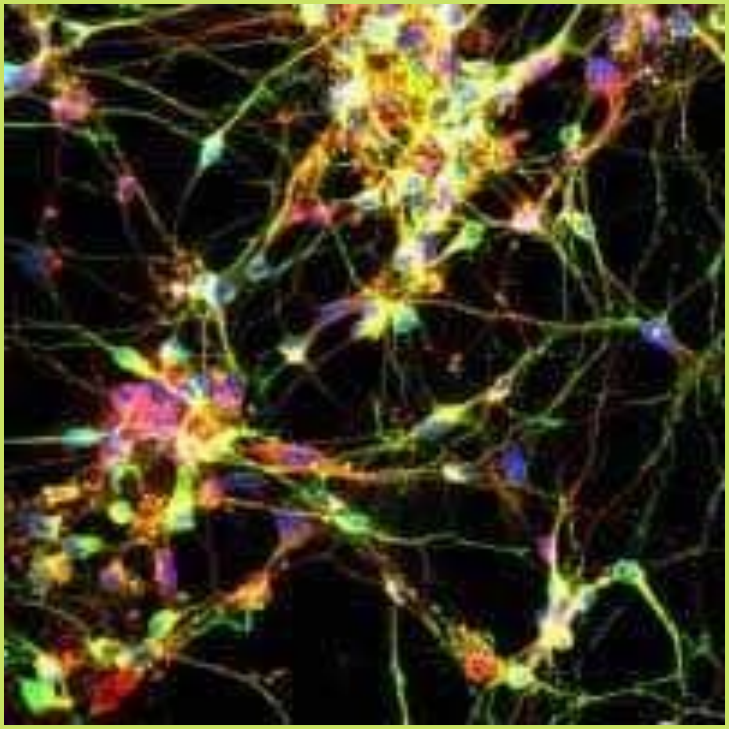
It's a CNG-type bus. Hydrogen in bottles at high pressure is stored at the top of the bus and there would be zero pollution.

The hydrogen cells were a spin-off of the cryogenic technology that ISRO had been developing for the last few years, the Bangalore-headquartered ISRO officials said.

"That's not exactly the cryogenic technology... (It's) liquid hydrogen handling and that's where ISRO has some expertise," they said.

Harvard Medical School

dangerous microbe of ers a new way to silence pain?



Anthrax has a scary reputation. Widely known to cause serious lung infections in humans and unsightly, albeit painless, skin lesions in livestock and people, the anthrax bacterium has even been used as a weapon of terror.

- Now the findings of a new study suggest the dreaded microbe also has unexpected beneficial potential -one of its toxins can silence multiple types of pain in animals.

The research reveals that this specific anthrax toxin works to alter signaling in pain-sensing neurons and, when delivered in a targeted manner into neurons of the central and peripheral nervous system, can offer relief toanimals in distress.

"This molecular platform of using a bacterial toxin to deliver substances into neurons and modulate their function represents a new way to target pain-mediating neurons," said study senior investigator Isaac Chiu, associate professor of immunology at the Blavatnik Institute.

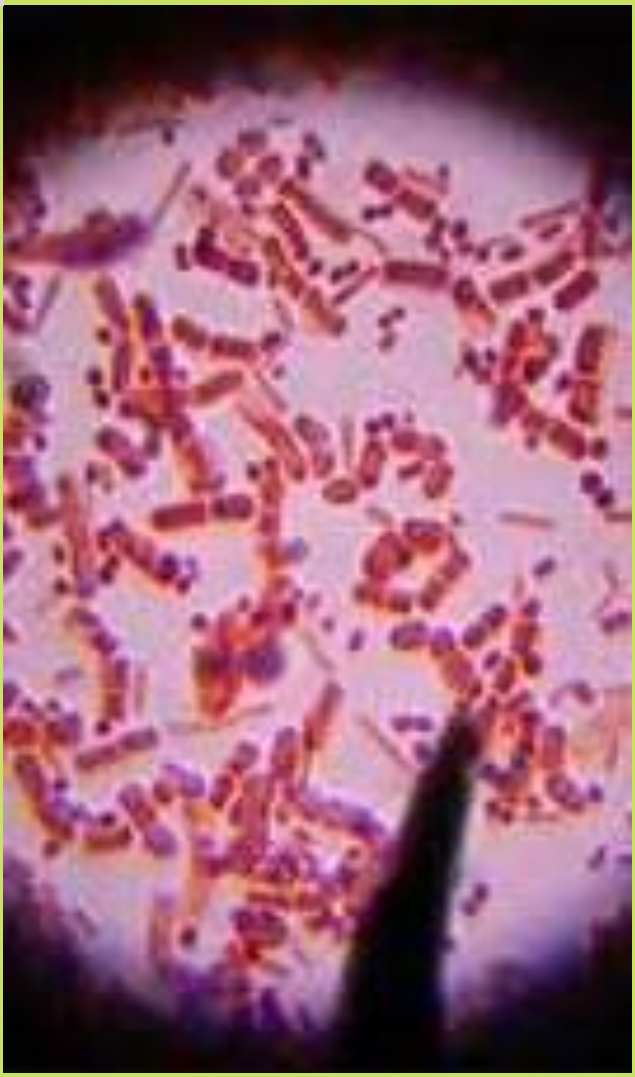
A new study shows that a toxin from the microbe that causes anthrax can silence multiple types of pain in mice. Researchers found the toxin targets pain-sensing cells to alter signaling and block pain. Building on that finding, researchers engineered an anthrax protein vehicle to deliver different types of treatments to pain receptors and modulate nerve-cell function. The findings can inform the design of therapies that selectively target pain- sensing fibers without the widespread systemiceffects of opioids and other pain killers.

In a final step, the team designed a carrier vehicle from anthrax proteins and used it to deliver other pain-blocking substances into nerve cells. One of these substances was botulinum toxin, yet another potentially lethal bacterium known for its ability to alter nerve signaling. That approach, too, blocked pain in mice. The experiments demonstrate this could be a novel delivery system for targeting pain.

"We took parts of the anthrax toxin and fused them to the protein cargo that we wanted it to deliver," Yang said. "In the future, one could think ofdifferent kinds of proteins to deliver targeted treatments."

The scientists caution that as the work progresses, the safety of the toxintreatment must be monitored carefully, especially given that the anthrax protein has been implicated in disrupting the integrity of the blood-brain barrier during infection.

A highly speculative one, he added -- may be that microbes have developed ways to interact with their host in order to facilitate their own spread and survival. In the case of anthrax, that adaptive mechanism may be through altered signaling that blocks thehost's ability to sense pain and therefore the microbe's presence. This hypothesis could help explain why the black skin lesions that the anthrax bacterium sometimes forms are notably painless.



"Doing so can increase the range and diversity of the types of substances we look to in search for solutions."

AEROPONICS

SOIL LESS CULTIVATION

RESEARCH AUTHOR: P. Gopinath
ASSOCIATES: P. Irene Vethamoni and M. Gomathi

OZONE 6.0

Aeroponics is the soilless cultivation and it is a process of growing cropssuspended in the air or in a mist without using soil. The principles of aeroponicsare based on the possibility of cultivating vegetables whose roots are not insertedin a substratum or soil, but in containers filled with flowing plant nutrition. Inthese containers roots can find the best condition regarding oxygenation andmoisture. These conditions allow for better plant nutrition assimilation in a more balanced way, with consequential faster development of the cultivated plants.The aeroponic system is more user-friendly as the plants are all separated, they are all suspended in the air and the roots of the plants are not in anything like soilor water.

Also, the harvesting of crops is simple. Many vegetable crops like potato, yams, tomato, lettuce and some of the leafy vegetables are being commercially cultivated in aeroponic system.

SOIL-LESS

CULTIVATION

AEROPONICS

Aeroponics is the process of growing plants in an air or mist environment without the use of soil or aggregate media. The word aeroponic is derived from the Latin word ‘aero’ (air) and ‘panic’ means labor (work). This is an alternative method of soil-less culture in growth-controlled environments. Aeroponic culture differs from conventional hydroponics, aquaponics, and in-vitro (plant tissue culture) growing. Nowadays, aeroponics is being applied successfully in South America and attempts are made to introduce this technology also in some African countries. In modern horticulture, different soil-less production techniques such as aeroponics and NutrientFilm Techniques have been developed. Earlier works have shown good results with NFT for potato tuber production. However, tuber initiation was poorer in a nutrient solution without solid media than in porous media (e.g. perlite or vermiculite). The tuberization inhibitions of stolons immersed in a solution could be the consequence of the lack of mechanical resistance. The utilization of aeroponic systems for potato seed production is very recent in Europe. Until 10 years ago, the use of these technologies was limited almost everywhere in the world and only some countries such as China or Korea were using them for the commercial production of potato quality seeds.

The aeroponic culture technique is an optional device of soil-less culture in growth-controlled environments suchas greenhouses. This method consists of enclosing the root system in a dark chamber and supplying a nutrient solutionof mist device

DEVICE ACTS AS BOTH SOLAR CELL AND BATTERY

SOLAR CELL AND A BATTERY >

HYBRID DEVICES?

A new photoelectric device can convert light into a charge that it can then store indefinitely. Energy from sunshine. Harvesting light energy with solar cells generally requires them to be hooked up to an energy storage device such as a battery. A new device might provide both photoelectric power and energy storage.

Photoelectric devices, which convert light energy into electricity, have a vital role in clean energy technologies. They often need to be coupled to batteries that store the captured energy, but researchers have now built a device that combines photoelectric charge generation with charge storage. The excited electrons can be retained for at least a week until they are discharged as an electric current. The team says the device might find uses in energy generation, photodetectors, or light-based memories.

A good photoelectric device contributes a charge carrier to an electric current nearly every time it absorbs a photon; in other words, it has a high "external quantum efficiency" (EQE).

The problem is that the negatively charged electron and the positively charged hole generated by a photon often recombine shortly after their creation.

One way to increase the EQE of a device is to temporarily trap the charge carriers—at crystal defects, for example—before recombination can occur.

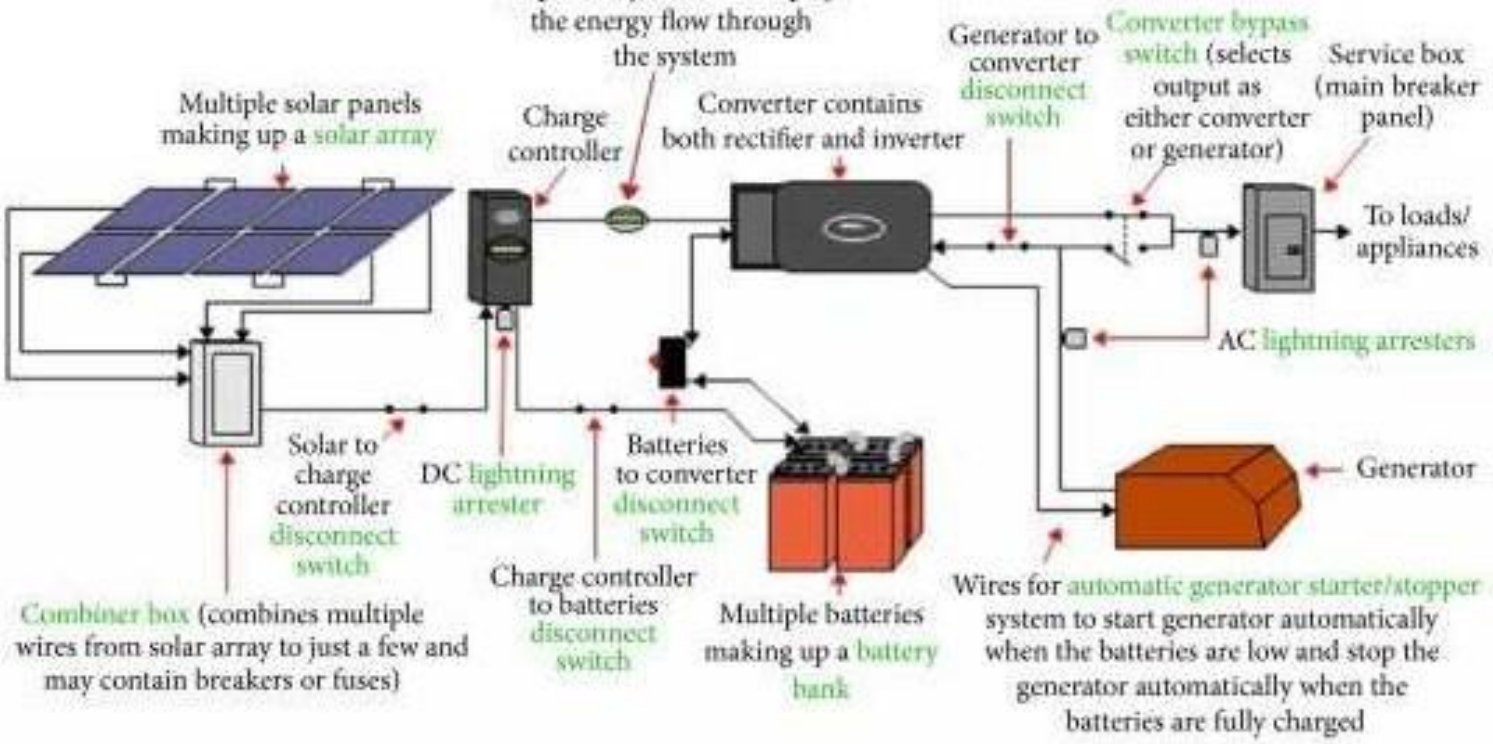
Yucheng Jiang of the Suzhou University of Science and Technology, China, and his co-workers set out to use this strategy in a device called a van der Waals heterojunction, in which two materials are held in contact by relatively weak van der Waals interactions

DETAIL >

They used tungsten diselenide, a semiconducting material, and the transparent conductor strontium titanium oxide (STO). On the surface of the STO, the team produced a nearly two-dimensional "electron gas" (a state in which electrons move freely and independently) by employing a surface treatment. Using an electron gas as one component of such a heterojunction was new and led to the device's novel properties.

The interface region between the two materials forms a so-called *p*-*n* junction, a common structure in solar cells. Ordinarily, photons generate electron-hole pairs that can be separated by a voltage, though some inevitably recombine. Jiang and colleagues hoped that in their structure, recombination might happen more slowly than in other *p*-*n* photovoltaic devices

. But to their surprise, they found that the photoinduced charge carriers could persist for very long times.



After illuminating their device with a blue laser and then storing it in the dark at a temperature of 30 K for up to 7 days, they could extract a large current (2.9 milliamps) when they connected it to a circuit. The photoexcited charge was being stored without degrading appreciably, as if in a battery that could be charged and discharged at will. They named this new phenomenon chargeable photoconductivity.

The researchers think that the trapping happens in a part of the tungsten diselenide film called the space-charge region, adjacent to the interface with the STO crystal. Here, light-induced holes can be accumulated and retained until a sufficiently large applied voltage draws them into a circuit.

The device is then ready to be charged again by light. The EQE of the device is 93.8%, whereas many photovoltaic cells are considered “high performance” if their EQE is greater than 50%.

However, the need to cool the device to around 30 K to keep the stored charge stable might restrict it to certain applications, Jiang says, unless improvements using other materials can significantly raise this operating temperature.

The heterojunction device could also act as an optical memory. Information would be input with a light pulse and stored until it was read out as a pulse of electric current. “We do not know what the limit of this stability is, but we think the storage lifetime is almost infinite,” Jiang says.

Other layered materials have previously been used to make heterojunction devices with a photoinduced storage capability. But Jiang says that the trapping process in those cases is less readily switched onand off because it involves “stronger” traps (in defect sites in the crystal).

Home Interior Designer

NANOPARTICLES TO CONVERT CO2 INTO VALUABLE RESOURCES

J. JUSTIN GOODING

Richard D. Tilley

WOLFGANG SCHUHMANN

Enzymes use cascade reactions to produce complex molecules from comparatively simple raw materials. Researchers have now copied this principle.

“Transferring the cascade reactions of the enzymes to catalytically active nanoparticles could be a decisive step in the design of catalysts,” says Wolfgang Schuhmann.

An international research team has used nanoparticles to convert carbon dioxide into valuable raw materials. Scientists at Ruhr-Universität Bochum in Germany and the University of New South Wales in Australia have adopted the principle from enzymes that produce complex molecules in multi-step reactions. The team transferred this mechanism to metallic nanoparticles, also known as nanozymes. The chemists used carbon dioxide to produce ethanol and propanol, which are common raw materials for the chemical industry.

The team led by Professor Wolfgang Schuhmann from the Center for Electrochemistry in Bochum and Professor Corina Andronescu from the University of Duisburg-Essen, together with the Australian team led by Professor Justin Gooding and Professor Richard Tilley

Enzymes have different active centers for cascade reactions, which are specialized in certain reaction steps. For example, a single enzyme can produce a complex product from a relatively simple starting material. In order to imitate this concept, the researchers synthesized a particle with a silver core surrounded by a porous layer of copper. The silver core serves

as the first active center, the copper layer as the second. Intermediate products formed at the silver core then react in the copper layer to form more complex molecules, which ultimately leave the particle.

Above
Peter O'Mara from Sydney (on the left) and Patrick Wilde from Bochum working with an electrochemical cell for CO2 reduction. © RUB, Kramer.

In the present work, the German-Australian team showed that the electrochemical reduction of carbon dioxide can take place with the help of the nanozymes. Several reaction steps on the silver core and copper shell transform the starting material into ethanol or propanol.

"There are also other nanoparticles that can produce these products from CO2 without the cascade principle," says Wolfgang Schuhmann. "However, they require considerably more energy."

The researchers now want to further develop the concept of the cascade reaction in nanoparticles in order to be able to selectively produce even more valuable products such as ethylene or butanol.

Summary: An international research team has used nanoparticles to convert carbon dioxide into valuable raw materials. Scientists have adopted the principle from enzymes that produce complex molecules in multi-step reactions. The team transferred this mechanism to metallic nanoparticles, also known as enzymes.

PLASTIC SMARTCITIES | WWF

PlasticRoad is a prefabricated, modular and hollow road structure built from recycled plastics.

KWS, a VolkerWessels company, Wavin and Total are working on the development of plastic roads, also known as the PlasticRoad. Every component of the PlasticRoad is being designed to make its application completely circular, with the goal of using recycled plastic as much as possible. Imagine that constructing a road would take days instead of months. That roads would last three times as long. That maintenance and traffic disruption are things of the past. And that cable and piping problems as well as the urban water problem are solved overnight.

The PlasticRoad concept consists of a prefabricated, modular and hollow road structure based on (recycled) plastics. The prefabricated production, the light weight and the modular design of the PlasticRoad make construction and maintenance faster, simpler and more efficient compared to traditional road structures.

The PlasticRoad has a hollow space that can be used to (temporarily) store water, thus preventing flooding during extreme precipitation. The hollow space can also be used for the transit of cables and pipes, thus preventing excavation damages. And there are numerous other conceivable applications, including the installation of sensors or the electric charging of vehicles.
The PlasticRoad is a completely circular product that is based on recycled plastics. It has a significantly smaller carbon footprint than traditional road structures thanks to the longer lifespan and the reduction of transport movements involved in its construction.

KEY CONSIDERATIONS: Pilot projects have been launched, but long-term monitoring has not yet been conducted to validate durability.

CASE STUDY EXAMPLES

The PlasticRoad partners launched their first PlasticRoad on September 11th 2018, a bike path of 30 meters in Zwolle (NL). The second pilot in Giethoorn (NL) was installed in November 2018.

QUIZZZZ!!!!!!

1. WHY LOG MEAN TEMPERATURE DIFFERENCE IS USED TO CALCULATE DRIVING FORCE IN HEAT EXCHANGER?

2. WHAT IS THE DIFFERENCE BETWEEN FORWARD EFFECT AND BACKWARD EFFECT EVAPOURATOR ?

3. WHAT IS OPERATING LINE AND EQUILIBRIUM CURVE ?

4. DIFFERENTIATE BETWEEN Z-N SETTINGS AND COHEN-COON SETTINGS ?

5. WHAT IS THE SIGNIFICANCE OF E- CURVE ?

6. DESCRIBE ABOUT FLORY-HUGGINS SOLOUTION THEORY ?

7. WRITE DANCKWERTS BOUNDARY CONDITIONS ?

8. DEFINE MACH NUMBER ?

9. HOW CAN YOU DESCRIBE MODEL PREDICTIVE CONTROL?

10. WHAT IS THE SIGNIFICANCE OF SHERWOOD NUMBER?