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Center for Nanotechnology in Society

University of California, Santa Barbara

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WEEKLY CLIPS

April 13 – April 20, 2009

Posted: April 20, 2009

Nanotechnology-enabled 'printed power'

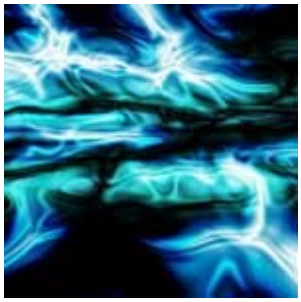
(*Nanowerk Spotlight*) The field of printable electronics is already well established and you can find a lot of information about it here on Nanowerk (see for instance: Gutenberg + nanotechnology = printable electronics or Low-cost nanotechnology substitute for gold and silver in printable electronics). The biggest limitation to further increasing the functionality of printed electronics devices is energy management, i.e. the space requirement and cost of batteries. Ideally, power and energy storage devices will be integrated into the manufacturing process to be printed at the same time.

"What is still needed to complement a further deveopment of printed electronics device technology are truly printable charge storage devices that can be easily fabricated using large-scale, solution-based, roll-to-roll processing, while still displaying good electrochemical performance," Yi Cui tells Nanowerk. "Only fully printable charge storage devices would allow for full integration into the manufacturing process of printed electronics."

Cui, an assistant professor in the Department of Materials Science and Engineering at Stanford University, together with George Grüner's group at UCLA, has been working toward fully printable high-performance supercapacitors based on thin films of single-walled carbon nanotubes (SWCNTs).

One charge storage component that holds great promise for printed electronics is the supercapacitor with its high power density. In their latest work, Grüner and Cui demonstrate that thin film supercapacitors based on SWCNT networks in combination with a printable gel electrolyte have great potential as printed charge storage devices. The paper, first authored by Martti Kaempgen Candace K. Chan, was published in the April 6, 2009 online edition of *Nano Letters* (Printable Thin Film Supercapacitors Using Single-Walled Carbon Nanotubes).

Cui explains that many high performance supercapacitors use carbon nanotubes because the high surface area can allow for very high capacitances. However, many CNT-based devices are fabricated using methods that cannot be commercially scaled, such as vertically aligned growth onto a metallic substrate.



(a) Scanning electron microscopy image of as-deposited SWCNT networks. (b) Thin film supercapacitor using sprayed SWCNT films on PET as electrodes and a PVA/H_3PO_4 based polymer electrolyte as both electrolyte and separator. (Reprinted with permission from American Chemical Society)

"Our goal was to make a device that could be fabricated using low-cost methods such a printing without sacrificing performance" he says. "Rather than use an expensive technique to make a few devices, we wanted to take CNT materials that are already being commercialized by the ton and incorporate them into a device using printing techniques that can be used on a large-scale. We have shown that these printed supercapacitors can display good performance while utilizing an inexpensive and scalable manufacturing process."

High surface area, amorphous carbon materials are typically used as the active material in supercapacitors to store charge. However, the poor conductivity of the particle networks makes a metallic current collector a requirement.

In contrast, CNT networks can display very low sheet resistances and can display high porosities and surface areas. These properties make it so that the CNT networks can act as active electrode materials as well as the current collector, combining both functions and simplifying the device architecture. This also makes devices on flexible and light-weight substrates, such as plastic, possible. CNTs can be easily solution processed as an ink.

The team has also explored the use of a gel electrolyte, which can also be printed and can double as a separator between the two electrodes. The end result is that the entire device can be printed.

The device architecture itself is fairly straightforward with two SWCNT thin films serving as both electrodes and charge collectors enclosing the electrolyte. The thin films were fabricated simply by suspending purified SWCNTs in water and then using an air brush pistol to spray it on hot PET substrate. Two of these films were then sandwiched together with the gel electrolyte in the middle.

These printable supercapacitors developed by Grüner's and Cui's labs can be used as an on-chip power source for printed electronics. The flexible and light weight nature of these devices also make them attractive for portable electronics application.

"Even though our devices are not yet optimized in terms of electrical conductivity of the nanotube films and the amount of the various active components, their performance already spans the typical range of conventional supercapacitor devices for all electrolytes used," says Cui. "This can be explained by the increased effective surface area in the thin films maximizing the efficiency of thin film CNT supercapacitors compared to the thick electrodes in regular devices."

By Michael Berger. Copyright 2009 Nanowerk LLC

http://www.nanowerk.com/spotlight/spotid=10164.php

CNNMoney.com

Nanotech's big booster

Bernard Marcus sees enormous potential in the science of the small.

NEW YORK (Fortune) -- Bernard Marcus, co-founder of Home Depot, free-market absolutist, aquarium builder and philanthropist is way into nanotechnology these days.

It isn't that the 79-year-old, home-improvement billionaire has suddenly become an expert in the science of manipulating matter at the most granular of levels. (The "nano" in nanotech refers to one-billionth of a meter.) But as a major donor to Georgia Tech's Nanotechnology Research Center - the university officially is opening the doors of the new Marcus Nanotechnology Building later this month - Marcus has started looking for opportunities to share his thoughts on the subject.

"To me, this whole area is just fascinating," Marcus declared during a recent visit with Fortune. "It will change medicine, high-technology, consumer products, everything."

And indeed, the Marcus building at Georgia Tech is taking a somewhat novel, cross-disciplinary approach to nanotech research. Biotechnology students will work in clean rooms adjacent to engineers looking for information technology breakthroughs, forcing experts in the two seemingly disparate sciences to share ideas and even collaborate on research.

Nanotech is a bit hard to define, and few reliable statistics show, say, the number of nanotech-based products or inventions populate the marketplace today. Georgia Tech describes it as the "science of the small." In the future, nanotech enthusiasts believe, nanotechnology will lead to the creation of aspirin-sized television cameras that a patient might swallow so that a doctor could examine the inside of his body. Today nanotech already is used in a number of applications, perhaps the most famous being wrinkle and stain-resistant pants in which special nanofibers combine with traditional cotton fibers to create new kinds of fabrics.

http://money.cnn.com/2009/04/20/technology/home_depot_nanotechnology_bernard_marcus.fortune/?postversion=

Stem cells and nanosurgery may change what it means to be human

By Larry Marsh, Kansas City Star Midwest Voices columnist 2009

Stem cells are prompting ethical debates, but a bigger debate is looming. Nanotechnology, which is just beginning to make its debut, may change what it means to be human.

We have recently developed a rather versatile and sensitive artificial hand for amputees. This follows similar improvements in artificial knees, ankles and hips. Is this just the beginning of a long-term trend to replace damaged or aging body parts? Can nanotechnology accelerate this process?

Can we do anything to enhance our brains? Brain scanning experiments have led to a better understanding of the functioning of our brains. We can see how the two hemispheres of our brain interface with one another. Information is flowing back and forth that may initially allow us to record the physical manifestations of our thinking process and ultimately allow us to intervene to retrieve or add to specific thoughts. This opens up the possibility of adding to our memory's storage capacity. Combine pattern recognition using artificial neural networks with relational databases and Google search technology and what do you get? => Technology to potentially help enhance brain power and retrieve information more efficiently.

Is it time to ask where all this is leading? Could we ever get to the point where it might be possible to replace the entire body? Will nanotechnology lead to nanosurgery? What if nanosurgery ultimately allows us to transfer the mind out of the brain into silicon in a stainless steel model? We could then avoid cancer, heart attacks and strokes. Will a timely transfer to a bionic body save our Medicare system from paying for the costs of old age?

Of course you would want to have more than one copy of your mind in case you get hit by a truck. You can't

expect to live forever if you don't back up the backup that backs up the backup.

http://voices.kansascity.com/node/4297

`Black gold of the forest' makes a solid investment

By Sulaiman Jaafar

KOTA BARU: At RM10,000 or more a kilogramme, agarwood certainly lives up to its name of "the black gold of the forest".

It is, therefore, not surprising that more local investors are planting aquilaria trees, better known as karas or depu, which yield the valuable heartwood.

Agarwood, or gaharu in Malay, is extracted from these large evergreen trees, which are native to Southeast Asia.

They produce a valuable aromatic oil used extensively in the Middle East and Asia in religious ceremonies, personal fragrance, incense and other scented products besides being used as a medicinal herb by the Chinese.

Agarwood Plantations Sdn Bhd marketing director Wan Ab Malik Wan Mamat said indiscriminate harvesting had resulted in the trees being listed as endangered .

He said trees grown in plantations provided a renewable source of agarwood.

He said the depletion of trees was because of illegal harvesting and low production in Malaysia, Thailand and Vietnam had led to spiralling prices in the global market. The region meets about 20 per cent of global demand.

The company has been involved in the industry since 1999, starting work with a local company near Bangkok, on 400ha.

Since starting in Kelantan about two years, it has planted about 1,000 trees and set up demonstration farms in Kadok and Mulong near here and Selising in Pasir Puteh.

Wan Ab Malik said the company would be going into large-scale planting of trees at a 400ha site in Nenggiri, Gua Musang, this year, where it would be offering a unique investment opportunity to the public.

Under the scheme, the public can buy a tree for RM100 each and redeem it after the trees mature in seven years at nine-fold the original price.

"All participants will receive a certificate stating the number of the plots of land planted with trees.

"We also guarantee that any plant which dies will be replaced".

Wan Ab Malik explained that the company used the latest nanotechnology to induce the formation of agarwood in trees unlike in earlier days where karas trees were hacked with axes to get to the oil.

He said the new process not only assured the formation of substantial agarwood but also a quality end-product.

http://www.nst.com.my/Current_News/NST/Thursday/National/2532590/Article/index_html

Tsongas and Meehan tout nanotech as job generator

The Sun, Lowell, Massachusetts (April 19, 2009)

Apr. 19--LOWELL -- What, exactly, is a "Bistable Nanoswitch Single Wall Nanotube Memory Device""

While neither the keynote speaker of the third annual Nanomanufacturing Summit, U.S Rep. Niki Tsongas, nor Chancellor Marty Meehan were ready to give a detailed answer to that question, both dignitaries did come to Thursday's event at the University of Massachusetts Lowell prepared to sing the praises of one of only four nanomanufacturing research centers in the country.

"I support the center because it is truly a national asset with important implications for the district's competitiveness," Tsongas told an audience of about 150 faculty members, students, business and military representatives. "I am currently supporting a request for additional funding in fiscal year 2010 for nano research (for the university). If approved, these funds will support efforts focused on making our soldiers safer, and eliminating threats to our safety here at home because of biological and chemical warfare."

Tsongas said she returned from her recent visit to Iraq and Afghanistan more convinced than ever that the innovations created at the nanomanufacturing center at UMass Lowell are essential to ensure that our troops "have the tools to be safe and to get the job done."

Besides making our troops safer and more efficient in the field, Tsongas said she views the nanotechnology research center as a key to emerging from the current economic crisis.

"All we have to do is think

of the university's historic dominance in plastics engineering and the textile industry -- technologies developed years ago that still spark new innovation and important business opportunities," she said. "What you are doing today will play itself out for decades to come."

After her address, Tsongas took a walk around the Suffolk Conference Center on the second floor of the Wannalancit Mills building to study the text and graphics that university researchers had posted on about three dozen billboards, summarizing the various types of nanomanufacturing research that is being done at UMass Lowell. Found among the displays was information about a new type of "lead-free solder," the development of "low cost, non-toxic anti-bacterial nanoparticles" to combat infectious diseases, and the before-mentioned Bistable Nanoswitch SWNT Memory Device, which was described as "a more powerful and economical memory storage device."

Representatives of about 50 high-tech companies attended the summit, including BAE Systems, Teradyne, Corning, BASF, Motorola, Kodak, Textron, Raytheon, IBM, Lockheed Martin and Intel.

Meehan, who also addressed the Nano Summit audience, said he believes the product innovations and high technology being developed within UMass Lowell's National Science Foundation Center for High-Rate Manufacturing (a collaborative partnership with Northeastern University and the University of New Hampshire) "are keys to the greater Lowell region's economic growth."

Also in his speech, Meehan referred with apparent renewed optimism to the proposed construction of a $90 million science and technology center on campus that UMass Lowell officials put on hold last month due to concerns about insufficient federal stimulus package funding.

"Hopefully soon we will have an emerging technologies and innovation center to house nano- and biomanufacturing research and other leading-edge work in a green, clean facility," Meehan said.

http://www.smalltimes.com/news/display_news_story.cfm?Section=WireNews&Category=HOME&NewsID=176912

Posted: April 16, 2009

Phantoms Foundation coordinates the first Spain Pavilion at NSTI Nanotech 2009

(*Nanowerk News*) The world's largest and most anticipated annual nanotechnology conference and expo, NSTI Nanotech 2009, will be held from May 3 to 7, 2009 at George R. Brown Convention Center, Houston, Texas (U.S.A.). The twelfth edition of this conference and exhibition is more international in scope than ever, expecting over 5,000 attendees and 250 exhibitors.

The Phantoms Foundation in collaboration with The Spanish Institute for Foreign Trade (ICEX) will bring together for the first time a nanoscience and nanotechnology Spanish Pavilion at NSTI.

Leading Spanish nanoscience and nanotechnology companies, science and technology research centers and industry associations will showcase innovative technologies and projects from Spain under "Spanish Nanoscience and Technological Offer" presenting uses and advances in nanotechnology to better integrate the Spanish Science-Technology-Company-Society in the U.S.

The Spain Pavilion will promote the "Spanish Nanoscience and Technological Offer", allowing to represent the scientific, technological and innovative agents of the country as a whole, to foster relationships with other NSTI Nanotech 2009 participants, to promote country culture of innovation, to better integrate the Spanish "Science-Technology-Company-Society" system in USA, to generate and to develop scientific and technological knowledge, to improve competitiveness and to contribute to the economic and social development of Spain.

http://www.nanowerk.com/news/newsid=10136.php

Industrial Nanotech, Inc.'s Nansulate Energy Saving Products to be Presented at Green Schools NYC 2009

Business Wire (April 16, 2009)

NAPLES, Florida, Apr 16, 2009 (BUSINESS WIRE) -- Industrial Nanotech, Inc. (Pink Sheets: INTK) announced today that the Company's patented Nansulate(R) nanotechnology-based energy saving coatings will be showcased at Green Schools NYC 2009, an event sponsored by The Green Schools Alliance and the Collegiate School. The event is the first city-wide Green Schools Conference and will be attended by students, parents, faculty and building administrators from over 100 public and independent schools who are seeking ways to make their schools leaders in environmental sustainability and promote green schools.

The event will be held on Saturday, April 18, 2009, from 11:30 am to 5:00 p.m. at the West End Collegiate School and it includes a screening of the DisneyNature's first film, EARTH. Industrial Nanotech's New York state distributor, Earth Energy Enterprises, will be presenting information on Nansulate(R) and its use for providing an affordable option to reduce energy use and improve air quality.

"We are looking forward to presenting Nansulate technology to schools in New York, and other areas," stated Mark Kabbash of Earth Energy Enterprises. "The technology represents the next step in reduction of energy use by means of clean, thin film insulation that is affordable and provides consistent insulating performance over time. Collegiate School is one at the forefront of the Green Schools initiative and they have chosen to use Nansulate in an application on their facility. It makes sense to reduce operating costs of schools with an affordable technology such as Nansulate and take the savings that have been achieved by commercial and industrial customers (between 20%-40%) and utilize that savings in schools. Less money spent on heating and cooling means more can be spent on students and teachers. We are excited about this Saturday and look forward to providing a sustainable schools solution."

"The idea for the event builds upon three years of grassroots collaboration among K-12 schools to become more environmentally sustainable," said Harrison Monsky, lead organizer for the event and a senior at Collegiate, "The rationale and desire for sustainability exists; now schools want to know how to do it. The resources exist today and it is a matter of connecting 'the will' and 'the way.'"

http://www.smalltimes.com/news/display_news_story.cfm?Section=WireNews&Category=HOME&NewsID=176829

UCLA INTERNATIONAL INSTITUTE *Educating Global Citizens*

Argentinean Paper La Nacion Features Joint CNSI Argentina Conference

Laura Garca Oviedo For LA NACION (This text has been translated from the original)

SAN CARLOS DE BARILOCHE, ARGENTINA. - The Argentinean investigator Orlando Auciello, who works at the Argonne National Laboratories in the United States, is developing an almost science fiction-like device: an experimental microchip that works like an artificial retina so blind people can see, albeit partially. A unique aspect of this work is that his latest test was done utilizing a new ingredient, the "ultranano" crystalline diamond, which to be made is manipulated in a scale of 1 to 100 nanometers (a nanometer is one billionth of a meter).

The ultranano crystalline diamond is just one of a range of materials that scientists modify on infinitely small scales to provide them with new properties, such as a greater strength.

Last week, a scientific meeting held in this city - the US-Argentina Workshop on Nanomaterials e_SEnD - reviewed precisely these nanomaterials, which, besides microchips, are already being used in an experimental way to promote wound closure and as anti-contaminant "sponges", among many other applications.

"Already there are people who have received the first prototype of artificial retina and now we are testing a second type of design of microchip covered with diamond nanomaterial to improve its efficiency," said Auciello during his presentation. Auciello has been living for more than 30 years in the United States and collaborates with the prestigious team headed by Dr. Mark Humayun.

On another front, the team headed by Galen Stucky, from the University of California at Santa Barbara, is developing nanotechnology-designed materials capable of stopping hemorrhages from different types of wounds.

In particular, the group works with a silicon nanomaterial that helps to speed up wounds coagulation. Stucky's team, which also participated in this Argentinean-American initiative, managed to identify how changes in the structural properties and the surface of metallic oxide influence the coagulation response of blood. But, for now, on the experimental terrain, investigators think that this same nanomaterial could be used to transport antibiotics and therapeutic proteins.

The truth is that "bionanomedicine" is only one of multiple fields where experiments are being done using these types of materials.

Dr. Galo Soler Illia, an investigator of CONICET and the Atomic Energy National Commission, is working on the development of a nanoporous oxide material with "eco-friendly" properties.

"We made a type of sponge with nanometric holes, a "nano- gruyere cheese", that can, for example, capture polluting molecules," he said to LA NACION.

"In a gram of titanium oxide, thanks to its nanoholes, we were able to create 200 to 300 square feet of exposed surface, something equivalent to a tennis court," said Soler Illia, who presented his work during the meetings.

Another area of nanomaterial experimentation is in energy generation. Thomas Moore, chemistry professor of the Arizona State University Center of Bioenergy and Photosynthesis, is running experiments in the area of energy efficiency from a biological perspective.

"In our laboratory, we were inspired by biology to create artificial photosynthesis with the help of nanotechnology. Although it is already known how to transform solar energy into electricity, our challenge is to convert solar energy into fuel," noted Moore.

For this, they are currently experimenting with photobiocombustable cells, which work via light-generated chemical reactions, utilizing ethanol and hydrogen. But Moore emphasizes that, for now, there are still many obstacles to overcome.

The meetings, where these scientific advances were presented, were organized by Lia Peitrasanta, Director of the Advanced Microscopies Center of the Faculty of Exact Sciences of Buenos Aires University, and by Heather Maynard from the Department of Chemistry and Biochemistry [...as well as the California NanoSystems Institute...] of the University of California at Los Angeles.

"The objective was to promote the meeting of investigators and students from both countries to exchange experiences, to stimulate discussion about the latest advancements in the area of nanomaterials, and to strengthen cooperation between participants," said Pietrasanta to LA NACION.

The meetings, which had 82 participants, received support from Argentina's Ministry of Science, Technology and Productive Innovation and from the Embassy and State Department of the United States.

The organizers are planning to hold a second workshop in Argentina in 2010 and another one the following year in the United States.

This article was originally published in La Nacion (Spanish)

http://www.international.ucla.edu/article.asp?parentid=107093

Posted: April 15, 2009

Nanomedicine's use of targeted delivery vehicles will revolutionize cancer diagnosis and therapy

(*Nanowerk Spotlight*) Applications with targeted nanoparticles are expected to revolutionize molecular imaging and cancer therapy. Cancer researchers are looking to nanoparticles as agents in various nanomedicine applications – as a drug carrier capable of localizing, attaching to, and directly releasing drugs into the cell nucleus; as a cellular biomarker; and as imaging and therapy agent in cancer medicine.

In today's chemotherapy, together with radiation and surgery the main tools against cancer, doctors are pumping the patient full of cytotoxic drugs, that go everywhere in the body, with the hope that enough of the drugs reach the cancer cells and target their nuclear DNA to damage it or destroy the cell. Not only do chemotherapeutic techniques have a range of often serious side effects, mainly affecting all the fast-dividing cells of the body, it also has been shown that often less than 1% of the administered drug molecules enter tumor cells and bind to the nuclear DNA.

Another complication is drug resistance of cancer cells. This actually is one of the main causes of failure in the treatment of cancer. Dividing cancer cells acquire genetic changes at a high rate, which means that the cells in a tumor that are resistant to a particular drug will survive and multiply. The result is the re-growth of a tumor that is not sensitive to the original drug.

Cancer researchers are therefore experimenting with nanoparticles as both contrast agent and drug carrier capable of pinpointing and destroying individual cancer cells.

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