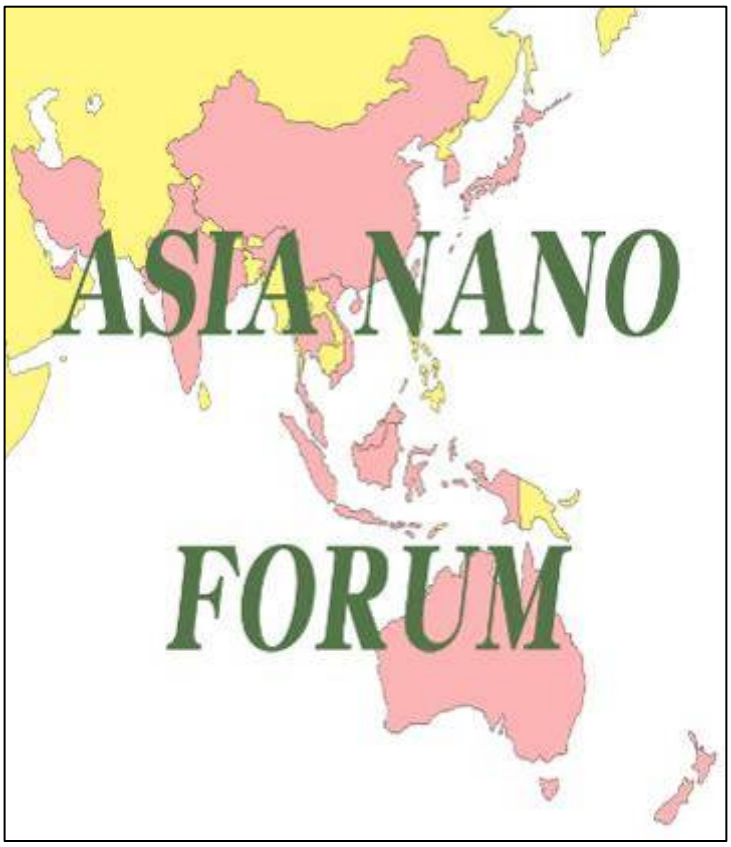

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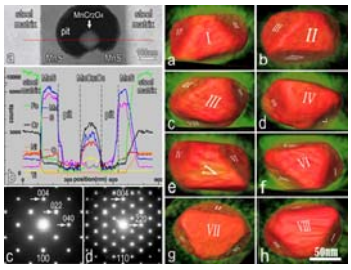

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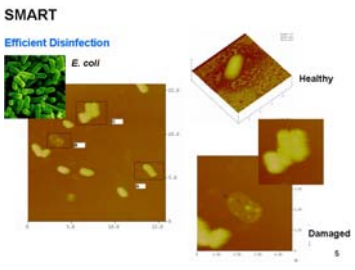

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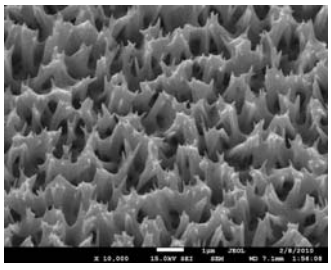

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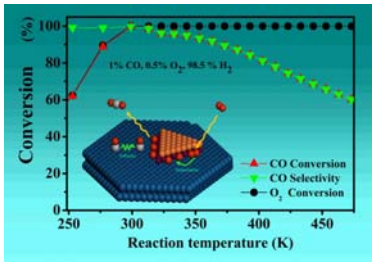

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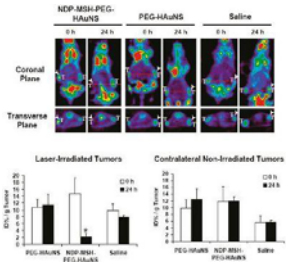

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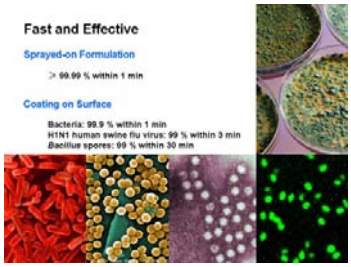

Courtesy of Hong Kong

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NEWS

✧ Partnerships/Collaborations

China

- *SuZhou City in China Promotes Nanotechnology Industrialization - Highlight of Symposium on the Transition of Suzhou and Suzhou Industrial Park (Ms. Jing JIANG, NanoGlobe)*

A high level government and industry delegation from SuZhou visited Singapore in July 2010 and held a grand ceremony on July 8th inviting Singapore high level government officials and industry leaders as well as research institution executives and distinguished scientists to express Suzhou government's appreciation to Singapore for a twenty-year long mentorship, partnerships and friendships in advancing Suzhou High-tech industry and economic development. The Suzhou delegation is led by Mr Jiang Hongkun, Secretary of Suzhou municipal committee of Communist Party of China. The ceremony is themed as Mutual Benefits through Harmonious Cooperation. Suzhou and Singapore authorities signed 34 contracts with a total value of 1.6 billion US dollars on the cooperation of finance, technology, tourism, logistics, and outsourcing. Having identified nanotechnology as the impetus of innovation, Suzhou Industrial Park (SIP) plans to invest 10 billion RMB (1.5 billion USD) and will further attract 50 billion RMB (7.5 billion USD) investments in five industry areas: nanomaterials, optoelectronics, bio-pharmaceuticals, nano manufacturing, and nano energy. NanoGlobe (on behalf of SingNano) and Biobay (on behalf of CHINANO) signed a MoU for promoting bilateral collaboration in nanotechnology R&D and industrialization between Singapore and China. (Read the Whole Article)

India

- *Indian-Korean nanotechnology collaboration to supply high-end nanofabrication equipment (Dr.S.Joshi, ARCI)*

The Nano Science & Technology Consortium (NSTC) located at NOIDA, India, announced a tie-up with Midas Systems, Korea to supply high-end nanofabrication equipment in India. “With this collaboration we hope to be able to supply high-end equipment to various industries in India. Our dream is to see India as a leader in Nanotechnology by the year 2020”, said Mr. Puneet Mehrotra, Director, NSTC.

- *Webinars on nanotechnology for a knowledge society in emerging economies and developing countries (Dr.S.Joshi, ARCI)*

The ICPC-NanoNet project, an European Union funded project brings together partners from the EU, China, India, Russia and Africa, with the goal of providing wider access to published nanoscience research and opportunities for collaboration, and issued an invitation to a series of two unique free online events. These webinars consist of an online debate on the contributions nanotechnology may make to a knowledge society in developing countries and emerging

economies, and will offer a platform for information exchange on good practices and proposals for international cooperation among governments of the Netherlands, the European Union, and International Cooperation Partner Countries. (http://www.icpc-nanonet.org)

- *Association for well-organized growth of nanoscience and nanotechnology in Asia (Dr.S.Joshi, ARCI)*

A new association, the ANNA (Asian Nanoscience and Nanotechnology Association), to group Asian scholars engaged in research and education in all aspects of nanoscience and nanotechnology, has been launched. The mission of ANNA is to keep pace with the growing needs for cooperative interactions in these fields among researchers in Asian countries, while also having an impact on future technology and life standards worldwide. ANNA is a nonprofit organization registered under the Ministry of Economy, Trade and Industry, Japan. It is composed of its members, director board members, and National Nanoscience and Nanotechnology Associations (ANNA chapters) of the People's Republic of China, India, South Korea, Singapore, and Taiwan, with more Asian countries expected to join in the near future.

Indonesia

July 15, 2010 – Engineering Data & Information Center (EDIC) Faculty of Engineering, University of Indonesia and Indonesian Society for Nano signed a memorandum of understanding for collaboration in sharing nanotechnology information. Starting point of this agreement came from both organizations' understanding about the importance of promoting Nanotechnology to increase people awareness about nanotechnology.

Iran

- *President Ahmadinejad Presents Qatari Emir with Iranian Nanoscope (Mr.A.R.Roodsaz, INIC)*

TEHRAN (INIC) - Iranian President Mahmoud Ahmadinejad at the end of a joint press conference in Doha presented Qatari Emir Sheikh Hamad bin Khalifa Al Thani with a home-made Iranian nanoscope.

"This is a gift from the Iranian technology to Qatar. You can use it in educational and research centers," Ahmadinejad said, addressing the Qatari Emir.

During the press conference, Ahmadinejad also pointed to the fact that the device had been made by the Iranian specialists and only five other countries apart from Iran are able to make the device.

After receiving the gift, the Emir of Qatar stated, "In 1960s during Gamal Abdel Nasser rule, Iran gave a present to Qatar, which we still keep. We are happy to receive this present today and we will protect this present too."

Ahmadinejad had presented two other nanoscopes to the Brazilian and Venezuelan Presidents before.

During his visit to the nanotechnology stall in 'Made in Iran Exhibition' in May 2010 in Doha, the Qatari Minister of Energy and Industry observed closely the abilities of the nanoscope, and he described Iran's progress in the field of nanotechnology as "very interesting".

The production of the Iranian nanoscope, commercially known as NAMA, began in May 2007. In addition to the noticeable technical progress of the nanoscope, a considerable number of this device has been sold to the domestic and international research centers and universities. It also provides the researchers in nanotechnology with analytical services.

- *ISO Approves Iran's Method for Nanomaterials Catogorization as Int'l Standard (Mr.A.R.Roodsaz, INIC)*

TEHRAN (INIC)- The International Organization for Standardization (ISO) approved the method suggested by Iran for categorizing and classifying nanomaterials and published it in the form of an international standard.

Iran Nanotechnology Standardization Committee (ISIRI/TC229) had proposed a method entitled 'Nanotechnology Tree' for the categorization of various types of nanomaterials and nanostructures to the International Nanotechnology Standardization Committee (ISO/TC229). After studying the proposal at various stages, the 32 member countries of the committee approved the publication of the standard.

The standard, entitled “Methodology of Categorization and Classification of Nanomaterials” presents a methodology and a systematic method in order to categorize and classify nanomaterials according to their size, chemical nature, properties, and characteristics.

Nanomaterials can be easily classified by this method according to their properties and characteristics, and they can be placed in similar groups in a branch of the tree. As a result, similar standards can be devised for nanomaterials with similar properties.
Nanotechnology Trees have been used in Iran for several years in order to classify nanomaterials.

The extent and the rapid development of nanotechnology will result in a wide range of nanomaterials to be produced by this technology in the future. Therefore, studying and compilation of standards both in the field of measurement and properties determination and in the field of safety and security will be very difficult without categorizing or classifying nanomaterials.

The fourth standard was published by ISO/TC229. Having had an active participation in the meetings of the committee, Iran has played an important role in the compilation of these standards.

- *Iranian Companies Attended NANO KOREA 2010 Exhibit (Mr.A.R.Roodsaz, INIC)*

TEHRAN (INIC)- Iranian companies active in the field of nanotechnology presented their latest achievements at an international exhibition named NANO KOREA 2010 in South Korea.

The exhibition was held on August 18-20 at KINTEX center, South Korea.

NATSYCO, producers of STM microscopes, Sodoure-Ahrare-Shargh Ltd., supplier of Khazra fertilizer, Middle East Bio-Researchers, producer of food preservative additives, Asia Technology Pioneers Ltd., producers of durable polymers based on nanotech, and Payamavaran Nanotechnology Fardanegar Co., producer of VSM equipments were the Iranian companies which attended the international event under support of INIC.

One of the goals of INIC is to introduce and present the latest scientific/technological achievements of knowledge-based Iranian companies at the international platforms. Seemingly, this international exhibition provided a suitable opportunity for Iranian companies to get to know and interact/exchange ideas with their foreign counterparts.

Prior to this, Iran has actively participated in several other international exhibitions held in foreign countries like Qatar, Japan, Russia and the Middle Eastern countries.
Iran was the only Middle Eastern representative at NANO KOREA 2010.

The 8th International Nanotech Symposium and the 3rd International Micro/MEMS Exhibition and Conference were held in South Korea simultaneously with the exhibition.

- *Iran to Hold Congress on Applications of Nanotechnology in Quality Management of Kiwifruit (Mr.A.R.Roodsaz, INIC)*

TEHRAN (INIC)- The second scientific-promotional congress on the applications of nanotechnology in post-harvest quality management of kiwifruit is expected to be held in Tonekabon city, northern Iran, on September 15.

Supported by Middle East Bio-Researchers Company and held in Tonekabon's Cultural-Educational Growth Center, the congress is intended to familiarize fruit producers of the country with the benefits of using ethylene nano adsorbers in optimal preserving of fruit, kiwifruit in particular.

Each year, considerable amounts of farm and garden products are spoiled or lose their quality due to poor inventory conditions/control. Consequently, knowledge-based inventory management and applying the principles of harvested crops preservation would be of high benefits to farmers and garden products producers/exporters

Considering the approaching harvest period for kiwifruit, the Middle East Bio-Researchers Company decided to hold the congress with the emphasis on application of nanotechnology in fruit production industry.

Participants will present their research outcomes concerning the possible role of nanotechnology in improving fruits' quality during sowing stage, their preservation during cultivation, and the optimal inventory management in four sessions.

Next to the lecture halls, several educational workshops about ethylene adsorption by nano adsorbers experiment and familiarization with "nano-fog" device will be held. Within the workshops, adsorption mechanism and kinetics of ethylene adsorption upon nano adsorbers together with the operation of the "nano-fog" device are described to the attendants. Also, an exhibition presenting the fruits grown assisted by the nano adsorbers and "nano-fog" will be held alongside the workshops.

Owners of garden and cool rooms and fruit exporters are among the participants of the event.

- *Iran Nano 2010 Exhibit Extended (Mr.A.R.Roodsaz, INIC)*

The exhibition is due to be held on October 25-29 at Imam Khomeini's Musalla, Tehran.

More than 130 companies have signed up for participation in the event so far and at least 250 of them are from Iran's academia, research institutions, science and technology parks, laboratories and nanotech-relevant publishers.
Moreover, representatives from countries including South Korea, Russia, Middle East and Central Asia regions have applied for taking part in the exhibition so far.

The exhibition covers several topics, namely textile industry, auto industry, constructions, oil, gas, petrochemical, composites and polymers, medical and pharmaceuticals, packaging, agriculture and raw materials for nanotech processes.

Korea

- *Establishment of National Nanotechnology Policy Think-Tank (Dr.B.K.Choi, KoNTRS)*

On August 10, 2010, the Ministry of Education, Science and Technology (MEST) designated the Korea Institute of Science and Technology Information (KISTI) as the National Nanotechnology Policy Center (NNPC) to support efficient nanotechnology investment, comprehensive policy making, and prompt response to international issues based on the strategy of 'choice and focus'.

For the past years, the functions of national nanotechnology policy support have been distributive executed by three different organizations, National Research Foundation (NRF), Korea Nanotechnology Research Society (KoNTRS) and KISTI under the program of 'Nanotechnology information and policy support' of MEST. Thus it has caused inadequate policy support and inefficient budget input in nanotechnology, raising consistently the necessity for an integrative nanotechnology policy center.

Under the circumstances, MEST evaluated several major institutes related to nanotechnology on their capability and growth potential as a pivotal player in nanotechnology policy. And finally, referring to major nanotechnology researchers' opinions, MEST designated KISTI, which has been undertaking tasks of collection and management of nanotechnology information and operation of NanoNet (Nanotechnology information portal website) for the last ten years (2001~2010), as the National Nanotechnology Policy Center (NNPC). MEST adjusted similar policy support functions which have been distributed among separate organizations and eventually unified them into the policy center.

Main objectives of the National Nanotechnology Policy Center (NNPC) include: to support long-term policy making in nanotechnology area including "Comprehensive Plan for National Nanotechnology Development", to discover future strategic technology projects through promising technology exploring and to study policy trend, to collect and analyze nanotechnology information, and to diffuse research performance and foster human resources in cooperation

with global organizations. While KISTI originally has gathered nanotechnology trend information and analyzed simple basic statistics, NNPC is to specialize and systemize previous work scopes to execute 4P (paper, patent, people, and performance) analysis and TRIZ analysis. NNPC will also provide in-depth statistical analysis reports on domestic and global nanotechnology trend, patents, papers, etc, so that government and researchers can make the best use of their reports in time.

In particular, MEST plans to promote NNPC to play a pivotal role for supporting nanotechnology policy as a neutral organization rather than a sub-organization of KISTI. Therefore, the head of NNPC will have the independent authority to operate the center. MEST also plans to make NNPC the national-level nanotechnology policy center by maintaining the cooperative relationship with NRF and KoNTRS, and encouraging researchers' active participation.

- *Nano Korea 2010 (Dr.B.K.Choi, KoNTRS)*

"Nano Korea 2010" was held at KINTEX in Ilsan from August 17 to August 20. This large nanotechnology festival in Korea concurred with IEEE NANO, a well recognized international conference. 253 companies from 11 countries attended this event and attracted much attention in terms of size and quality. The theme for this year's meeting was "Nanotechnology for Green world".

"Nano Korea 2010" consisted of three programs, academic presentations, business exhibitions and information exchange & cooperation. For academic event, NANO conference was held. 75 globally prominent scholars in nanotechnology, including Nobel Prize laureates, were invited for the lectures and 1,011 research outcomes were presented. Nano Korea 2010 also provided exhibitions form diverse industries, such as nanotechnology, microtechnology, printed electronics technology and laser technology, making an unprecedented record in its size. 422 booths in total from 253 institutions in 11 countries, which increased by 100 booths compared to last year's, were offered. As a program of information exchange and cooperation, seminars in 3 areas, nanowire, mecatronics and MEMS were provided. In addition, international cooperation programs were provided between Korea-Japan, Korea-England and Korea-India.

In opening ceremony, Kim Chang-Kyung, Vice Minister of MEST, said that the government would continuously support nanotechnology development as nanotechnology is a foothold for Green Korea. Cho-Seok, Director in Ministry of Knowledge Economy, announced that the government is trying to commercialize nanotechnology and minimize safety problems in nanotechnology products. Also, three members of National Assembly, Suh Sang-Gi, Park Young-Ah and Kim Young-Hwan attended the NANO Korea 2010 opening ceremony and showed their great interests in nanotechnology.

Kim Young-Hwan emphasized the combination of traditional industries and IT & NT. Especially, he expressed that nanotechnology should be applied to the global warming, renewable energy and environmental green world, etc. and he assured more support for nanotechnology. Suh Sang-Gi said that we need to increase the competitiveness of nanotechnology and Park Young-Ah pointed out that the budget of nanotechnology area should be increased and promised an assistant at the level of National Assembly.

In Nano Korea 2010 Awards ceremony, the grand prize of nanoindustrial technology award (by the Prime Minister) went to Daejoo Electronic Materials for developing nano powder using the vapor phase process. Nanoindustrial technology awards (by the Minister of Knowledge Economy) were given to LG Chemicals, NANO Technology and WorldTube and the award by the Chairman of the Organizing Committee went to Seron Technology and JEIO.

Nano research innovation award (by the Minister of Education, Science and Technology) were given to Prof. Lee Yong-Tak from GIST, Prof. Kim Do-Hyun from KAIST, and Prof. Lee Tak-Hee from GIST. The awards by the Chairman of the Organizing Committee went to Prof. Kim Yong-Kwon from Seoul National University, Prof. Suk Jung-Hyun from University of Seoul, Prof. Hisataka Maruyama from Nagoya University in Japan, and Prof. Said Hamdioui from Delft University of technology in Netherlands.

Malaysia

- *National Nanotechnology Directorate (Prof.H.HaliMaton, UTM)*

  The National Nanotechnology Directorate (NND) was officially formed under the Ministry of Science Technology and Innovation (MOSTI) Putrajaya in June 2010. Prof. Dr. Halimaton Hamdan (hali@mosti.gov.my) is appointed the Under Secretary for NND for two years to lead and coordinate the nanotechnology initiatives in Malaysia. More information on www.nano.gov.my

- *Launching of the National Nanotechnology Statement (Prof.H.HaliMaton, UTM)*

  The National Nanotechnology Statement was launched by Datuk Seri Dr. Maximus Johnity Ongkili, Minister of MOSTI on 24 July 2010 at Putra World Trade Center, Kuala Lumpur. Detail on the statement may be found on www.nano.gov.my

- *Nano Strategic Direction, Roadmap and Plan of Action Workshop - 25-27 August 2010 Impiana Hotel Kuala Lumpur (Prof.H.HaliMaton, UTM)*

  NND organised a 3-day workshop to deliberate and formulate the nano roadmap and develop strategies and action plan of nanotechnology in Malaysia for the 10th Malaysia Plan. The workshop was attended by 21 invited participants representing various sectors. The roadmap and strategic action plan is being drafted to be tabled to the MOSTI by October 2010.

- *ICPC NanoNet Workshop 2010(14^{th}-15^{th} June, 2010) (Prof.H.HaliMaton, UTM)*

The workshop facilitated the required insight into Nanoscience and Nanotechnology (N&N) activity in International Cooperation Partner Countries (ICPC) and presented an online networking platform to foster and intensify the number of collaborations between the EU and ICPC in the area of N&N. It also provided a summary of the N&N landscape over the past year and looked ahead to the future. Finally, the workshop focused on the contribution that China and the region can make to the Framework Programme.

Prof. Hali represented NND of Malaysia and other join delegates from prestigious institutions such as the Institute of Nanotechnology (UK), St. Petersburg Electrotechnical University (Russia), Jawaharlal Nehru Centre for Advanced Scientific Research (India), Chinese Society of Micro-NanoTechnology (People's Rep. of China), Malsch TechnoValuation (The Netherlands), MERIT of University of Maastricht (The Netherlands), and Sociedade Portuguesa de Inovação (Portugal) and NanoAfNet (Africa). The workshop obtained the necessary insight into current N&N activities in ICPC, and further explored the possibility of setting up collaborations with ICPC entities of special interest.

- *A report on "Nanoscience and Nanotechnology in East Asia" is published and available for download at* www.icpc-nanonet.org

New Zealand

- *Zooming in – by Veronika Meduna (Dr.R.Blaikie, MacDiarmid Institute)*

If nano-sized machines and devices are to be part of our future world, research into the basic electronic properties of these miniscule systems is a prerequisite. However, most questions are impossible to investigate, let alone answer, through experiments alone and require the input of theoretical physicists such as Michele Governale.

Governale joined Victoria University's School of Chemical and Physical sciences in June last year. After several years at research institutes and universities in Italy and Germany, he says the MacDiarmid Institute was one of the attractions, as was New Zealand as a country. "People are a bit more relaxed but still productive. There are places that are very relaxed but nothing works and other places that are very effective but unpleasant. Here the mixture is right."

Earlier this year, Governale joined the MacDiarmid Institute as a principal investigator. As a condensed-matter theorist, he focuses on the theory of quantum transport in nanostructures and his research zooms in on the basic electronic properties of low-dimensional systems, which means that electrons are confined in their movement.

"Usually, electrons are free to roam through three-dimensional space but we can squeeze them in and make them move in a plane. A lot of physics, including three Nobel prizes, has already been done on 2D electron gases. You can

go further and confine electrons to move in a line, and that's when people talk about quantum wires or one-dimensional systems. A further step down the dimensionality ladder is taken by confining the electron motion in all three spatial directions, thus realising a quasi zero-dimensional system, a so-called quantum dot."

Governale describes quantum dots as artificial atoms because the electrons in a quantum dot show discrete energy levels, as in the textbook example of a particle in a box. "An atom is a natural given, but the nice thing about quantum dots is that we can tune the properties and engineer them so that we can test theories or use them for applications."

The degree of control over such systems means that experimentalists can change the number of electrons sitting on a single quantum dot down to the last few, they can control the potential that is keeping the electrons confined, or control the spin on the dot by applying a magnetic field. "For quantum dots realised in semiconductor structures, by using electrostatic potentials to confine the electrons in a quasi zero-dimensional system, you can drive a current through them and you can measure electrons jumping on and off the dot." It is also possible to combine quantum dots with other materials, such as superconductors or ferromagnets, and it is these hybrids" that fascinate Governale. "There are several experiments where quantum dots are coupled by tunnel barriers to superconductors so that you can investigate the superconducting proximity effect, the effects of the superconductor on the quantum dot."

In a recent series of publications co-authored with collaborators in Germany and France, Governale describes the effect of a current flowing through interacting quantum dots tunnel coupled to normal and superconducting leads. In the case of two quantum dots, the Cooper pairs in the superconductor – pairs of electrons bond together in a certain manner – break up and move to the two quantum dots, leaving the dots in an entangled state. "For me it's the pure theoretical understanding that's interesting, to see how superconductivity, quantum confinement, Coulomb repulsion and non-equilibrium phenomena are influencing each other. This can lead to new effects, but it is hard to tell whether it will lead to practical applications in the short term."

Governale says one possible use would be as a method to produce entangled electron pairs, which would be of interest in quantum computing as quantum dots have been proposed as qubits, the quantum analogue of the classical bit. "Whether we see quantum computers in our lifetime is uncertain because there are still many hurdles to overcome, but we are now also exploiting this work for possible new effects."

Governale's other main research interest is in studying timedependent phenomena in nanostructures. "With this one it's clear why it is important. If you want to use any of those structures in an electronic device you need to switch it on and off, so you need to understand time-dependent transport. It means that you ask yourself how the system responds to changes, gradual or abrupt, say in voltage. It is also interesting as a fundamental question because you want to see what quantum effects do and how the electron-electron interaction affects those response times."

One particular aspect of this research in both nanostructures and low-dimensional systems is a transport mechanism called pumping. Governale explains that in this instance, electrons are not pushed through by applying a voltage but simply by the time-dependent change in the properties of a nano-scale conductor, because the system is being moved

out of its equilibrium state. "We're all familiar with pumps that exist in everyday live, for example the digestive tract is a peristaltic system. Now people are doing the same thing with electrons in quantum dots, moving them from one side to another by suitably changing potentials. It is analogous to peristaltic pumping in a macroscopic system."

But the most exciting aspect for Governale is to predict or observe quantum effects. "You can have pumping mechanisms which do not have a classical analogue. They rely on the fact the electrons behave like waves and can show interference. These things become interesting for a theorist because they exist only in the realm of quantum mechanics and can yield counterintuitive results. However, for me the most interesting issues with pumping are how electron-electron interaction affects the process. The fact that electrons don't move one by one independently but talk to each other makes it a difficult but also interesting challenge."

As he tries to describe the complexities of the nano-world with equally complex theoretical techniques, he says he has found that Nature is often even more complicated. "Certainly more complicated than we theorists would like. Often there is more going on in an experiment than what we included in our models. As a result, it might be difficult to extract the signal that is interesting to us from spurious effects and noise."

Governale says theory and experiments have to go hand in hand and he likes to talk to experimentalists when he's dealing with a tricky issue. "I prefer to work on models and ideas that can actually be realised in an experiment, but sometimes it's impossible to know what may be possible in the future. There has been theoretical work done on the electronic structure of graphene, a single layer of carbon atoms, in the late 1940s, but at the time it was just an academic exercise. It's only now that the structure can actually be made and analysed that the work attracts a lot of interest."

To foster close links between theory and experiment, Governale is already collaborating with MacDiarmid researchers such as Ben Ruck and talking to others he would like to work with in future. "I would also like to set up a theoretical group at Victoria University. Many of the best ideas come from brain-storming sessions in groups and interaction is very important, so I'd like to bring in more postdoctoral fellows and post-graduate students while strengthening the links with my collaborators abroad."

- *Peering inside nanopores - Izon's collaboration with MacDiarmid spawns research spin offs – by Dacia Herbulock (Dr.R.Blaikie, MacDiarmid Institute)*

"We make money from invisible holes. But we can't afford to be invisible." Hans van der Voorn, Executive Chairman of nanotechnology start-up firm Izon, spreads out a series of brochures highlighting his company's brightly-coloured, cheerful-looking devices, each housing its trademark nanopore technology.

"We made a conscious decision not to have any grey instruments. It's a little unusual, I suppose, for science, which can be a bit serious. [Our competitors] are all beige or grey boxes. They look like little microwaves. Boring as hell. We wanted these to be the centre of attention in someone's lab."

From an initial research idea five years ago, Izon's devices have emerged on the international market as the self-proclaimed "world's most comprehensive nanoparticle analysis systems".

Inside each coffee-grinder-sized machine is a plastic membrane containing a single flexible nanopore -- a tiny hole which can be "tuned" by stretching and relaxing the plastic to allow particles of different sizes to pass through one-at-a-time.

As they cross, the particles trigger a characteristic dip in the electric current that runs across the membrane, allowing precise measurements of the quantities and characteristics of the particles in transit. Under the right conditions, the technology can record particles as small as an individual molecule.


Hans van der Voorn holds one of the devices used to analyse nanoparticles

One of Izon's product lines has been customized to count viruses -- an application particularly suited to vaccine research laboratories. Another major target for Izon is the emerging field of nanomedicine, which uses nanoparticles for targeted drug delivery. Here, reliable measurements of the number and attributes of the nanoparticles involved are critically important.

Bringing their initial concept out of the lab into working prototypes and fully-fledged commercial-scale production has taken a great deal of hard work and investigation, but Hans says they still face many unknowns. "We're still learning. I don't think we'll ever stop doing research."

Over the past four years, that research has involved MacDiarmid partner organisation Industrial Research Limited (IRL), and has more recently grown into a multi-faceted collaboration with the Institute itself. Out of this collaboration, a new understanding of the basic science underpinning Izon's technology is emerging, with direct applications for the company's commercial goals.

In 2008, MacDiarmid, IRL and Izon (then known as Australo) launched a joint project entitled "Nanotechnologies for DNA sequencing". It aimed to combine two very different technologies, each with the capacity to measure objects on the scale of a single molecule, and apply them to the complex task of decoding genes.

The idea behind the project was IRL senior scientist Jeff Tallon's brainchild: if Izon's nanopores could be adapted to thread a single nucleotide of DNA through the pore, the genetic sequence could be read off base-by-base as it passed through the hole.

The second technology, MacDiarmid's surface enhanced Raman spectroscopy (SERS) system, had demonstrated the ability to detect individual molecules with its laser light-scattering technique. Perhaps this feat could be replicated at the site of the nanopore, and together the two technologies would form the basis for a world-leading, novel solution for rapid DNA sequencing.

That was the theory, at any rate.

As the project has progressed, it's become clear that its real value will have a lot more to do with fundamental science than with DNA.

"Since we first started, lots of others have come to the party. When people start talking about a $30 genome, that's not a market we're realistically going to chase," says Hans. "The original purpose of the project may never be met, but you find out a lot in the meantime". Currently, although single molecule-scale resolution is attain-able using the nanopores, it can't be achieved consistently. IRL's contribution to the project has focused on extending the pores' capacity.

Virus-sized particles, which Izon's current devices target, are around 50 nanometers wide. To refine this down to the width of a single strand of DNA -- only two nanometers across -- more work was clearly needed. To that end, MacDiarmid principal investigator Geoff Willmott -- based in IRL's micro- and nano-fluidics lab -- has been running a series of experiments examining which conditions give the clearest signal when a particle crosses the pore. Does a surface electrical charge on the pore make a difference? How do different nanoparticles and different solutions behave? What is the strength and duration of the signal that results? Nailing down these basic parameters will help Izon generate more reliable outcomes for smaller particles.

Another useful development came to light when the project team realised the nanopores did not appear to be stretching as much as they expected. Images from the University of Canterbury's microscopes showed that this came down to faulty assumptions about the geometry of the holes. Instead of the regular, cone-shape punctures the researchers had expected, they found more complicated three-dimensional structures when they peered inside the tiny pores. So working out how much the pores open as the plastic is stretched turns out to be a tricky problem -- something not factored into Izon's original mathematical models.

Thus far in the company's product development, Hans says, they've relied extensively on calibration to work around

the gaps in their understanding of the fundamental science. Currently, with each product sold they supply standard-sized particles and guidance on calibrating the instrument for different uses.

"We can get a very adequate answer by sending through a set of known nanoparticles. But we still don't have a model that's good enough to give someone a measurement from first principles. When we do, that will be a big advantage." Refining the model with data produced by the collaboration will be a major help as the company targets new markets and refines its products, he says. Izon sells primarily to research laboratories at present, but envisions additional applications for its technology. These include medical testing and diagnostics, and eventually hand-held devices for air and water quality testing, as well as point-of-care diagnostics in the GP's office. A better understanding of the fundamental science will improve accuracy and effectiveness, laying the groundwork for these future applications.

Another of the unexpected outcomes of the collaboration has seen Izon's flexible plastic film, or elastomer, adapted for research into the inner workings of the SERS technique in Pablo Etchegoin's palimonies laboratory. Single-molecule resolution, the starting point behind the DNA sequencing project, can only be achieved where very high SERS resonance develops. Typically, SERS works when a resonant "hotspot" develops on a surface that's been coated with a random array of gold or silver nanoparticles. These hotspots are dependent on very closely-spaced particles landing just the right distance apart, so there is little control over where and how they form.

In an effort to introduce that element of control, post-doctor-al researcher Kamal Hossain has been coating the membrane inside Izon's device with gold nanoparticles. As he stretches and relaxes the plastic, he can make direct observations of how the changing spacing between particles affects the SERS signal.

If successful, these will be the first experimental investigations of their kind, providing new fundamental insights into plasmonic resonance. It is hoped the precise observations of stretching and deformation will feed back into Izon's product development as well.

At Izon, Hans van der Voorn says this type of fundamental research isn't something he would have predicted, but that's the nature of collaboration. Other "children" of the original collaborative project with MacDiarmid include spin off projects with Massey, Auckland, Canterbury and Victoria Universities, and the addition of MacDiarmid PhD graduate Sam Yu to Izon's science staff.

According to Hans, this kind of basic research wouldn't happen without the initiative of collaborators and partner organisations. As the company has grown, its internal research priorities have inevitably shifted to focus exclusively on product development and marketing.

Well-targeted incentives for research and development early in a company's growth go a long way, he says. Izon received TechNZ funding from 2005 to 2008 that enabled them to reduce the size of their devices. They're eager to apply again, with the aim of fully automating the particle analysis process.

MacDiarmid PhD graduate Sam Yu

However, he believes restricting new R&D incentives to large companies that should be able to fund themselves is a waste of money.

"When we're a 100 million dollar company, I'm not going to have my hand out." At that stage, he says, Izon looks forward to being able to fund the MacDiarmid Institute and sponsor research in universities and CRIs.

He hopes there will be a continued recognition of the advantages of a diverse range of research funding opportunities. Izon's experience has shown that there are substantial -- and often unpredictable -- benefits from collaborations between research institutions and the commercial sector.

"It's not MacDiarmid or us. It's MacDiarmid and us. Because what they do helps us, and what we do helps them. We become symbiotic."

Singapore

- *Nanoparticles Enabling More Effective Chemotherapy: Interview with One of the World's Nanomedicine Leaders - Prof. FENG Si-Shen at NUS, Singapore (Ms. Yesie BRAMA, NanoGlobe)*

Traditional chemotherapy presently has been associated with severe side effects such as hypersensitivity reaction and toxicities thus degrading the patient's quality of life. As a visionary leader in nanomedicine, Professor FENG Si-Shen has developed new concept of chemotherapy that involves nanoparticles of novel biodegradable co-polymers resulting in more effective and efficient drug delivery, significantly improving the treatment of cancers and improving quality of life of cancer patients. There are three products related to improved chemotherapy developed by Prof. Feng's group: NanoTaxanes, TargetingTaxanes and OralTaxanes. His group has also developed the 3rd generation of cardiovascular stents, as well as novel nanoparticle formulations of iron oxides and quantum dots for safer cellular and molecular imaging application. These activities have been taking place in his Chemotherapeutic Engineering Laboratory in National University of Singapore (NUS). (Read the Whole Article)

- *Singapore Promoting Clean Energy & Sustainable City - Site Visit of the Zero Energy Building (Ms. Yesie BRAMA, NanoGlobe)*

Zero Energy Building (ZEB) of Singapore BCA Academy was officially opened on 26 October 2009. It is intended as demonstration of application of clean and green technologies as well as intelligent building design, requiring no traditional energy (fossil fuel based) at all. ZEB is a retrofit of an existing building in BCA Academy featuring innovative green technologies such as sunrays collector and mirror ducts, green shading, solar chimneys and solar panels, coated glass for heat reduction, cool paint and cool pavement coating. Since its operation in October 2009, ZEB has been producing more energy than what it has been consuming. It is estimated that the building will save SGD 84,000/year energy cost compared to a typical office in Singapore (based on 21.69 cents/kWh). In this article, we share our knowledge of the green technologies that are adopted in the building. (Read the Whole Article)

- *Nanoimprint Lithography Enabling NanoManufacturing - Singapore's Initiative in Industrial Consortium on Nanoimprint (I.C.O.N.) led by the Institute of Materials Research and Engineering (IMRE) (Ms. Yesie BRAMA, NanoGlobe)*

Nanoimprint Lithography (NIL) being simple thus low cost has attracted increasing attention from industrial players. This has motivated NIL group in IMRE, led by Dr Low Hong Yee, to form Industrial Consortium on Nanoimprint

(I.C.O.N.) to further promote and accelerate the adoption of NIL in industry manufacturing. I.C.O.N. was successfully launched together with the 4th Industrial Symposium on Nanoimprint Lithography (NIL) on 3rd August 2010. In this article, we share a brief overview about I.C.O.N. and highlight the NIL capability of IMRE presented during the industrial symposium. (Read the Whole Article)

Thailand

- *Thai labs build capabilities in nano-agri technology(Ms.S. Suteetida , NANOTEC)*

Thailand, 28 July 2010, Thailand's National Science and Technology Development Agency (NSTDA), and Department of Agriculture, Ministry of Agriculture and Cooperatives have signed a research collaborative MoU to identify and initiate agricultural research activities. The initial phase of the collaboration will focus on nanotechnology particularly in the area of food packaging and encapsulation technology for control release of fertilizers.

Commenting on the development, Prof Sirirurg Songsivilai, Executive Director of NANOTEC, Thailand, said, “The application of nanotechnology is diverse. It is predicted that nanotechnology will have major impacts on the entire food industry, changing the way food is produced, processed, packaged, transported, and consumed. Therefore, as an agriculture-based economy, it is important that relevant ministries and research agencies work together to build knowledge in the area of nanotechnology in agriculture.”

“The research collaboration initiative will be a positive experience for our researchers especially since the use of nanotechnology in agriculture in Thailand is still considered ground breaking discovery, but it will come in a dramatic way,” said Mr Somchai Charnnarongkul. Director General, Department of Agriculture, Ministry of Agriculture and Cooperatives

The research collaboration will focus on research and development of agricultural technology, sharing of human resources and infrastructure, knowledge exchange, and human resource training. In addition, the collaboration will also look at areas related to intellectual property of research output. Dr Chamorn Chawengkijwanich from the NanoHybrid Laboratory will lead the research team from NANOTEC for nano food packaging technology.

The duration of the collaboration will be for five years starting from July 12, 2010 to July 11, 2015.

UAE

- *2 days Forum on Minimum Energy Electronic Systems (MEES 2020)..*

In collaboration with the Semiconductor Research Corporation (SRC) and the National Science Foundation (NSF), Abu Dhabi Technology Investment Company (ATIC) hosted a 2-day forum on Minimum Energy Electronic Systems (MEES 2020), that took place on May 23-24, 2010,

The Forum was attended by leading semiconductor scientists, technologists and designers. The Forum provided important input for future directions in the development of micro/nano-technologies for portable electronic devices, and provided a basis for the identification of future cooperative research involving government, industry, and academia. In addition, the Forum offered extensive networking opportunities for UAE local universities with global academic and industry leaders including MIT, Stanford University, UC-Berkley, GLOBALFOUNDRIES, IBM and Intel.

Additionally, two of KUSTAR principle investigators (Dr. Abdel Isakovic and Dr. George W. Hitt) submitted a white paper proposal for the Proposal Call issued by the Semiconductor Research Corporation (SRC) on July 8th, for projects on metrology of defects and nano-enegineered materials. In short, the proposal suggests the need to start complementing the current state-of-the-art electron-based microscopies (SEM, STM, TEM) with X-ray based nano-characterization, and is focused on developing a multi-mode instrument with nano-XRD/nano-XRF/XRI capability.

✧ Commercialization and Business

India

- *Tata group unveils two new variants of low-cost water purifiers*

  Tata Group, has unveiled two new variants of its already existing low cost water purifiers which do not use electricity or running water to operate - in order to supply clean drinking water for larger number of people, especially those at the lower end of the economic bracket, at minimal cost. Manufactured by Tata Chemicals, the water purifier uses nanotechnology combined with natural ingredients, it delivers safe drinking water at a benchmark price of Rs 1 a day for a family of five.

- *Shasun's JV with US's Nanoparticle Biochem for $2-3 mn*

  Chennai based pharmaceutical major Shasun Pharmaceuticals Ltd has entered into a joint venture with US based Nanoparticle Biochem Inc to explore opportunities in the field of Nanotechnology. As per the joint venture the company will invest close to $2-3 million over the next 18 months period. The company has entered into 50:50 JV with Nanoparticle Biochem, Inc which is partly owned by University of Missouri, Colombia.

✧ New education/research program

China

- *National Science Foundation of China Launched its Significant Nano-manufacturing Project (H.X.Zhang, P.K.Uni.)*

50 projects will be financially supported and more than 600 million dollars will be funded to solve those critical issues on Micro/Nano manufacturing in recent 3-4 years. There will be a Joint Laboratory set up by 13 laboratories to make the best use of resources, and it will be open to the counterparts from China.

27-29, September 2010; Qingdao, China

India

- *Jawaharlal Nehru Technology University (JNTU), Hyderabad collaborates with Mentor Graphics and Trident Techlabs for higher education in VLSI and other nanotechnology challenges.(Dr.S.Joshi, ARCI)*

Mentor Graphics Corporation, a leader in electronic hardware and software design solutions, along with Trident Techlabs, announced a joint collaboration with JNTU located in Hyderabad. Under the auspices of its Higher Education Program, Mentor Graphics will provide the university with leading edge design tools for classroom instruction and academic research, by donating a complete suite of electronic design automation tools. The group effort will enable students to gain proficiency in VLSI (very large scale integration) design and other emerging nanotechnology challenges in a Mentor Graphics lab at JNTU.

Indonesdia

In order to increase understanding about nanotechnology for student collage, Indonesian Society for Nano organize "1st Nano Camp" held on june 21-23, 2010. This event held for students who join in Student Nano Club. The event explain nanotechnology intensively and its product application.

Iran

- *NIC Holds Advanced Technology Courses for Special Students 2010-08-07 (Mr.A.R.Roodsaz, INIC)*

TEHRAN (INIC)- Students shortlisted at the first stage of Student Nanotechnology Olympiad will take part in various educational courses to be held by Iran Nanotechnology Initiative Council.

At this stage, students were educated in two phases in a 10-day expedition, which had been commenced on July 30. In the first phase that takes place in Research Institute of Petroleum Industry, the principle of nanomaterial production methods is introduced to the applicants. Then the students are trained to synthesize samples through various methods such as sol-gel and wet chemistry, chemical steam sedimentation, spray pyrolysis, micro-emulsion, and hydrothermal.

The applicants were invited to University of Tehran in the second phase that began on Saturday, July 7. The major part of the second phase is about a simulation workshop at a nano scale.

A visit to the laboratories of Nanotechnology Research Centre of University of Tehran completed the second phase, which finished on Monday, July 9, simultaneous with the second stage of the examination.

Research Methodology Workshop and Technology Management Workshop are among other educational courses that have been scheduled for this scientific expedition.

UAE

- *Kustar send students to Taiwan for their summer internship(Dr.A.Dawood, Kustar)*

In this expedition ten students, visited various research centres and universities in Taiwan, to discover the world of Nano-technology and to expose the students to the latest, mind boggling, research activities.

In the first two weeks they toured institutions scattered all over Taiwan such as, the Institute of Physics or Academia Sinica (Taipei), the National Taiwan University (Taipei), the National Tsing-Hua University (Hsinchu), Hsinchu Science Park, and many other science parks and research centres.

The tour covered many aspects including visits of their research laboratories where they had the chance to witness the real work, and the science involved in Nano-scale technologies as well as all equipments required for such work. They also had the chance to talk to the professors about their under- and post-graduate programs which leads to specialists in material science and nano-scale technology.

In the final week, the students were divided into 5-groups, each group was assigned a mini project. The students worked on; 1) Deposition and observation of Ge nano-particles, 2) Atomic force microscopy, 3) Dynamics of DNA molecules in different environment, 4) Gold Nano Rod Chemo Synthesis, 5) DIY YBCO superconductor.

At the end of the 3rd week, students presented their work before a panel of experts and many questions were asked in relation to the work they had done.

- *Kustar students visiting Germany for their summer internship(Dr.A.Dawood, Kustar)*

With the support of Abu Dhabi Educational Council (ADEC), several UAE students from different institutions (including KUSTAR) participated in an 8-week internship/summer camp that focused on the manufacturing of nano-electronic semiconductor integrated circuits. The summer camp was held in a German fabrication facility that is owned by Abu Dhabi Technology Investment Company (ATIC) and operated by its Global Foundries business unit.

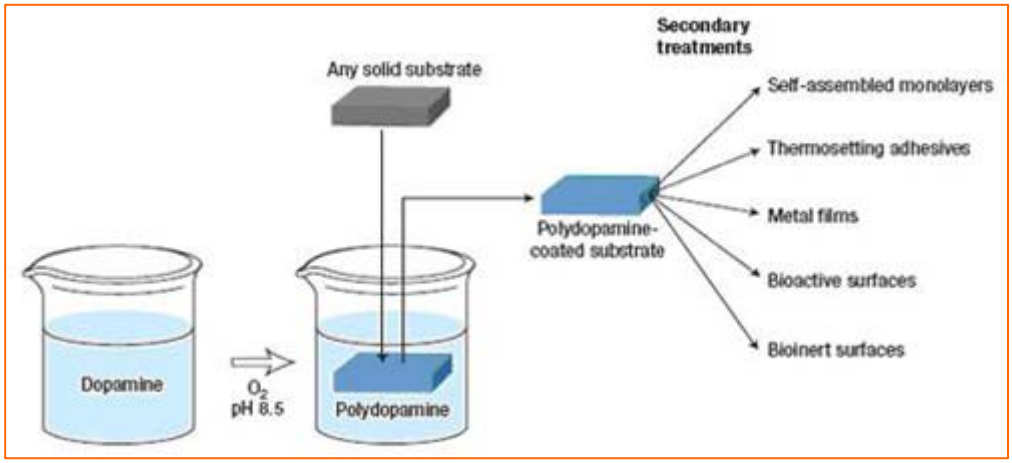
RESEARCH BREAKTHROUGH

China

- *Research on Polydopamine-based Composite Films(Dr.H.W.Dong, Nanoctr)*

Progress in the research on material surface modification and preparation of nanocomposite films has been achieved by the research group of Polymer Tribology of the State Key Laboratory of Solid Lubrication, Lanzhou Institute of Chemical Physics (LICP), CAS.

Surface and interface have always been a research focus in nanoscience. The properties of materials can be improved by tuning the surface microstructure and composition. Currently, there exist many techniques for surface modification. However, the development of a facile method with strong applicability has still been a challenge.



Schematic diagram of the construction of multi-layered films by using polydopamine coating as the interlayer (Picture/WANG Jinqing et al.)

What's encouraging is that the polydopamine material recently reported has made the development of such method possible. Polydopamine possesses two distinctive characteristics: firstly, it can be attached to almost all surfaces to form polydopamine coating; secondly, there is a great quantity of functional groups on the surface of coating thus formed. The functional groups can undergo a series of reactions, which create the conditions for the further modification.

Researchers of the State Key Laboratory of Solid Lubrication have constructed a series of polydopamine-based composite films on various material surfaces, including single crystalline silicon wafer, aluminium sheet and some polymer substrates by using polydopamine as the platform. They have investigated in detail the relationship between the micro-structure and the properties (tribological property, corrosion resistance, biocompatibility, etc.) of the films as well.

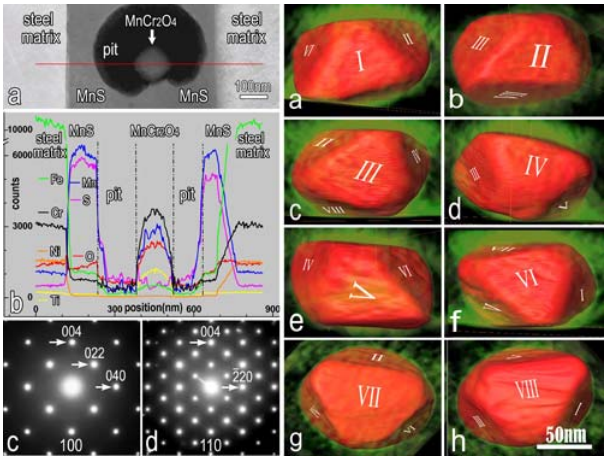
It has been found that the as-prepared multi-layered films and substrates were combined through covalent bonding due to the introduction of polydopamine. And the film was connected between layers through covalent bonding as well. The films show greatly enhanced stability, excellent tribological property, corrosion resistance and biocompatibility.

The research results were published in The Journal of Physical Chemistry C (2009, 113: 20429-20434), Applied Surface Science (2009, 256: 894-899) , Colloids and Surfaces B: Biointerfaces (2010, 76: 123-127) , Progress in Organic Coatings (2010, 68: 244-247) and Surface and Interface Analysis (DOI 10.1002/sia.3631).

The work was supported by the National Natural Science Foundation of China and Hundred Talents Program of the CAS.

- *MnCr2O4 Nano-octahedron in Catalysing Pitting Corrosion of Austenitic Stainless Steels was Identified (Dr.H.W.Dong, Nanoctr)*

Stainless steels are widely used in modern lifefor their superior corrosion resistance. However, stainless steels are actually not "stainless"; in the presence of aggressive anionic species they are susceptible to the localized pitting corrosion that is one of the major causes of materials' failure and hence leads to a huge loss to our society. The pitting event is generally believed to originate from the local dissolution in MnS inclusions which are more or less ubiquitous in stainless steels. However, the initial location where MnS dissolution preferentially occurs is known as unpredictable, which makes pitting corrosion remain a big headache for stainless steels.



Identification of the spinel MnCr2O4 nano-octahedron around which MnS dissolution occurs in the presence of salt water.(Image by SYNL)

Recently, Professor MA Xiuliang and colleagues at Shenyang National Laboratory for Materials Science applied in-situex-environment transmission electron microscopy (TEM) and found a number of nano-sized octahedral $MnCr_2O_4$ crystals embedded in the MnS medium, generating local MnCr2O4/MnS nano-galvanic cells. The TEM experiments combined with first-principles calculations clarified that the nano-octahedron, enclosed by eight {111} facets with metal terminations, is "malignant", which acts as the reactive site and catalyzes the dissolution of MnS. This study uncovers the origin of MnS dissolution in stainless steels and provides a new basis for understanding pitting corrosion of stainless steels. This work has been published recently in Acta Materialia (58, 5070-5085, (2010)).

So far, little attention has been paid to the ultra-fine inclusions in stainless steels, which is based on the cognization that they do not undermine the mechanical properties of the steels. However, the nano-sized oxide particles identified in the present study are found to play a critical chemical role in catalyzing MnS dissolution and pitting corrosion of the steels. The present findings are of great importance for steel-making industry by calling for the attention to nano-inclusions whose presence is neglected ordinarily. This work is expected to draw attention of material scientists,chemists, and biomedical workers to a general concern that the phenomena similar to the one in this study may occur in a wide range of engineering alloys and biomedical materials/instruments serving in wet environments.

- *PRL Reports MD Simulations New Results of EEC from IMECH (Dr.H.W.Dong, Nanoctr)*

Supported by the Ministry of Science and Technology (MOST), Chinese Academy of Sciences (CAS) and the National Natural Science Foundation of China (NSFC), the research group of “Mechanics in Micro- and nano- systems and Physical Mechanics” from Institute of Mechanics (IMECH), CAS, achieves new research progress in the molecular dynamics (MD) simulations of wetting, electrowetting and electro-elasto-capillarity (EEC), which was published as cover story on the “Physical Review Letter (PRL)” (Yuan QZ and Zhao YP*. Precursor film in dynamic wetting, electrowetting and electro-elasto-capillarity. Physical Review Letters, 104 (24): 268101 (2010)) (Figure 1).

Dynamic wetting and electrowetting is of great importance where fundamental researches (physics, chemistry, biology, etc.) and industry (aerospace, automobile, petroleum, etc.) intersect, which relate to the classical problem of "Moving Contact Line (MCL)". As pointed by the "Huh & Scriven paradox", the no-slip boundary condition in the hydrodynamics would induce infinite energy dissipation in the corner of the three-phase contact line. Thus, a very thin (usually a single molecular layer) precursor film (PF), which is driven by the disjoining pressure and propagating ahead of the nominal contact line, is a crucial part in the wetting and electrowetting process. (1) In the wetting process, PF propagates quickly, then droplet propagates above PF. (2) In the electrowetting process, a typical electric energy in PF cannot be neglected in comparison to the thermal energy, which makes unique properties of PF. However, there exists no study on PF in the electrowetting process. There is still lacking of understandings about PF in the wetting process.

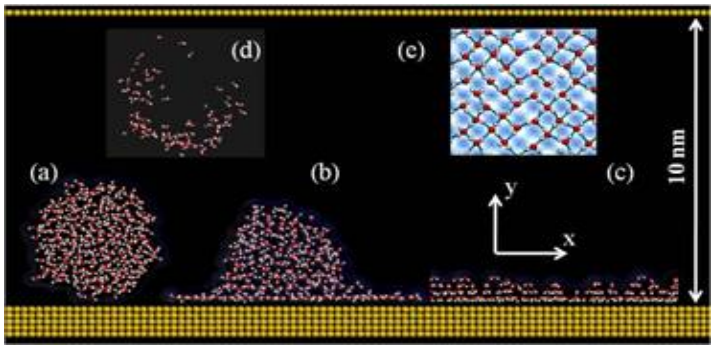


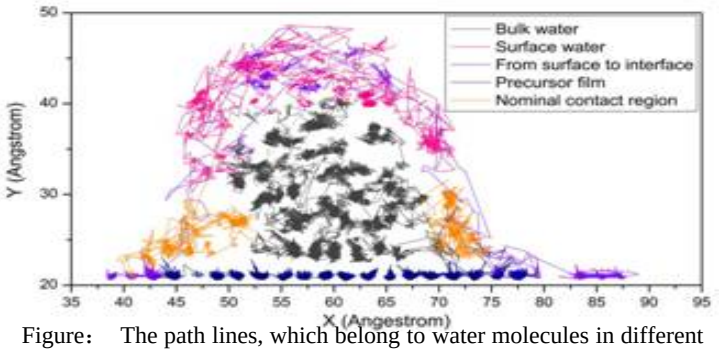
Figure: The wetting and electro wetting processes. (Picture/ZHAO Yapu and YUAN Quanzi)

Professor ZHAO Yapu and his Ph.D. student YUAN Quanzi studied the unique properties and important functions of PF in wetting, electrowetting and EEC, employing a combined method of MD simulations (Figure 2) and the

molecular kinetic theory (MKT). Their results have recently been published as the cover paper in the PRL. The new results in this PRL cover paper are as follows:

1. (a) The spreading radius R of PF obeys the power law with respect to the spreading time t (R~tn(E)), where n(E) is a function of the electric field E. (b) Owing to the fast diffusion from the surface water molecules of the droplet to the front of PF, PF propagates fast, but with low energy dissipation (Figure 3). (c) There is a unique 2 dimensional hydrogen-bond network in PF (Figure 2e). (d) Owing to the pinning of the substrate, PF is solid-like, whose self-diffusion coefficient is much less than bulk water. PF induces atomic details to eliminate the infinite energy dissipation due to the no-slip boundary condition. PF can be an answer to the "Huh & Scriven paradox".

2. ZHAN and YUAN proposed and realized EEC in MD simulations. When the size of a droplet is larger than "elaso-capilary length", soft film can wrap the droplet automatically. When external electric field is induced to this system, EEC would happen. PF pushes the soft film to unwrap the droplet under electrostatic force. EEC exihibits the important role of PF in the electrowetting process, as well as a potential application in nano/micro drug delivery.

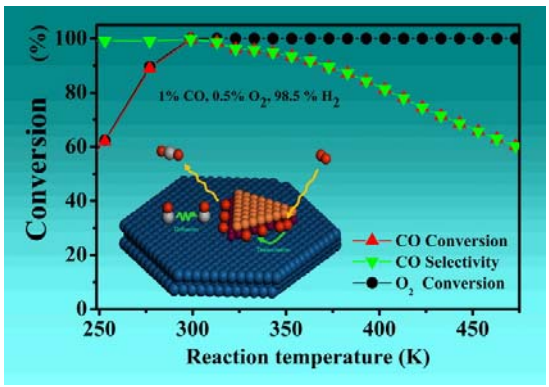


Figure： The path lines, which belong to water molecules in different region, in the wetting process

The PRL referees highly evaluate this work “The Letter suggests a novel mechanism of contact line propagation and provides an important contribution to studies of dynamics of wetting.”; "The paper raises a lot of fundamental and technical questions.” Owing to the novelty and importance of this Letter, PRL selects it to be the cover story in Issue 24, Volume 104.

- *Important Contribution in Basic Research of Catalysis(Dr.H.W.Dong, Nanoctr)*

Coordinatively unsaturated metal atoms with confined nano-structures are active sites of various enzymatic and homogeneous catalytic reactions. Realization of the controllable preparation of highly efficient and stable enzyme-like active sites on heterogeneous catalysts is a great challenge in basic research of catalysis.



Recently, in the Dalian Institute of Chemical Physics (DICP) State Key Laboratory of Catalysis, FU Qiang, MA Ding and BAO Xinhe of the research group of Nano & Boundary Catalysis, in collaboration with LI Weixue and co-workers of the Theoretical Catalysis group, have realized the generation of a kind of coordinatively unsaturated

ferrous sites (CUF sites), which were formed via the boundary confinement effect produced by the strong interaction between noble metal surfaces and ferrous atoms in mono-layer films.

Results from theoretical density functional analysis have helped the designing of the CUF sites. Under the synergistic action of the CUF sites and metallic supports, highly unique catalytic activities were exhibited for low temperature activation of oxygen molecules. Thus, by applying this approach to the selective oxidation of CO in the presence of rich hydrogen (CO PROX) under real operating conditions of proton exchange membrane fuel cells(PEMFC), CO could be removed with high efficiency.

These results were published in the Science journal appeared recently (Science 2010, 328, 1141). This achievement was also reported by the C&E News in America and the Chemistry World in Britain.

These results were published in the Science journal appeared recently (Science 2010, 328, 1141). This achievement was also reported by the C&E News in America and the Chemistry World in Britain.

Hong Kong

- *HKUST DEVELOPS WORLD'S FIRST SMART ANTI-MICROBIAL COATING TO CONTROL INFECTIOUS DISEASES (Dr.K.L.Yeung,UST)*

The Hong Kong University of Science and Technology (HKUST) today announced the successful development of a smart anti-microbial coating that has the longest-lasting effect against the widest range of microbes.

"This revolutionary coating will set a new standard in the maintenance of public health, as it is easy to apply, safe to use, fast and effective in killing a wide spectrum of microbes, long-lasting, and environmentally friendly," said Prof King-Lun Yeung of HKUST's Department of Chemical and Biomolecular Engineering.

"This will have monumental effect on curbing the spread of infections on a global basis. With increasing mobility, we are under increasing exposure to dangerous disease-causing microbes, such as viruses, bacteria, fungi and spores. Meanwhile, the heightened emergence of antibiotics-resistant micro-organisms presents another major global public health challenge," said Prof Joseph Kwan, Director of Health, Safety and Environment Office at HKUST.

"As contaminated surfaces are common vehicles for the spread of microbes, keeping surfaces clean in public areas is essential in controlling the spread of infections through physical contact," Prof Kwan added.

The smart anti-microbial coating was invented by HKUST's research team comprising Prof King-Lun Yeung, Prof Joseph Kwan, Prof Arthur Lau and their research assistants. It has a range of qualities that are unrivaled anywhere in the world.

Transparent, colorless and odorless, this smart coating can sustain surface disinfection by simply spraying on a broad array of surfaces, including glass, metals, ceramics, wood, concrete, paper and cloth.

Compared with conventional disinfecting coatings, the coating is effective for at least 30 days. It disinfects a full spectrum of microbes in practically all body fluids, including saliva and blood.

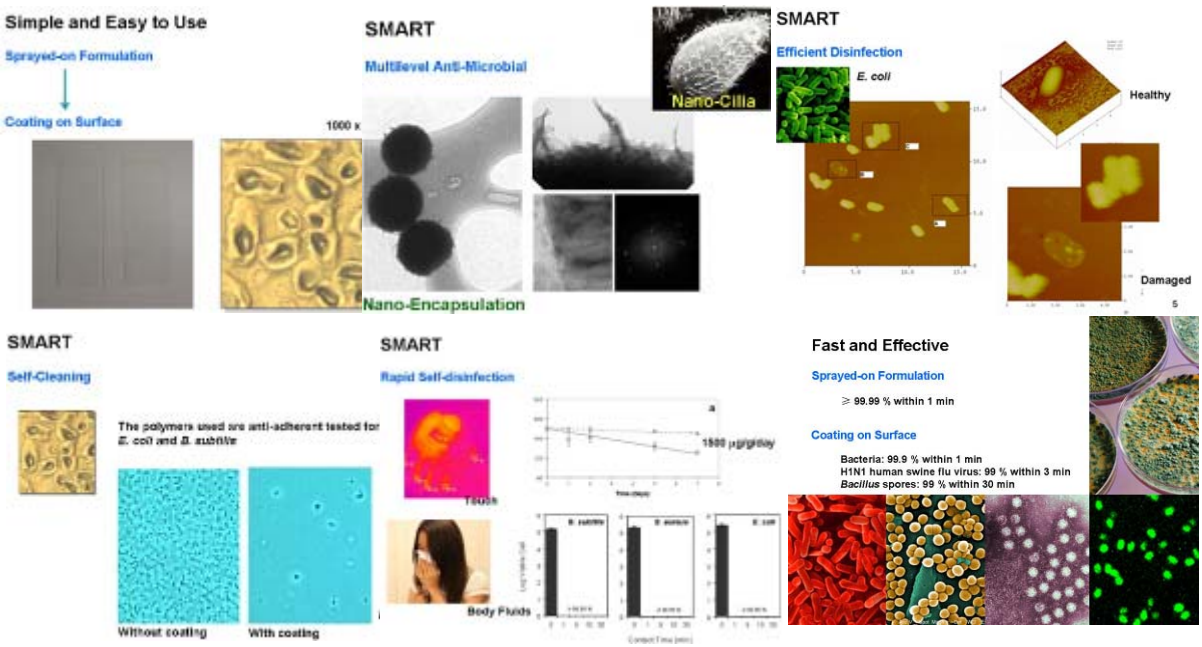
According to test results, this smart coating can kill 99.9% of bacteria within one minute, 99% of H1N1 Human Swine Flu virus within three minutes, 99 % of bacillus spores within 30 minutes, and also inhibit mold and fungal growth.

The effectiveness of this coating lasts significantly longer than the conventional disinfectants, many of which will lose their function as they evaporate. On the other hand, tests carried out in laboratory showed that this smart coating is indeed capable of long-term effective surface disinfection with 100% effectiveness even after 30 days.

Besides, the smart polymer of the coating can rapidly respond to contamination from touch or droplets. Whenever our hands touch the coating, or droplets land on the coated surface, it will sense the increase in temperature from the body heat or moisture from drops, and automatically release a larger amount of disinfectant to inactivate the disease-causing microbes. This prevents another person touching the same surface from picking up the germs, become infected, and further spread the disease.

In addition, the smart coating is easy to apply and easy to remove. A simple sprayer can be used to apply the coating liquid on the desired surface. Meanwhile, the coating can be removed by washing off with detergent-in-water solution.

Approved by US Environmental Protection Agency and US Food and Drug Administration, the ingredients of this coating are non-toxic and do not lead to any observable skin reaction. Besides, the biodegradable coating does not pose any threat to the environment.



"By stopping this route of infection, disease transmission can be better controlled. This is particularly significant as there are more and more antibiotic resistant pathogenic microorganisms such as methicillin resistant Staphylococcus

aureus appearing in our community and elsewhere. The use of a smart surface coating, coupled with good hand hygiene, can help to curb the spread of these deadly microorganisms,"Prof Yeung said.

Each year, about one billion people worldwide suffer from influenza infection with fatalities reaching half a million. These figures will further increase whenever a new strain of virus emerges. Hand, foot and mouth disease is another global public health threat, and in China alone, 1.3 million cases were recorded in the first 8 months of this year. It is hoped that the anti-microbial coating developed by HKUST will make a significant contribution to addressing this issue.

With the funding support from William Mong Institute of Nano Science and Technology, and Innovation and Technology Fund, the research on this smart antimicrobial coating started in 2003. A series of field tests will soon be conducted to explore the economic feasibility of launching this smart coating to the market.

Meanwhile, patent applications have been made in the US, Mainland China, and Taiwan. Download press release and photos: http://www.ust.hk/eng/news/press_release.php

Iran

- *Iranian Physicists Successfully Accomplish Metal-Insulator Transition 2010-09-11 (Mr.A.R.Roodsaz, INIC)*

Researchers at Isfahan University of Technology (IUT), central Iran, managed to find a way to successfully convert metal graphene into insulator graphene.

"By applying numerical methods we managed to study extra large networks and achieve primary designs for control of electronic properties of graphene (like band-gap formation with controlled geometry and desizing it to nanometric stripes)," Mohammad Hossein Zare', a member of the research group, said to the news service of INIC.

Noting that lithography methods which are used to produce nanostructures do not provide angstrom-level precision for the case with grapheme, Zare' stated, "As a consequence, the synthesized nanostructures inevitably possess uneven borders that cause strong effects in transient characteristics of the nano stripes/bands. However, it is possible to form gaps in bilayer graphene by applying an electric field perpendicular to graphene planes."

"At first, we simulated the desired network and then added disorder samples to it. The numerical Chebyshev polynomial method (KPM), which is based on polynomial expansion/approximation of functions, was used to investigate the effect of disorders on nano shells of bilayer graphene. Accordingly, local densities of states were calculated with the help of DP determination parameter. DP is a criterion by which replaced states and discrete states are distinguished. We find that this model undergoes an Anderson metal-insulator transition at a critical value of disorder strength", Zare' explained.

A more detailed report on this research work has been published in the Journal of Condensed Matter, volume 22, number 25, doi: 10.1088/0953-8984/22/25/255503.

- *Nanosensors Raise Hope for Elimination of Toxic Gases from City Air 2010-08-29 (Mr.A.R.Roodsaz, INIC)*

  The new nanosensors, fabricated in University of Tehran, Iran, proved capability of removing some poisonous gases like NO2 to a large extent from the polluted city zones.

  "The synthesized nanosensors could sense the presence of hazardous gases such as NO2 within city environment," Azam Anaraki Firouz, researcher at Nano Center, University of Tehran, explained to the news service of INIC.

  "Based on the obtained results, addition of molybdenum compounds increases the specific area which in turn improves sensor response," she added.

  Anaraki Firouz went on to say that "ultrasonic spray pyrolysis (USP) is a semi-advanced method for production of oxide or metal particles with dimensions less than one micrometer. The device has an especial design for spraying a liquid solution by ultrasonic waves. The sprayed droplets are then directed by an air stream into an electric furnace (with temperature of 1100oC)."

  In the instant research work, nano and meso porous nanostructures of molybdenum oxide-doped tin dioxide have been synthesized through ultrasonic spray pyrolysis. In these compounds, SnCl4.5H2O, ammonium hepta-molybdate, and poly methyl methacrylate (PMMA) were used respectively as the precursor, doping agent, and substrate. Also the growth and sensory mechanisms of the aforementioned compounds have been investigated.

  "Because of the present shortcomings the practical use of these nanosensors is not possible for streets and city centers at the moment. Yet such an implication is hoped for the near future," Anaraki Firouz said.

  Details of this research work are available in the Journal of Sensors and Actuators B, volume 147, pages 554-560, 2010.

- *Iranian, Azeri Nano-Scientists Find Smart Method to Fight Cancer 2010-08-22 (Mr.A.R.Roodsaz, INIC)*

  TEHRAN (INIC)- The Iranian researchers at the International Research Institute of Arian Chemie Gostar, Tabriz, in a joint work with their Azeri collaborators from Baku State University, Baku, developed a smart method to fight against advanced cancers.

  Smart nano-scaled drug delivery systems are able to identify and target cancer cells to deliver anti-cancer drugs into them without causing the problems related to toxicity issues concerning the ordinary anti-cancer medicines.

  "The outcome of this research work is a nano-scaled drug system which can carry and transfer anti-cancer drugs towards disordered cells while it is possible to monitor them via MIR at any time," Mohammad Reza Saboktakin, the researcher in chief, explained to the news service of the INIC.

  The main constituent of this drug delivery system is based on polyamidoamine polymers (dendrimer) which are acetylated through a chemical reaction and act as shells for paramagnetic iron oxide nanoparticles. Such magnetic carriers not only can transfer anti-cancer agents, but also are able to identify and cling to cancer cells.

On the other hand, the magnetic nature of the applied compounds makes it possible to track the capsules via MRI spectroscopy. This helps the therapists give appropriate diagnoses and get valuable information on tumor progression level and treatment process.

According to Saboktakin, the research findings can be used in synthesis of anti-cancer drugs and treatment of advanced cancers. "In Vivo" tests on the proposed drug were conducted and the relevant results are to be published in an esteemed scientific journal in the near future.

For a detailed report on this research work please see the Journal of Polymer-Plastics Technology and Engineering, volume 49, pages 104-109, 2010.

Korea

- *The world's first guidance of nanoparticle size analysis(Dr.B.K.Choi, KoNTRS)*

Dr. Song Nam-Ung and his research team from Korea Research Institute of Standard and Science (KRISS) and National Institute of Food and Drug Safety Evaluation from Korea Food & Drug Administration (KFDA) announced that they developed the guidance for reliable determination of nanoparticle size which can be applied to safety and quality management of nanomaterials.

The main points of the developed guidance are as follows: the minimum number of particles for analysis, the sample pretreatment method, the verification method and technology by particle size distribution function, and calculation method of the uncertainty of the size distribution measure in nanoparticle size analysis using microscopy, etc. Those methods suggested in this guidance were recognized for their excellence and published in Metrologia, a globally renowned journal in measurement area.

Nanoparticle is widely used in pharmaceutical and medical fields. A few examples among many applications are drug delivery, bioavailability improvement, development of specific organ-targeted drugs and diagnostic medical devices etc. Worldwide market size of nanotechnology industry is expected to reach about 1 trillion dollars by 2015.

Dr. Song Nam-Ung said that "We now have developed how to analyze the nanoparticle size. And we will step further to develop surface analysis method and continuously put efforts to develop better and safer nano products."

- *Prof. Yu Il-Je suggests the world's first NOAEL of silver nanoparticles (Dr.B.K.Choi, KoNTRS)*

Prof. Yu Il-Je from Hoseo University and the safety assessment team from Korea Environment & Merchandise Testing Institute (KEMTI) published their research results titled "Subchronic oral toxicity of silver nanoparticles" in ‘Particle and Fibre Toxicology’ journal on August 7, 2010. This publication suggests NOAEL (No Observable Adverse Effect Level) of silver nanoparticles for the first time in the world and this research outcome will contribute to set the safety standard of silver nanoparticles for consumers in the future.

The target organ for the silver nanoparticles was reported to be the liver of test mice and a NOAEL is 30mg/kg per day. Under this concentration level, animals exposed to silver nanoparticles showed no adverse effect.

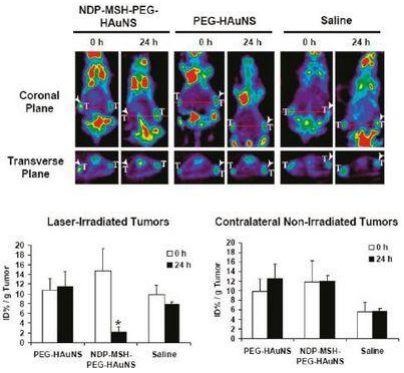
LOAEL (Lowest Observable Adverse Effect Level) is 125mg/kg and the laboratory animals gave hepatotoxic reaction above this level. In this test, test mice were exposed to 30mg/kg, 125mg/kg and 500mg/kg of 56 nm silver nanoparticles for 90 days and this experiment followed OECD's GLP (Good Laboratory Practices). As a result, the subchronic toxicity from inhaling silver nanoparticles is not so serious as expected. But the chronic toxic effects and its impact on the nervous system require further study.

Prof. Yu is currently working on the neurotoxicity of silver nanoparticles in cooperation with the National Center for Toxicological Research (NCTR) of Food and Drug Administration (FDA) of the US. This research program is part of subchronic oral toxicity study designed to establish the safety standard for the consumers who are exposed to silver nanoparticle products and it is supported by nanotechnology standardization project.

Based on this result and previous results, a risk assessment will be conducted together with domestic and foreign experts, in order to suggest the safety standard for nano products and nano workplaces. The government is determined to reduce potential risks of nanotechnology products and to provide the safety standard based on scientific evidences.

Singapore

- *Rational Design of Nanostructures and Tuning of Photo-physical Properties for Robust Cancer Detection Therapy and Drug Delivery (Ms. Jing JIANG, NanoGlobe)*

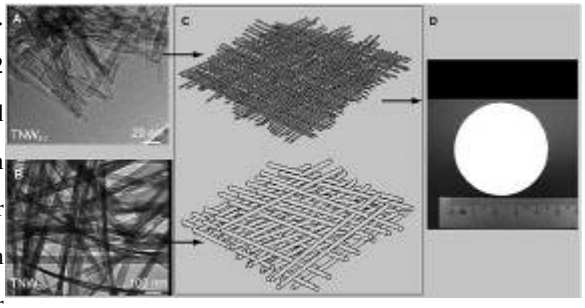


Prof. Zhang is one of world leading experts in photo-electrochemistry and optical nanomaterials. His lab is equipped with state of the art Femtosecond laser system allowing his team to probe fundamental charge carrier or exciton dynamics on the ultrafast time scale, directing more effective and efficient nanomaterials design with improved properties. We are particularly impressed by his group's recent achievement in the effectiveness of their hollow Au gold nanospheres (HGHs) in cancer detection and treatment both in vivo and in vitro. Their proprietary HGNs are ideally suited for Photothermal Ablation (PTA) therapy applications, at least 8 times more effective compared with solid Au nanoparticles, due to their strong photothermal conversion profile as a result of their unique combination of small size (average outer diameter of 30 - 50 nm), spherical shape, as well as strong, tunable, and narrow surface plasmon resonance (SPR) absorption in the NIR. The group is also developing novel solar energy conversion system utilizing synergistic effects of three-component (CdSe-TiO2:N) nanocomposite thin film. (Read the Whole Article)

- *Nanostructured Photocatalytic Materials Enable Capturing Solar Energy and Simultaneously Powering Water Purification - An interview of Associate Prof Darren Delai SUN, Nanyang Technological University, Singapore (Ms. Jing JIANG, NanoGlobe)*

A Singapore research group led by Associate Prof Darren Delai SUN in Nanyang Technological University (NTU) in Singapore has developed world leading research capability in TiO2-based nanostructures for clean water and energy

(hydrogen and solar energy) production. They have the expertise in synthesizing special shapes, composition and pre-designed nanostructures using electronspinning, hydrothermal, anodization or doping method. Their flexible TiO2 nanofiber/tube/wire membrane has not only successfully been applied in the water treatment system for the concurrent filtration and photocatalytic oxidation functions, but also used as electrodes for dye sensitized solar cells (DSSCs) to achieve low-cost, flexible and printable thin film solar cells. Dr. Sun and his colleagues designed a dye sensitized TiO2 nanostructures based system for producing clean water and electric energy simultaneously by taking advantage of both the photocatalytic and photovoltaic properties of their proprietary TiO2-based nanostructures. This smart design has great commercial potential in realizing the water purification at almost zero cost. (Read the Whole Article)



- *Nanotech Saving The Environment (Dr Ting's group, Temasek Polytechnic)*

The nanotechnology research group in Temasek Polytechnic's Applied Science School (ASc) has successfully secured the Ministry of Education (MOE) Innovation Fund grant to fund the group's research in magnetic cellulases for biofuel fermentation. This project which is effective between April 2009 and March 2012 is spearheaded by two ASc lecturers, Mr. Lim Tse Loong Wallace and Mr. Lloyd George.

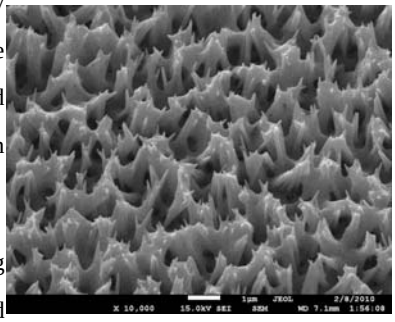
Global depletion of energy resources as well as the increase in energy consumption has created a serious global issue that needs to be tackled. A renewable solution is the use of solar energy in the form of biomass. Global potential of bioenergy is found in energy crops and lignocellulosic residues. Lignocellulosic biomass comprises of about 50% of the world's biomass and its annual production is estimated between 10 to 50 billion tons. However as only 49.8% of the 1.67 million tons of waste generated annually is recycled, this waste can serve as a huge source of lignocellulosic for biofuel production and can be processed to yield cellulose which can then be hydrolysed into bioethanol.

As the cellulase production accounts for a significant portion of the total cost of enzymatic conversion of cellulosics, the nanotechnology research group is working on fixing cellulase onto magnetic nanoparticles as this will aid in separating and recovering the enzyme from the slurry of lignocellulosic masses and its hydrolysed products. Furthermore, when the cellulase is fixed on supports, the potential of increasing the robustness, long-term stability and hydrolytic capability is significant and will further reduce the cost of bioethanol production.

By functionalising the magnetic nanoparticle with amine groups, the research group has currently achieved a maximum cellulase immobilization of about 60% and a maximum retained activity of about 80%. Furthermore results have indicated the cellulase remains active after repeated cycles of recovery and usage. This protein immobilization method can be extended to other applications in the recovery of other enzymes. The research group has also

successfully immobilized other proteins such as urease and anti-TNF onto various substrates for biomedical applications.

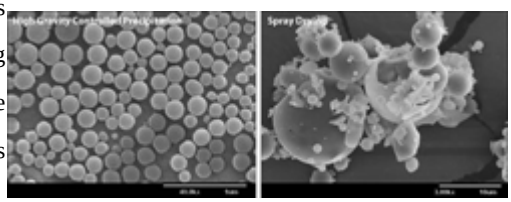
- *ZnO Nanowires and Nanoparticles Combined to Improve Dye-Sensitized Solar Cells (Source: Solar Novus Today)*



Researchers from the National University of Singapore and A*STAR (Agency for Science Technology and Research) have demonstrated a low temperature method to synthesize ZnO nanostructures that combine nanowires and nanoparticles. They also showed the usefulness of the nanostructures in dye-sensitized solar cells.

In dye-sensitized solar cells, ZnO functions as a scaffold for light harvesting dyes and as a medium for electron transport. The dyes absorb sunlight and then donate electrons to the ZnO nanowires. As electrons accumulate in the nanowires they diffuse out to the anode. Although ZnO nanowires have excellent electron transport properties, they have lower surface areas than ZnO nanoparticles. On the other hand, ZnO nanoparticles are relatively poor electron transporters.

"In this study, we have successfully employed both ZnO nanowires and nanoparticles in a single device, a combination that reaps the benefits of both nanostructures," said Ghim Wei Ho and Moe Kevin, members of the research team. As detailed in a Nanotechnology paper, they accomplished this combination by reducing the density of the nanowires and aligning them perpendicularly to the substrate using nanowire growth-selection. This chemical process allowed the nanoparticles to easily penetrate the spaces between the nanowires.



The researchers used monocrystalline ZnO nanowires with excellent electron transport properties to provide a quick and direct route for electrons to be collected at the anode. "This is essential in ensuring efficient separation of electrons and holes before recombination can occur," said Ho and Kevin.

They showed that the ZnO nanostructures enhanced the light harvesting, electron transport rate, and mechanical properties of dye-sensitized solar cells.

The structures can be formed using low-temperature synthesis, which can lessen production costs. "In addition, low temperature synthesis allows for the production of PV devices on conducting plastic substrates which are both lightweight and flexible," said Ho and Kevin. "This opens many new possibilities of implementing PV devices at the consumer level."

Next, the researchers would like to study the charge transport dynamics in these mixed-morphology dye-sensitized solar cells in order to optimize parameters such as nanowire density and length.

- *Nanomaterials Technology's High Gravity Controlled Precipitation (HGCP) platform Overcomes Nanoparticle Challenges in Clinical Applications (Source: GEN-News)*

One of the challenges in designing nanomaterials that are efficacious for clinical use is the nanoparticles themselves. Historically, it has been difficult to design nanoparticles in which multiple substances are distributed uniformly throughout the particle, and then to produce those nanoparticles with a consistent size and shape.

Singapore-based Nanomaterials Technology has overcome that with high gravity controlled precipitation (HGCP). "We can control the size the shape and shape and even the crystalinity," according to Jimmy Yun, Ph.D., CEO. "We are talking about particle design," not merely manufacturing nanoparticles. This method ensures the uniform mixing of two solutions, so nucleation can be controlled.

Nanomaterials' particles are of uniform quality, size, distribution, particle shape and morphology. Therefore, Dr. Yun explains, their contents behave more predictably than when carried by particles in which the solutions mixed unevenly, which is inherent in manual mixing methods.

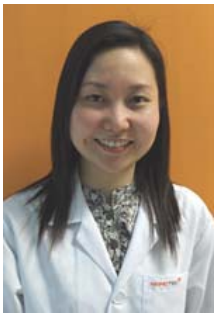
In comparing dissolution rates of gravity controlled precipitation particles with those of spray dried active ingredients, Dr. Yun says 80 percent of the HGCP particles dissolved within 10 minutes, compared to only 20 percent of the spray dried particles. Dispersion tests comparing Nanomaterials pherical nanoparticles to micro-sized APIs, the total measure of mass transfer for the nanoparticles was nearly 85 percent, compared 35 percent for the microparticles. Additional applications include using these nanoparticles as a controlled release technology for therapeutics and to induce hyperthermia for tumors (which do not dissipate heat as readily as normal cells).

The company is working at the industrial scale, designing particles as smalls as 10 nanometers. The first pharmaceutical pilot plant using HGCP technology can produce 40 tons of antibiotics per year, according to Dr. Yun, and the first commercial production facility can produce 10,000 tons per year. "We are working with the world's top pharmaceutical companies," Dr. Yun says. Nanomaterials just signed a deal to develop particles for a product destined for the FDA approval process, and has signed a license agreement with a Chinese pharmaceutical firm.

Thailand

- *Study looks at silver nanoparticle release from antibacterial fabrics into sweat (Ms.S. Suteetida，NANOTEC)*

A recent study by researchers at National Nanotechnology Center (NANOTEC) in Thailand has provided the data on detecting silver released from antibacterial fabric products using artificial sweat as a model to represent the human skin environment.



Dr Rawiwan Maniratanachote

"The amount of silver released from fabrics into artificial sweat was dependent upon the initial amount of silver coating, the fabric quality, pH and artificial sweat formulations" said Dr Rawiwan Maniratanachote, head of Nano Safety and Risk Assessment Lab. She also states that "The study could be useful to evaluate potential human risk when

exposed to silver nanoparticles from textile materials."

Application of silver nanoparticles in textile materials is one of the most interesting applications to improve the quality of the products, including wound dressings and anti-bacterial clothes. Meanwhile, there is also increasing concern on the safety of these nanoproducts.

To address public concern, the Environmental Protection Agency (EPA) has published a notice for public review and filed a petition, open to comment by concerned parties. That petition requested EPA to classify and regulate all products containing nanoscale silver as pesticides by taking regulatory actions under the Federal Insecticides, Fungicide and Rodenticide Act (FIFRA), as well as analyze the potential human health and environmental risks of nanoscale silver. These issues will certainly affect many stakeholders and, therefore, need public response and comment

Dr. Rawiwan is currently working on research projects related to human health and environmental impact of air-borne nanoparticles. The researchers reported their work in a paper published by Particle and Fibre Toxicology ("Determination of silver nanoparticle release from antibacterial fabrics into artificial sweat"). Collaborators on this study included the faculty of Science at Srinakharinwirot University, Thailand.

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China

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3. A joint contribution between MacDiarmid Institute Chemists and Engineers (Ben Flavel, Andrew Gross, David Garrett, Volker Nock and Alison Downard) has made the cover of the ACS journal Applied Materials and Interfaces (http://pubs.acs.org/doi/abs/10.1021/am100020a).
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EVENTS

Date	Avenue	Events
Oct. 3-14, 2010	**Singapore** and Kuala Lumpur, **Malaysia**	**Asia Nanotech Camp 2010 (ANC2010)**  http://www.imre.a-star.edu.sg/microsites.php
Oct.28-30, 2010	Wuxi, **China**	**The 2ND International Contest of Applications in NANO/MICRO Technologies** http://china.ican-contest.org/
Nov.9, 2010	Hanoi, **Vietnam**	**Asia Nano Forum Summit 2010** http://asia-anf.org/ANFSummitMeetingDetail.php?Id=59
Oct. 7-9, 2010	**Taiwan**	**Taiwan Nano 2010** http://nano.tca.org.tw/index.php?lang=e
Oct.14-15, 2010	Pune, **India**	**Nanotechnology-Materials & Composites for Frontier Applications (NanoCon2010)** www.bvucoepune.edu.in
Oct.23-24, 2010	**India**	**1st International Conference on Applications of Small Angle X-ray Scattering (SAXS) in the field of Nanoscience and Nanotechnology** www.nitrkl.ac.in
Oct.23-25, 2010	Beijing, **China**	**BIT's 1st Annual World Congress of Nanomedicine 2010** http://www.bitlifesciences.com/nanomedicine2010
Nov.18-20, 2010	Pathumthani, **Thailand**	**NanoThailand Symposium 2010-"Build Upon Success of Nanotechnology in Southeast Asia"** www.nano-thailand.com
Nov.19-21, 2010	Cochin, **India**	**Nanotech India 2010** www.nanotechindia.in
Dec.1-3, 2010	Kuala Lumpur , **Malaysia**	**NanoMalaysia 2010 Conference and Exhibition – "Nanotechnology as the growth engine for Malaysian New Economic Model"** Events: Malaysia Nano Summit 2010, Enabling Science and Nanotechnology Conference, Nano Exhibition, Nano Forum, Nano Education Workshop and Business Luncheon www.nano.gov.my
Dec.8-9, 2010	Bangalore, **India**	**3rd Bangalore Nano** www.bangalorenano.in
Dec. 13-16, 2010	Namakkal, **India**	**International Conference on Nanomaterials and Nanotechnology** **Nano 2010** http://www.nano.ksrct.ac.in

Jan.10-13, 2010	Islamabad, **Pakistan**	**8th International Bhurban Conference on Applied Sciences and Technology (IBCAST 2011)** http://www.ibcast.org.pk/
Feb. 7-11, 2011	Wellington, New **Zealand**	**The 5th International Conference on Advanced Materials and Nanotechnology** http://www.macdiarmid.ac.nz
Feb.16-18, 2010	Tokyo, **Japan**	**nano tech 2011 (10th International Nanotechnology Exhibition & Conference)** http://www.nanotechexpo.jp/en/
2011	Beijing, **China**	**MEMSIC Cup, The Second International Contest of Applications in Nano-micro Technology (iCAN'11)** www.iCAN-contest.com
Jun.26-Jul.1, 2011,	**Singapore**	**ICMAT 2011 (International Conference on Materials for Advanced Technologies)** http://www.mrs.org.sg/icmat2011