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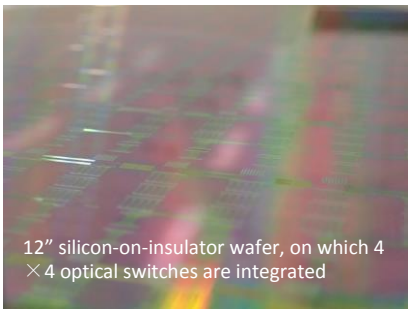

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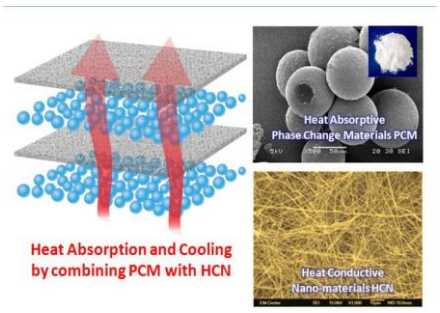

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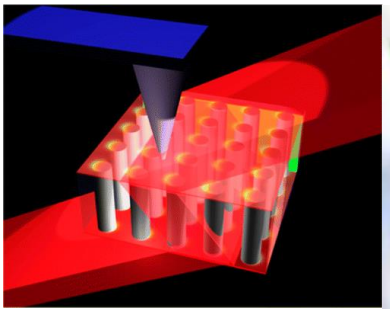
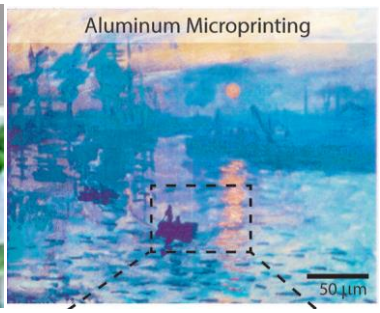
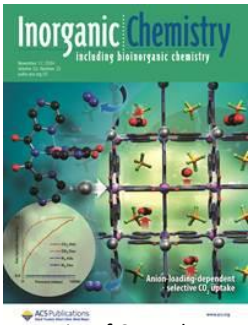


NPNT, Taiwan

MNI, Indonesia



IMRE, Singapore



Univ. of Canterbury
New Zealand

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NEWS

✧ Partnerships/Collaborations

Indonesia (Source: MNI)

- *Nano Center Indonesia – PT PERINUS (Indonesia Fisheries Corporation) Program for Adapting Nanobubble Technology*

Indonesia as the largest archipelago in the world has sea area of about 5.8 million km^2 that contains great potential of fisheries and marine resources that have to be used as the foundation of economic development. In contrary, more than 20 million tons spoiled fishes dumped to the sea each year during shipping to nearest port from fishing spot. By conventional preservation, fish could be preserved only up to 2 days.

Nano Center Indonesia and Perinus co. ltd. visitation to Japan

In order to prolong fish shelf life time during shipping, nanobubble technology becomes a new preservation method. Nano Center Indonesia, Indonesia's leading research institution on nanotechnology, and PT Perikanan Nusantara (Perinus), a state-owned enterprise deals with fishery business, collaborate for adapting this technology. PT Perinus as the only one stated-owned fisheries enterprises concern about Indonesia fisheries and has goal to optimize Indonesia economic development based on fisheries product. Nano Center Indonesia has been trusted for facilitating this project.

This joint program initiated by visiting Nanox co. ltd., which is company that already successful to commercialize nanobubble technology, in Kitakyushu, Japan. Nanofresher, one of Nanox co. ltd. machine based on nanobubble technology, picked interest of Nano Center Indonesia and PT Perinus. By using nanofresher, water dissolved oxygen (DO) can be reduced to 0.7 mg/L by dissolving nitrogen. Because of low DO in water, fish can be preserved up to 8 days. This result can give enormous beneficial for economic development in Indonesia based on marine and fisheries.

By support from Nanox co. Ltd., Nano center Indonesia and PT Perinus brought home one nanobubble machine to be field tested in Indonesia. Recently, Nano Center Indonesia and PT Perinus team have been field testing Nanofresher as new preservation method in Bitung, Sulawesi Utara. For future project, Nano Center Indonesia and PT. Perinus will test this machine to help accelerate aquaculture in Indonesia based on nanobubble technology.

Malaysia (Source: Nano Malaysia)

- *. Joint development programme between NanoMalaysia and IBM*

August 2014 – As part of the joint development programme between NanoMalaysia Berhad and IBM, a third team of three researchers have been sent to IBM Almaden's research lab to conduct research on anti-microbial coating and drug delivery applications. The joint work on platform development and testing will be an iterative process, to identify the most viable materials candidate. These researchers will explore novel candidates to antimicrobial films, and gels,

exploiting living polymerization, polymer modification chemistry, etc. The team will provide synthesis, characterization and early microbiology testing feedback to Malaysia regarding the novel candidates.

- *MoU was exchanged between NanoMalaysia and Steinbeis Malaysia Foundation*

  August 2014 - A Memorandum of Understanding was exchanged between NanoMalaysia Berhad and Steinbeis Malaysia Foundation to form collaborative efforts to tap into Malaysia's nanotechnology research and development community to create, promote and commercialize nanotechnology invention and innovation that has patentable Intellectual Property (IP).

- *MOU was exchanged between NanoMalaysia and NanoCommerce Sdn. Bhd*

  October 2014 – A Memorandum of Understanding was exchanged between NanoMalaysia Berhad and NanoCommerce Sdn. Bhd. to form a collaboration to venture into the production of synthetic nanosilica zeolites derived from rice husk ash. The exchange of the MoU was held during the 10th World Islamic Economic Forum (WIEF) in Dubai and was witnessed by the Right Honorable Prime Minister of Malaysia, Dato' Seri Najib Tun Razak.

- *MOU was exchanged between NanoMalaysia and SIRIM QAA International*

  October 2014 - A Memorandum of Understanding was exchanged between NanoMalaysia Berhad and SIRIM QAS International to develop a programme with standard protocols to verify nanotechnology elements in processes and products. The exchange was witnessed by the Minister of Science, Technology and Innovation, Datuk Dr. Ewon Ebin, the Deputy Minister of Science, Technology and Innovation and the Secretary General of the Ministry of Science, Technology and Innovation. NanoMalaysia was represented by its CEO, Dr. Rezal Khairi Ahmad whereas Pn. Khalidah Mustafa, the Managing Director represented on behalf of SIRIM QAS International. The certification programme, known as NANOVerify programme and carries the NANOVerified brand of nanotechnology product claims will be jointly implemented and developed in Malaysia with the hope of being the answer to building consumers' confidence and for setting industrial standards for nanotechnology related products.

Taiwan

- *NPNT-UC Joint Workshop on Nanotechnology, Taiwan*

  Professor Sir Mark Welland, the director of the Nanoscience Centre, University of Cambridge (UC) and the research team visited National Program on Nanotechnology (NPNT) and together held a join workshop in Taiwan this October. The joint workshop was held at the National Chiao-Tung University (NCTU) on 1st October. This workshop was to enhance the closed relationship between NPNT and UC. The speakers from both sides have given speech in several topics related in nanoelectronics and nanobio, which also created a lively interaction with all the attendees.

Photo source: National Program on NanoTechnology

- *Austrian-Taiwan Joint Workshop on Nanotechnology, Taiwan*

NPNT invited the Austrian professors and researchers with recommendation from Austrian Ministry for Transport, Innovation and Technology (bmvit) together have a joint workshop during the 2014 Taiwan Nano exhibition in Taipei. The workshop provided a discussion platform with the several topics, such as Polymeric Materials, Diamond-like Carbon and EDA in order to initiate possible further collaborations for both sides.

Photo source: National Program on NanoTechnology

- *NPNT, Taiwan continue to join the M-ERA.NET Call 2014*

NPNT is one of the observers and the first partner from Asia for M-ERA.NET --- the European joint strategic program, which is developed by a network of national and regional funding organizations, systematically advised by external high-level experts selected from the European RTD community. Taiwan has join M-ERA.NET since Call 2012. The current result, M-ERA.NET Call 2013 selected 25 full proposals for funding, and Taiwan is participating in 2 of the projects, while Call 2014 is now in the pre-proposals checking stage.

Thailand (Source: NANOTEC)

- *MOU Signing Ceremony between NANOTEC (Thailand) and H-GUARD (Korea)*

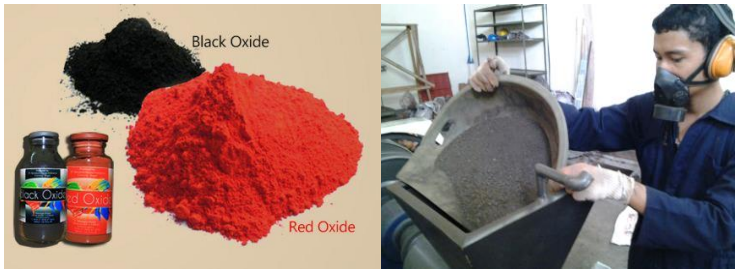
On November 26, 2014 NANOTEC (Thailand) and Bionano Health Guard Research Center (H-Guard) (Korea) has recently signed a collaborative research agreement on the topic of "Integrated dialogistic platform technology of tropical infectious disease" The Signing ceremony was signed between Dr. Sirirung Songsivilai, Director on behalf of NANOTEC and Professor Bong Hyun Chung, Director on behalf of H-Guard.

✧ Commercialization

Indonesia (Source: MNI)

- *PT. Nanotech Inovasi Indonesia (Nanovasi) : First Nano Inorganic Pigment Manufacturer in Indonesia*

Coating is one of science that already widely applied in daily life especially paint. Paint has been used not only for protective purpose but also decorative purpose. Pigment as one of paint components plays important role either to give color, have protection function,



Milling process of Nanovasi co. ltd. pilot plant and product

or both of it. For protective purpose, pigments used usually come from inorganic material such as iron oxide, etc.

International painting company recently interest to take Indonesia as one of promising market in Southeast Asia. Good side of it is many domestic paint company rise and grow to compete with international product. Though, paint sector in Indonesia rise rapidly but not many of raw material can be supplied independently from Indonesia especially pigment. To fulfill inorganic pigment needs are still imported from China or other countries.

Because of this cause, Nanotech Inovasi Indonesia (Nanovasi) co. ltd. was established on early 2014. Nanovasi co. ltd. aims not only as an ordinary inorganic pigment manufacturer but also as inorganic pigment manufacturer based on nanotechnology. By applying nanotechnology on manufacturing inorganic pigment, Nanovasi co. ltd. hopes nano inorganic pigment can give all merits that nanotechnology has for paint application and also to compete with other pigment industries that already established before.

Nanovasi co. ltd. recently establish its first factory in Gunung Putri, Bogor. First products will be launch is black and red inorganic pigment based on iron oxide. This color is chosen to be produced because of massive needs of this color from many paint company in Indonesia. This Black oxide and red oxide were planned to be launched in Q1 2015.

Iran (Source: INIC**)**

- *Iranian Scientists Convert Curcumin Existing in Turmeric into Edible Nanodrug*

TEHRAN (INIC)- The Iranian enterprise Exir Nano Sina Company succeeded in the production of an edible nanodrug by using the API in turmeric plant.

Curcumin (diferuloyl methane) is a polyphenol that is classified as one of the diarylheptanoids. This substance is the active part of a perennial plant known as turmeric. Turmeric is cultured in India, Southeast of Asia, China and the tropical zones in Asia. Many studies carried out in the past 50 years showed a few important effects of curcumin. Generally speaking, the most important biological effects of turmeric and curcumin are its anti-inflammation, anti-tumor and antioxidant specifications.

Many studies suggest that curcumin has anti-oxidant and anti-angiogenesis effects, prevents cell proliferation and aggression and can be used in the treatment of wounds, diabetes, Alzheimer's, Parkinson's, cardiovascular diseases, microbial diseases, lung diseases and arthritis.

Clinical studies showed that curcumin does not have any toxic effect and is completely safe even when it is consumed 12 grams per day for three months.

Due to the lipophilic nature of curcumin, the sorption of this substance is very low in normal forms of eating such as powders, capsules and tablets. Like other lipophilic materials, very small amount of curcumin turns into missile in a natural manner and is absorbed after being eaten. However, when it is encapsulated in nano-missiles, all of the curcumin is trapped in the hydrophobic part of curcumin nano-missiles. The spherical nano-missiles are about 10 nm in size and they increase the solubility of curcumin in water more than 100,000 times.

After being eaten, softgel capsules containing curcumin nano-missiles break in the acidic environment of stomach, and the drug is released. The nano-missiles are stable at least for six hours in the acidic environment of stomach, and they reach the small intestine without being opened.

- *First Home-Made Edible Herbal Nanodrug Presented to Pharmacies across Iran*

The first edible herbal nanodrug produced in Iran under the title of SinaCurcumin is being distributed in the pharmacies across Iran

TEHRAN (INIC)- The first edible herbal nanodrug produced in Iran under the title of SinaCurcumin is being distributed in the pharmacies across the country by the medical distributing companies after the acquirement of necessary certificates from Food and Drug Organization of the Ministry of Health, Treatment and Medical Education.

"SinaCurcumin edible herbal nanodrug contains curcumin as API, which is extracted from turmeric and it has many useful effects such as prevention of the proliferation of malignant cells in the body, anti-oxidant properties, reducing inflammation in joints, and protective effects on liver in cases like fatty liver," Dr. Mahnaz Qomi, the producer of the drug and Managing Director of Exir Nano Sina Company, stated.

Turmeric has been used in traditional and modern medicine and it is consumed as additives in cooking different meals. Curcumin existing in turmeric has very low sorption by the digestive system. However, its sorption has significantly increased by using nanotechnology and by encapsulating it in nano-missiles.

The drug is presented to consumers in the form of soft gelatin capsules in packages containing 50 capsules without the need for prescription. According to the recommendation of the producing company, the consumption of one capsule per day is appropriate for the adults. No toxic effect has been yet reported for this drug in the tests.

The production of the drug is the result of cooperation between the Knowledge-Based Exir Nano Sina Company and Minoo Pharmaceutics Company.

New Zealand (Source: Univ. of Canterbury**)**

- *Award*

Dr. Fred Samandari, one of MacDiarmid institute Board members who, as part of the Wireless Network Partnership took out the BNZ Supreme Award as well as the Minter Ellison Rudd Watts Research & Business Partnership Award.

Dr. Ian Brown, Associate Investigator at Callaghan Innovation and Dr. John Kennedy Principal investigator at GNS Science, was also an award winner as part of the Titanium powder metallurgy technologies creating a platform for high value manufacturing in NZ team who took out the AJ Park Commercialisation Collaboration Award.

- *Start-up company : Photonic Innovation*

Ojas Mahapatra, a former PhD Student in Simon Brown's group at UC, is now CEO of Photonic Innovations, a start-up that is developing technology that originated from the University of Otago. Ojas has just featured in Unlimited magazine and the company has recently featured in a number of awards. Awards: Finalists in NZ Innovators awards, 2014, Winner of Rising Star award, Deloitte fast 50 awards, 2014, Finalists in Indian Newslink Business awards, 2014. Link to Unlimited: http://digimag.unlimitedmagazine.co.nz/?iid=108233&startpage=16#folio=16

Singapore (Source: IMRE**)**

- ***'Smart' packaging that extends shelf-life and reduces food wastage***

IMRE recently signed an agreement with key industry partners to develop and test a new packaging material for industry use. The companies which have come onboard are Mitsui Chemicals Asia Pacific, Ltd (Japan), Toyo Ink SC Holdings Co., Ltd (Japan), Dai Nippon Printing Co., Ltd (Japan), Piaget Chemicals & Manufacturing Pte Ltd (Singapore) and Dou Yee Enterprises (S) Pte Ltd (Singapore). The companies are part of the IMRE-led Industrial Coatings and Packaging (ICAP) consortium.

Dr Li Xu, the principal scientist leading the R&D said, "We want to develop a protective plastic that is as effective as metallised plastic films in the market, but at 20 percent lower cost."

"Improvements to mundane materials like the plastic wrapping in your local supermarket are often taken for granted but technology proves that such innovations could significantly change the world we live in," said Prof Andy Hor, Executive Director of IMRE. "Our new material will help reduce food wastage considerably, and allow consumers to more accurately identify when food actually spoils."

The newly developed packing plastic incorporates nanotechnology that is based on non-toxic ferric compounds. The plastic also has a unique dual purpose high-barrier plate silicate sheet, which effectively blocks moisture and oxygen from seeping into the packaging, and scavenges oxygen to create an anaerobic environment that makes perishables last longer than they would in regular plastic packaging. IMRE has also developed a sensor strip that can help detect minute chemical concentrations associated with the freshness of meat, fish or poultry to give a more accurate indication of food spoilage and expiration.

The phase two of the consortium, which was launched on 17 November 2014, will further explore, develop, advance and test new materials for food packaging. The researchers at IMRE are also working to adapt the packaging material to applications in other areas like electronics and medical packaging.

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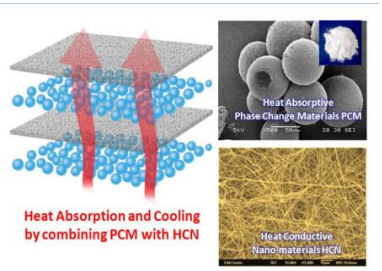
The new plastic packaging material (left) is as good as metallised plastic films but costs 20 percent less, can be used for a variety of perishables to extend shelf-life (middle). The packaging can be coupled with other IMRE technology like a 'freshness' sensor (right) that can tell more accurately when meat goes bad

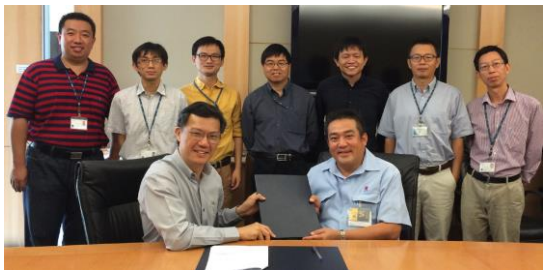
- *'Cool' materials technology for new eco-friendly buildings*

Local construction company, Sunhuan Construction Pte Ltd, has licensed IMRE's phase change materials (PCM) technology for use in constructing green buildings. The 'smart' PCM technology helps passively cool the building by absorbing the heat in the day and releasing it at night.

Under a joint project on "Nanostructured phase change materials in concrete-based construction materials for passive-cooling and green building applications", Sunhuan Construction will incorporate IMRE's proprietary PCM technology in the company's new 10-storey headquarters in Tuas.

"This will be the first building in Singapore that will use such advanced technology to passively cool the building," said Dr Shah Kwok Wei, the lead IMRE researcher for the PCM technology. The PCMs will be integrated into the walls of the building to help dissipate heat, reduce daytime temperatures within the building, and decrease energy usage from artificial cooling components like air-conditioning and fans. Construction on the new building began at the end of September.





- *IMRE and Kibing tie-up on glass technologies*

IMRE's expertise in materials such as titanium dioxide (TiO2), phase change materials, nano silver, and polymer composites are some of the R&D being explored to create high value coatings for advanced glass surfaces in collaboration with Kibing. IMRE is also helpingcontact

Kibing chart their R&D directions in glass technologies as well as advising the company on the setting up of an R&D centre in Singapore. The Zhuzhou Kibing Group Co, Ltd is one of the leading glass manufacturers in China and already has two affiliated companies in Singapore.

President of Zhuzhou Kibing Group Co. Ltd, Mr Yu Qibing, (seated, left) endorsing the MoU with A*STAR IMRE Executive Director, Prof Andy Hor (seated, right). Witnessing the signing is IMRE's Director for Industry and Enterprise, Dr Mark Lim

Taiwan (Source: NPNT)

- *MOEA, nanoMark Progress*

  - Passed 53 certification standards, 39 Companies with 2065 products

The nanoMark enhances the overall enterprise competitiveness. The nano has been promoted for 10 years and has cumulative fruitful results. From 2004 to 2014, there are already 53 companies, 2065 products that passed the nanoMark certification. The results of a market research indicated that not only can the nanoMark help the companies who have passed the nanoMark certification increase their "corporate image", gain customer affirmative and promote "market sales", it can even increase the selling price of their products by 20%. (Information/Photo source: MOEA, nanoMark website).

✧ New Education/Research Programs

Indonesia (Source: MNI)

- *3rd Interational Conference on Advanced Material and Practical Nanotechnology*

3rd International Conference on Advanced Material and Practical Nanotechnology (ICAMPN) had already successfully organized by Indonesia Society for Nanotechnology (MNI) last August. 3rd ICAMPN was attended by more than 110 participants from 8 different countries. Countries that contributed in this event either as participants or speakers were Indonesia, Malaysia, Singapore, Japan, South Korea, India, Germany, and Canada.

First day of event was opened by speech about nanotechnology by Prof. Teruo Kishi (NIMS Japan) and Dr. Nurul Taufiqu Rochman (LIPI, MNI Indonesia). Prof. Teruo Kishi spoke about development of nanotechnology around the world especially Japan. Dr. Nurul Taufiqu Rochman was continuing speech from Prof. Teruo Kishi and spoke about nanotechnoogy in Indonesia and it potential in the future. These two experts gave detail descriptions of nanotechnology and how it will develope in recent future.

Second day of event was opened by speech from Prof. Freddy Boey (NTU Singapore) and Dr. Ika Dewi Ana (UGM Indonesia). These two experts talked about success story of how nanotechnology research can be applied and commercialized. Prof. Freddy Boey was opening the day by give speech about his research and products which is already commercialized. Dr. Dewi Ika Ana was giving speech about her research product about biomaterial which is ready to commercialized.

Chairman of 3rd ICAMPN, Dr. Ikhlasul Amal, give his speech as closing statement. He expressed his gratitude toward all institutions and organizations which were already support 3rd ICAMPN including ANF which already helped to promote this event to its networking.

Iran (Source: INIC)

- *Student Nanotechnology Laboratories Network Set Up in Iran*

Student Nanotechnology Laboratories Network was established in Tehran in the presence of Iranian Vice-President for Science and Technology and the Minister of Education and Training.

The network consists of 42 nanotechnology laboratories for the education and training of students. The laboratories are equipped with at least eight important laboratorial devices in the field of nanotechnology that are made in Iran, including optical and

electron microscopes (STM, SPM, and AFM), sputtering device, electrosonic device, electrospinning, wire electrical explosion device and so on.

The plan to establish student nanotechnology laboratories began in 2012 and seven student laboratories were equipped with nanotechnology devices by March 2013. In 2014, the equipment of student nanotechnology laboratories was done faster and the establishment of 42 laboratories began. Based on the plan, 39 nanotechnology student laboratories will start their activities by March 2015.

A budget of $1,700,000 has been allocated to this program, which has been provided by Iran Nanotechnology Initiative Council, Ministry of Education and Training, and the office of Vice-President for Science and Technology.

Students of nine provinces in the country have access to nanotechnology student laboratories, and more laboratories will start work in other provinces by the end of this year.

Malaysia(Source: NanoMalaysia**)**

- *National Graphene Action Plan 2010*

July 2014 - Minister in the Prime Minister's Department has launched the National Graphene Action Plan 2020 (NGAP 2020) jointly developed by NanoMalaysia Berhad, Performance Management and Delivery Unit (PEMANDU) and Agensi Inovasi Malaysia (AIM). The launch was witnessed by the Minister of International Trade and Industry, and the Deputy Minister of Science, Technology and Innovation. This strategic alliance between NanoMalaysia, PEMANDU, and AIM has undoubtedly created a dynamic synergy to exploit newly emerging technologies, strengthen Malaysian's industries, and to establish Malaysia as a global player in technologically-driven areas of economic importance. With NanoMalaysia given the mandate as the lead agency, a Graphene Action-plan Team was formed within the entity to drive the execution of this strategy.

Singapore (Source: IMRE**)**

- *Research Focus – Consumer Care Technology Programme*

This programme targets areas such as sustainable and green materials, developing materials with high efficacy and also intelligent encapsulation for active ingredients, in the development of new materials for the consumer care industry. The programme's platform technology develops capsules that deliver active ingredients to specific targeted surfaces, such as skin, hair or fabrics. Technologies to improve the efficacy of these active ingredients, to improve deposition efficiency and selectivity, and to customize green materials for use in consumer care products also form a large part of the work done by the programme.

- Functional polymers – Using less to do more

The programme carries out studies to understand the structures, properties and relationship of complex colloids, all of which have critical impact on the performance of consumer care products. The knowledge obtained guides the design, identification and development of suitable polymer materials that

result in cost effective formulations with enhanced efficacy and stimuli-responsive properties. The group develops suitable polymer materials for better rheology modification, enhanced and targeted deposition, skin care, imaging, and added functionalities such as antimicrobials and antifungal. IMRE also explores naturally derived products as alternative, and eco-friendly materials, for the consumer care industry.

- Encapsulation and delivery systems – Protected, delivered and targeted

The programmes's platform encapsulation systems provide multiple solutions for applications at various levels. At the basic level, the IMRE technology is capable of storage, protection and controlled release of various active species such as dyes, vitamins, fragrances, flavours, lipids and oils. At the intermediate level, intelligent systems are being developed and coupled with molecular self-assembly processes to achieve triggered delivery mechanisms. At the advanced level, IMRE focuses on developing targeting capsules, which can be applied in products for skincare, haircare, fabric care, food products and dietary supplements.

- Porous films

This research studies the fundamental processes self-assembly for porous film fabrication. Such assemblies may have uses in cell-arrays, as micro-reactors, and even in the formation of inverse-opal photonic crystals. This facile and economical approach may be applied for the formation of various polymer films, including biocompatible polymers for cell-culture. We may also utilise this material for patterning 3-D microstructures.

✧ General News

Australia (Source: ANN**)**

- *APVMA Nanotechnology Regulation Symposium 2014*

The Australian Pesticides and Veterinary Medicines Authority (APVMA) hosted a symposium on nanotechnology regulation in Canberra, Australia, on 28 October 2014.

The symposium sought input from industry, scientists, regulators and the broader community on developing a regulatory framework for nanotechnologies in Australian agriculture and animal husbandry.

More than 120 people attended and contributed to discussion on the properties of nanomaterials, manufacturing, human health and environmental considerations.

The program was based on the APVMA draft report Regulatory considerations for nanopesticides and veterinary medicines, released in early October.

The report is the first of its kind to be released in draft for public exposure and discussion. National and international comment has already been received, much of it supporting the release and discussion of the working document.

During the symposium, the APVMA's Dr Phil Reeves, who produced the report, emphasised the importance of consultation and engagement when dealing with emerging technologies and encouraged further constructive feedback from participants.

He said that the process had already revealed some gaps that would be considered in the final report.

The APVMA is expecting to release the final document by the end of January 2015.

More information is available at: http://apvma.gov.au/node/11191

The report is available at: Link

Iran (Source: INIC)

- *3rd Iran-Proposed Nano Standard Approved by International Standard Organization*

TEHRAN (INIC, 2014-11-22)- The standard proposed by Iran under the title of 'Definitions for the evaluation of science, technology and innovation indicators' was approved in the 17th Meeting of the International Nanotechnology Standardization Committee held in New Delhi, India, on November 3-5, 2014.

Representatives of Iran, the United States, Germany, South Africa, Australia, Britain, Brazil, China, Switzerland, Singapore, Russia, Japan, France, Canada, the Republic of Korea, Poland, Malaysia, Mexico, India, and the Netherlands participated in the 17th Meeting of the International Nanotechnology Standardization Committee. They discussed and exchanged ideas on the compilation of international standards in the field of nanotechnology. Also the representatives of the Asian Nano Forum (ANF), European Committee for Standardization (CEN) and Joint Research Center (JRC), as well as some members from other technical committees of ISO participated in the forum.

A standard entitled "Definitions for the evaluation of science, technology and innovation indicators" had been proposed to ISO by Iran about three years ago, and it had been approved in the primary voting by the member countries of ISO/TC229. The standard was developed by Iran's leadership in the past three years, and other countries proposed revisions on the standard in forms of technical, general and editorial comments.

The standard provides definitions on expressions, including nano products, nano companies, nanotechnology market, nano devices, and so on, which are vital for the evaluation of nanotechnology. The standard focuses on nanotechnology evaluation indicators at the international level. In fact, the standard enables the evaluation of the effects of economics, volume of nanotechnology market and the number of companies and products. That is why this standard was very important to the countries and the leading countries in nanotechnology paid special attention to it.

During the meeting, the standard was discussed and it was approved by the member countries, and it will be published in the beginning of 2015 after the administration of the comments.

Meetings of the International Nanotechnology Standardization Committee are held every nine months in one of the member states.

Malaysia (Source: NanoMalaysia**)**

- *Innovating Malaysia Conference 2014*

August 2014 - Agensi Inovasi Malaysia (AIM) hosted the Innovating Malaysia Conference 2014 (IMC 2014) Prelude themed “Nanotechnology Industrial Adoption Through the National Graphene Action Plan (NGAP2020)” in partnership with NanoMalaysia Berhad. This forum was the networking channel for sharing and forming strategic partnerships amongst innovation, thought leaders, entrepreneurs as well as public and private enterprise.

- *the Lux Research-NanoMalaysia Forum 2014*

  October 2014 – NanoMalaysia and Lux Research co-organised the Lux Research-NanoMalaysia Forum 2014 themed "Innovation for Sustainable Economic Growth through Advanced Materials" on the 27th October which gave participants an ideal opportunity to learn about the latest innovation trends in Advanced Materials. The event was officiated by Datuk Dr. Abu Bakar Mohd Diah, Deputy Minister of Science, Technology and Innovation (MOSTI). Two document exchange ceremonies were held between FGV Cambridge Nanosystems with its partners.

  More than 100 top level participants from various industries attended the forum which was by invitation only. Major sponsors for the event are MIDA, FGV, SIRIM Berhad and the Malaysian Industry-Government Group for High Technology (MIGHT). More than 20 companies had participated in the one-on-one 30 minute consultation with Lux Research's and NanoMalaysia's technology experts on site.

- *The National Workshop on NanoSafety and Regulatory Aspects of Nanotechnology*

  October 2014 – The National Workshop on NanoSafety and Regulatory Aspects of Nanotechnology co-organised by National Nanotechnology Directorate-Ministry of Science, Technology and Innovation (NND-MOSTI) and NanoMalaysia in partnership with SIRIM Berhad. This workshop is aimed to enhance knowledge on the development and advancement of nanotechnology; to understand the concerns and issues that nanotechnology raises with the community; and to get expert suggestions and inputs on developing a NanoSafety Roadmap with relevant tasks required for developing and setting up the regulatory framework in nanotechnology activities.

- *Regional Open Innovation Forum on Promoting Nanotechnology and Agriculture for Sustainable Development*

  October 2014 – NanoMalaysia co-organised the Regional Open Innovation Forum on Promoting Nanotechnology and Agriculture for Sustainable Development by ESCAP-APCTT in partnership with NND-MOSTI, Malaysia. This forum envisages discussing and brainstorming coordinated actions that would contribute to bringing the gap between research, innovation and industrial applications in nanotechnology; lowering the innovation barriers and spreading the best innovation practices for rapid innovation, commercialisation and investment in nanotechnology-based value added products and sustainable agricultural technologies and systems.

- *Research Seminar & Exhibition in Nanotechnology*

  October 2014 - NanoMalaysia had also co-organised the Research Seminar & Exhibition in Nanotechnology with the National Nanotechnology Directorate which in line with the MOSTI Commercialisation Year 2014. This seminar involves presentations to know the status of implementation of nanotechnology projects. The exposition covering the entire cycle of R&D to commercialisation and in nano science and technology.

New Zealand (Source: Univ. of Canterbury**)**

- *Award*

➢ Dr. Michelle Dickinson, Associated investigator of the MacDiarmid Institute has won the Prime Ministers Science Media Communication Prize and the New Zealand Association of Scientists Science Communicators Award for 2014. Michelle's work to make the serious subject of science fun and accessible, which she does through regular radio and television appearances, tweets, blogs and her 'Nanogirl' cartoon persona (www.medickinson.com and @medickinson) .

- The Deputy Director of the MacDiarmid institute Professor Alison Downard, University of Canterbury who was named a Fellow of the Royal Society of New Zealand this week
- Dr Grant Williams, Principal Investigator, MacDiarmid institute made Member of the New Zealand Order of Merit. The honour is bestowed on those "who in any field of endeavour, have rendered meritorious service to the Crown and the nation or who have become distinguished by their eminence, talents, contributions, or other merits".

Singapore (Source: IMRE)

- *Dr Ramam recognised for his contributions to the National Standardisation Programme*

IMRE's senior scientist and Head of Industry Alliance, Dr Ramam Akkipeddi, was awarded the SPRING Singapore Merit Award (SSMA) at the Standards Partner Awards Ceremony 2014. Dr Akkipeddi was recognised for his contributions to the standardisation programme, specifically in the development of international standards for nanotechnology, where he served as the Leader of the Singapore Delegation for the nanotechnology standards working group. The SPRING Singapore Merit Award is given to individuals who have made significant contributions to the National Standardisation Programme through their commitment and resourcefulness in the development, promotion and implementation of standards.

- *The Next Generation Carbon Fibre and Future Demand for Composites and Carbon Fibres Seminar, Global Innovation Imperatives (Gii) Event in Singapore: WITS Forum 2014*

IMRE hosted the inaugural Global Innovation Imperatives (Gii) event, which was organised by the Singapore National Institute of Chemistry (SNIC) and the American Chemical Society (ACS). This year, Gii focused on Water Treatment, through the Water Innovation Treatment & Solutions (WITS) forum. The forum included talks on global water resources development and management that were presented by key leaders of industry, universities and agencies. It was concluded by a roundtable meeting on the draft of the whitepaper on "Global Challenges, Local Solutions". Prof Ellene Tratras Contis, the co-chair of the forum, addressing issues of water treatment and innovation at the forum.

Thailand (Source: NANOTEC)

- *The 4th Thailand International Nanotechnology Conference* 2014

Thailand International Nanotechnology Conference in Thailand is an international conference both scientific and exhibition which are organized every 2 years by the Nanotechnology Association of Thailand. The 4th Thailand International Nanotechnology Thailand 2014 was being held from November 25-28 at Convention Center, Thailand Science Park. A total of 30 speakers and over 500 participants were attending consecutively 3 days event. Participants and visitors are from various institutions such as academia, private sector groups, research agencies, and S&T policy officials both Thai and overseas.

- *NANOTEC and KLEAN won Silver Prize Award in Korea*

Dr. Kittiwut Kasemwong a NANOTEC researcher from Nano Delivery System Laboratory at NANOTEC and Dr. Kitti Supchukun, Managing Director of KLEAN Greentech Co.,Ltd [whose joint research on "Zeta-Technology" a mycotoxin binding for animal feed pork, poultry, and fish] received the Silver Prize Award at the recent Seoul International Invention Fair (SIIF) 2014 in Korea. Zeta-Technology is a joint research on nanotechnology in selecting various types of nanoclay particles and transform their structure into nanocomposite. The processes helps promote reinforce action, enabling the products to effectively absorb all types of mycotoxin that pose problems in livestock production. In addition, the innovation also received a Special Award from the Association of Polish Inventors and Rationalizers a concurrent event under the name of International Warsaw Invention Show (IWIS).

- *Nano Smart Soil Mobile Unit joins Chulalongkorn Watergate* 118*th Anniversary Celebration*

The Nano Smart Soil Mobile Unit from NANOTEC joins the Pathumthani Governor in celebrating the 118 Years of the operation of Chulalongkorn Watergate on November 18, 2014. The theme of the celebration is traditional, that means that everyone attending the celebration party must wear traditional dress and join in activities depicting the era of 1889.

The Nano Smart Soil Mobile Unit also performed the first field test with water hyacinth at this Watergate on October 1, 2014. As part of the Nano Smart Soil Mobile Unit promotion activity, members of the NANOTEC team distributed sample smart soil as well as the mobile unit was also on a standby for visit.

- *NANOTEC Researcher won Australia -Thailand Young University Researchers Exchange Program Award*

H.E Mr. James Wise, Australian Ambassador to Thailand recently held a congratulation party at his residence for 10 Thai researchers who were selected to participate in the Australia -Thailand Young University Researchers Exchange Program.

Dr. Pisist Kumnorkaew is a researcher from NANOTEC Integrated Nanosystem Laboratory (INS) who one of 10 Thai researchers being invited to participate in the Australia -Thailand Young University Researchers Exchange Program. He will undertake a short research exchange program to work collaboratively with Flinders University in South Australia on the topic of organic photovoltaic.

NANOTEC and Flinders University have developed a mutual friendship collaboration based on science, technology and innovation development of advanced nanotechnology applications.

The program is jointly supported by the Australian Government Department of Education, the Innovative Research University Group, and the Office of the Higher Education Commission with a goal to facilitate science and research collaborations between the two countries, and bring together future research leaders in the hope that they will foster long term relationships.

It also aims to develop early and mid-career Australian and Thai researchers by increasing their understanding of culture, in terms of science and research practices and systems, while developing their leadership skills as future science ambassadors for Australia and Thailand.

- *NANOTEC Researcher awarded ASEAN-US Prize for Women in Science*

Dr. Nuttaporn Pimpha is a senior researcher at NANOTEC Hybrid Nanostructure and Nanocomposites Laboratory who is the recipient of the 2014 ASEAN-US Prize for Women in Science Award (in the field of water quality research) for her dedication to research on water quality during the Thailand mega-flood of 2011. The award ceremony took place on August 25, 2014 at the ASEAN Science and Technology Week 2014in Bogor, Indonesia.

The award supports water quality research aimed at improving the availability of clean and safe drinking water in the ASEAN region and encourages intra-ASEAN and ASEAN-U.S. collaboration on water quality research. This is the first year that the U.S. Department of State and UL (Underwriters Laboratories) has decided to join the ASEAN Committee of Science and Technology to strengthen ASEAN science and technical capacity through an ASEAN-U.S. Science Prize for Women.

Taiwan (Source: NPNT)

- *2014 Taiwan Nano Exhibition*

Taiwan Nano Exhibition and its serial demonstration of program achievements organized by NPNT was presented between 2nd ~4th October, 2014 at Hall 1 of Taipei World Trade Center. The largest Nano exhibition in the country has been moving into its 12th year, and this year attracted over 19,000 people to visit. The 2014 exhibition included government pavilions, domestic and foreign industry forum, and technology showcases, which display influential inventions and products. Not only the potential and advancement of Taiwanese nanotechnologies but also an international platform for further collaboration and business opportunities was revealed and provided to all of attendees.

Photo source: National Program on NanoTechnology

RESEARCH BREAKTHROUGHS

Iran (Source: INIC)

- *Production of Nanosorbent in Iran to Remove Aromatic Pollutants*

Iranian researchers from Shahid Bahonar University of Kerman succeeded in the production of a sorbent with comparable advantages over the commercial sorbents in the extraction and removal of pollutants.

The sorbent is produced through a simple and cost-effective method and no disturbing bi-product is produced during the process.

In this study, a polymeric nanocomposite layer was synthesized and used for the extraction and measurement of a type of multi-cyclic aromatic hydrocarbons taken from samples of polluted water.

The nanocomposite can be produced easily and in addition to having a long lifetime, it has also appropriate stability at high temperatures, to the extent that the tests showed that it can be used about 80 times at 280 ℃ without any changes in sorption properties.

Multi-walled carbon nanotube/poly ortho aminophenol nanocomposite was used in the production of the sorbent. The coating has been deposited on the surface of a wire made of stainless steel as the electrode to measure and adsorb cancerous pollutions in various environments. Real samples have been used in this research to study the validity of the method and its application in the separation and measurement of pollutants, including multi-cyclic aromatic hydrocarbons. Wastewater of coal washing unit, agricultural water near the factory, river water and drinking water of the city were also tested.

Results showed that the produced nanocomposite is able to effectively separate and remove the pollutants.

Results of the research have been published in Analytical Methods, vol. 6, issue 23, 2014, pp. 9234-9241.

- *Enzyme Biosensor Used for Rapid Measurement of Drug*

Iranian researchers produced a new type of enzyme biosensor to increase the speed of clinical diagnosis.

The produced biosensor has high selectivity and repeatability while it has low production cost.

Biosensors have been recently used in medical, biological and industrial aspects to increase the speed of diagnosis. According to Bahareh Salehi, the executor of the plan, an enzyme biosensor has been used in this research to selectively diagnose penicillin by using silver nanoparticles. In fact, the role of silver nanoparticles was the facilitation of electron transfer between the elements of biosensor, and as a result, increasing its accuracy and respond speed.

The main application of the results is in pharmaceutics industries in the production of antibiotics. The biosensor can also be used in medical and biochemical sciences for the production of laboratorial and diagnosis kits. The proposed biosensor is considered as an appropriate replacement for the commonly-used liquid chromatography method. The advantage of the new tool is the simplicity of the production method and application, quick respond, selectivity, repeatability and reasonable production cost.

The penicillinase enzyme has been used in the production of the sensor. This enzyme easily absorbs penicillin even in the presence of disrupting species and provides accurate and desirable responds.

The results showed that the average diameter size of the nanoparticles has been about 90 nm in this research. The effects of temperature changes on the respond speed of the biosensor were studied at the range of 15-85 ℃ after the production of the sensor and its modification with the synthetic nanoparticles. Observations showed gradual increase in the sensor respond as temperature increased. The maximum value was observed at about 50 ℃.

Results of the research have been published in International Journal of Electrochemical Science, vol. 9, issue 11, 2014, pp. 6201-6212.

- *Production of Special Nanocomposite in Iran with Application in Railways*

Iranian researchers from Sharif University of Technology succeeded in the production of a nanocomposite with appropriate mechanical properties and resistance against various environmental conditions.

The results of the research can be used in the production of insulators which have applications in railways.

The main objective of the research was to replace the commonly-used pieces in railways transportation, specially railways insulator with phenolic/fiberglass nanocomposite. The insulator should have high environmental resistance because it is imposed to various climate conditions during the year.

According to the researchers, the proposed pieces can be used in the body and top of spaceships and spacecraft, which require high strength at harsh environmental conditions, as well as in railways as a composite insulator. The reason is high resistance of phenolic resin against temperature and pressure.

Observations of the researchers showed that the use of clay nanoparticle in the structure of phenolic resin significantly increases the mechanical properties even at low compositions, to the extent that using only 2.5% of the weight of both types of clays in the composite structure results in 45% increase in the value of elasticity module and also an increase in tensile and shear strengths and impact resistance. On the other hand, the replacement of linen fibers that are widely used in railways with fiberglass results in an increase in the strength and environmental resistance.

Results of the research have been published in Composites Part A: Applied Science and Manufacturing, vol. 63, issue 1, 2014, pp. 149-158.

- *Silver Nanoparticles Produced in Iran from Forest Plants Extract*

Iranian researchers from the Islamic Azad University in Iran succeeded in the production of silver nanoparticles from the extract of a type of forest plant.

Among the most important advantages of the proposed method, is its simplicity, high speed, independency on expensive devices and biocompatibility.

Silver nanoparticles have special physical and chemical properties and biological activity. After many researches, the application of silver nanoparticles has widely increased, specially in health and hygiene fields. For instance, covering of the wounds, surgery devices and bone

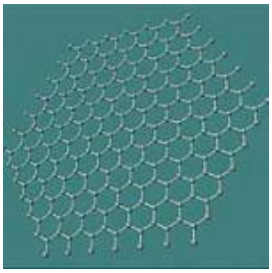
prostheses are coated with silver nanoparticles. Therefore, numerous methods have been invented for the production of the nanoparticles, such as chemical and physical deposition, reverse missile, hydrothermal and chemical vapor deposition. Among the present methods, nanophyto synthesis is a green method that has many advantages over other normal methods.

In this research, silver nanoparticles were synthesized through nanophyto synthesis method from the extract of viburnum lantana leaves. The proposed method is fast, simple and biocompatible and does not create any environmental pollution or hazard. The production of these nanoparticles through the proposed method is also cost-effective.

According to the researchers, the produced silver nanoparticles are cubic with average dimension of 48 nm. Studies showed that the antibacterial activity of silver nanoparticles with the cubic shape has a greater effect on microorganisms and cells than those with spherical shape.

Results of the research have been published in Synthesis and Reactivity in Inorganic Metal-Organic and Nano-Metal Chemistry, vol. 45, issue 3, 2015, pp. 381-387.

- *Graphene Applied in Production of Recyclable Electrodes*



Iranian researchers produced electrodes that increase sensitivity and detection limit of sensors and biosensors using graphene.

The ability to be used a few times by polishing the surface of the electrodes is the most important advantage of the product. Medical and diagnosis clinics and electronics industries can employ the results of the research.

One of the problems in normal modified electrodes is their need to be modified all the time. Therefore, electrodes that are modified in volume manner should be used to solve this problem. Carbon ceramic electrode is one of these electrodes. In this research, graphene was used in the structure of sol-gel instead of graphite to modify chemical and physical properties and increase the performance of carbon ceramic electrode.

The recyclable modified electrode can be used in the production of electrochemical sensors and biosensors. The sensitivity of sensors increases due to the use of graphene instead of graphite.

In this research, graphene was used for the first time in the structure of sol-gel-based electrodes. Graphene has many advantages over graphite and carbon nanotubes. It is a semi-conductor with zero band gap, and therefore, it has extraordinary high electrical conductivity. In addition, it has very desirable mechanical strength (about 200 times of steel) although it is very light.

Based on the results, the produced electrochemical sensor has high sensitivity, low detection limit and appropriate repeatability. It also has lower potential for the electrocatalytic oxidation of ascorbic acid in comparison with carbon ceramic electrode.

Results of the research have been published in Microchimica Acta, vol. 181, issue 15-16, 2014, pp. 1879-1885.

- *Iranian Scientists Take Step towards Production of Edible Insulin*

TEHRAN (INIC)- Iranian researchers from Endocrinology and Metabolism Research Institute of Tehran University of Medical Sciences studied and produced a drug nanosystem at laboratorial scale to achieve edible insulin.

The nanodrug increases the diffusivity of insulin to intestinal wall and decreases degradation against enzymes. Biocompatible and non-toxic nanoparticles have been used in the production of the nanodrug.

The main objective of the research was to open an edible path for peptide drugs, including insulin, increase the simplicity of insulin consumption for diabetic patients and take a step towards the treatment of diabetes.

Dr. Kobra Omidfar, one of the researchers, explained about the importance of the research, and said, "The most important challenges in the use of insulin as an edible drug are the degradation of insulin by numerous enzymes of digestive system, non-diffusivity of insulin macromolecule through intestinal wall, numerous blocks on the way of insulin to reach blood and its sudden release in inappropriate place. In order to overcome those problems in this research, niosome nanoparticle coated with trimethyl chitosan was synthesized and its ability to carry insulin in an edible manner was studied at laboratorial environment."

According to the results, the produced nanodrug prevents the degradation of insulin by trypsin and it significantly increases the diffusivity of insulin macromolecule through intestinal single-layer wall. Moreover, a test was carried out in the simulated environment of intestine, and it was observed that the nanodrug leads to delay release of insulin.

According to the researcher, the results lead to an increase in diffusivity of insulin through intestinal wall, decrease in enzyme degradation of insulin and increase in insulin release time. Achieving these objectives results in reduction of frequency of insulin consumption and elimination of pain due to insulin injection in diabetic patients.

Results of the research have been published in Materials Science and Engineering: C, vol. 46, issue 1, 2015, pp. 333-340.

- *Iranian Scientists Refine Wastewater of Nuclear Power Plants Using Nanoparticles*

Iranian researchers from Zabol University designed and produced a type of sorbent nanoparticles to extract small amounts of uranium from wastewater.

The nano-sorbent is able to detect low concentrations of uranium in the outlet stream of nuclear power plants, and it can extract more than 94.5% of uranium from different media.

Uranium is found at low concentrations in aqueous and non-aqueous outlet streams of nuclear reactors. However, low concentrations of this material can be harmful too. Therefore, the outlet streams should be refined so the least possible amount of uranium is released to the environment.

The researchers used zinc oxide/chitosan nano-sorbents to extract low concentrations of uranium from aqueous media. They also carried out the modeling process by using artificial neural network.

Zinc oxide nanoparticles can be used as an effective nano-sorbent due to their semi-conductive properties. These nanoparticles can be used with chitosan in form of hybrid to increase their desirable properties.

This research studies and compares detection limit and concentration factor with some other methods, including liquid-liquid distributing micro-extraction, solid phase of silica-gel and the polymer used for uranium extraction. Results showed that this method has a concentration factor much higher than that of other methods, and it also has appropriate detection limit.

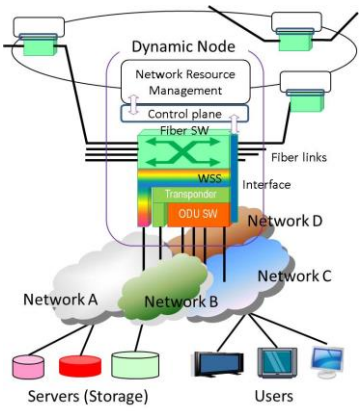
According to the researchers, results also showed that the concentration factor is 125 for this method, while it has been reported 11, 50, and 108 for liquid-liquid distribution micro-extraction, solid phase of silica-gel and polymeric solid phase, respectively.

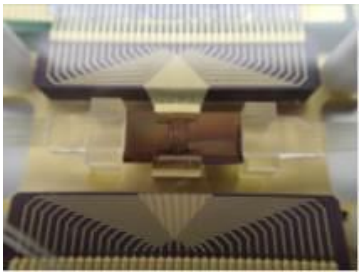
Results of the research have been published in Chemometrics and Intelligent Laboratory Systems, vol. 135, 2014, pp. 70-75.

Japan (source: AIST)

- *Ultra-low-energy "path on demand" optical network for video related applications*

Growing video traffic that dominates the Internet traffic will soon cause a serious energy crunch at electronic routers. As an effective solution, AIST, Ibaraki, Japan, has proposed Dynamic Optical Path Networks (DOPN)[1,2] that offloads the video traffic from IP networks to fast circuit-switched optical networks, and launched a research project, called "VICTORIES," in collaboration with NTT Corporation, FUJITSU LABORATORIES LTD., Furukawa Electric Co., Ltd., Trimatiz Limited, NEC Corporation, Fujitsu Limited, Fujikura Ltd., Alnair Labs Corporation, Sumitomo Electric Industries, Ltd., and KITANIHON ELECTRIC CABLES CO., LTD.. "VICTORIES" stands for the Vertically Integrated Center for Technologies of Optical Routing toward Ideal Energy Savings, which is partly supported by Project for Developing Innovation Systems of MEXT, Japan.





Recently, the VICTORIES project succeeded in building an eight-node DOPN testbed[3] by developing ODU cross-connects, CDC-ROADMs, and fiber cross-connects in a hierarchical manner, and enabled multi-granular traffic control. In common with Software Defined Networking, DOPN is equipped with a separate control plane and a Network resource Management System (NMS) in compliance with OGF Network Services, v. 2.0 (NSI-CS) protocol, which manages and controls the hierarchical network. As specific applications, AIST developed 4K-Video on Demand (VOD) and Video Conferencing (VC) services. NSI-CS is the only international standard protocol that supports advance reservation, which is essential for VOD and VC. DOPN successfully offers "path on demand" for 4K-VOD and VC services. The testbed is capable

Hierarchical node

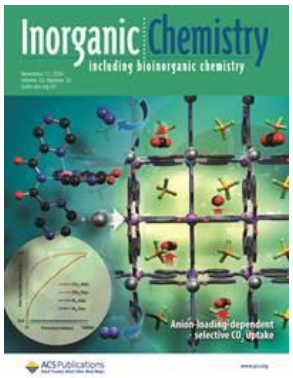
of controlling 90 Tbps traffic, with a measured power consumption of only 6 kW, orders of magnitude lower than the IP network with an equivalent capacity.

Commercialization of DOPN requires a cost-effective option of the fiber switch. The fiber switch, therefore, is preferred to be of integrated device. AIST has been developing integrated fiber switches utilizing silicon photonics technology and succeeded in fabricating an 8×8 switch thus far4. One of the testbed nodes actually employs a polarization-insensitive dual 4×4 fiber switch based on silicon photonics, fabricated in a CMOS facility of AIST that features immersion ArF lithography. To prototype such switches in the CMOS facility gives a good opportunity to clarify potential issues toward volume production. AIST is planning the fabrication of an integrated 32×32 switch in the near future, while the testbed will be utilized to evaluate not only technologies enabling DOPN but also applications enabled by DOPN.

4×4 Si-Photonics SW

New Zealand (Source: Univ. of Canterbury**)**

- *Front Cover of Inorganic Chemistry*



Doubling the anion occupancy in the channels of the metal organic framework (NiII-based MOF → Co^{III}-based MOF) increases the observed adsorption selectivity for CO_2 over N_2. These robust isostructural MOFs were assembled using $AgBF_4$ to activate the secondary coordination instructions present in the carefully designed monometallic pyrazine imide complexes of nickel(II) and cobalt(II or III).

Cover created by Michael Crawford (Dunedin) from a concept provided by Sally Brooker." See 2014 paper in Inorganic Chemistry: M. G. Cowan, R. G. Miller, P. D. Southon, J. R. Price, O. Yazaydin, J. R. Lane, C. J. Kepert, and S. Brooker, Inorg. Chem. 2014, 53, 12076-12083

- *the effect of Post Deposition Heat Treatment (PDHT) on the structural, compositional and surface characteristics of HA films deposited on T Ì6A1-4V*

Publication: Abdul Azis, S.A., Kennedy, J., Murmu, P.P., Fang, F., Cao, P. , Structural and compositional characterization of ion beam sputtered hydroxyapatite thin films on Ti-6A1-4v, Asian Journal of Applied Sciences Volume 7, Issue 8, 2014, Pages 745-752

Ion Beam Sputtering (IBS) technique has been used to prepare a series of hydroxyapatite (HA) thin films on Ti and Ti alloy substrates for biomedical application. We report the effect of Post Deposition Heat Treatment (PDHT) on the structural, compositional and surface characteristics of HA films deposited on T Ì6A1-4V. The films underwent PDHT for 2 h at 300, 400, 500 and 600 ℃ under air environment. After PDHT, the structure and the chemical composition of the films were characterized using Rutherford Backscattering Spectrometry (RBS), X-ray Diffraction (XRD), Fourier transform infrared absorption spectrometry (FTIR) and Scanning Electron Microscopy (SEM). The results showed that the crystallinity of HA increased with temperature. However, SEM results revealed that some cracks were observed if the temperature of PDHT was higher than 600 ℃. FTIR measurements showed that the existence of hydroxyl and phosphate bands in all films increased with temperature. RBS analysis indicated that the as-deposited films had a low Ca/P ratio which increased to stoichiometric value with increasing PDHT temperature. From this study we suggest that

600 ℃ is probably the best PDHT temperature to obtain a better characterization and surface properties of HA film produced by IBS. It can also be concluded that IBS can be used as an alternative method for deposit HA film on titanium alloy substrate.

- *Electrochemical detection of intracellular and cell membrane redox systems in Saccharomyces cerevisiae*

Scientific Reports: Rawson, F.J., Downard, A.J., Baronian, K.H., Volume 4, 9 June 2014, Article number 5216

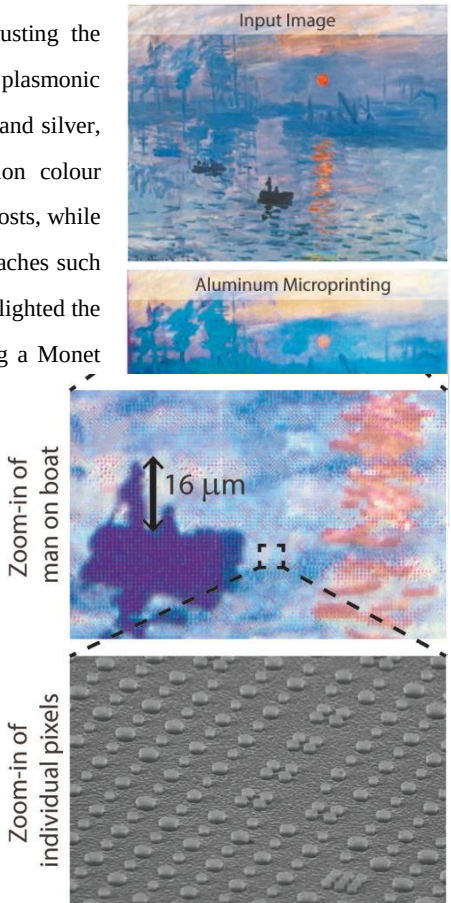
ISSN: 20452322 DOI: 10.1038/srep05216

Redox mediators can interact with eukaryote cells at a number of different cell locations. While cell membrane redox centres are easily accessible, the redox centres of catabolism are situated within the cytoplasm and mitochondria and can be difficult to access. We have systematically investigated the interaction of thirteen commonly used lipophilic and hydrophilic mediators with the yeast Saccharomyces cerevisiae. A double mediator system is used in which ferricyanide is the final electron acceptor (the reporter mediator). After incubation of cells with mediators, steady state voltammetry of the ferri/ferrocyanide redox couple allows quantitation of the amount of mediator reduced by the cells. The plateau current at 425 mV vs Ag/AgCl gives the analytical signal. The results show that five of the mediators interact with at least three different trans Plasma Membrane Electron Transport systems (tPMETs), and that four mediators cross the plasma membrane to interact with cytoplasmic and mitochondrial redox molecules. Four of the mediators inhibit electron transfer from S. cerevisiae. Catabolic inhibitors were used to locate the cellular source of electrons for three of the mediators.

Singapore (Source: IMRE)

- *Full-colour photorealistic printing at the nanoscale*

A team of researchers from IMRE, NUS and SUTD have created the first plasmonic palette utilising colour generation strategies for photorealistic printing with aluminium nanostructures. This work expands the visible colour space through spatially mixing and adjusting the nanoscale spacing of discrete nanostructures. Using aluminium as the plasmonic material instead of commonly-used plasmonic materials such as gold and silver, the research team achieved a full colour range for super-resolution colour printing with enhanced durability and dramatically-reduced materials costs, while operating in size regimes that are scalable to higher-throughput approaches such as photolithography and nanoimprint lithography. The researchers highlighted the versatility and quality of aluminium plasmonic pixels by reproducing a Monet masterpiece in the form of a plasmonic "micropainting" which measured a mere 200 by 250-micrometres.



The team fabricated isolated plasmonic aluminium nanodisks that are able to scatter light of different wavelengths which manifests as colour in the visible regime. The colours generated can be tuned by controlling the size of each nanodisk, and new colors can be

generated by "mixing" nanodisks of different sizes or adjusting the relative position of nanodisks within a defined pixel. This builds upon their previously-published technique of printing plasmonic colours, which eliminates the use of conventional colour dyes and enables super-resolution colour printing up to 100,000 dpi.

The advances in the plasmonic colour printing technology could pave the way toward a new generation of low-cost, high-resolution colour printing with direct applications in anti-counterfeiting, security tagging, cryptography, and information storage.

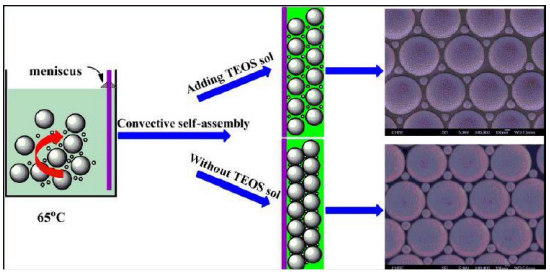
For more information about the publication, please contact Dr Shawn Tan shawn-tan@imre.a-star.edu.sg.

Publication: Zhongyu Cai, Yan Jun Liu, Xianmao Lu, and Jinghua Teng; "Fabrication of Well-Ordered Binary Colloidal Crystals with Extended Size Ratios for Broadband Reflectance"; ACS Appl. Mater. Interfaces, 2014, 6 (13), pp 10265–10273.

- *New, improved binary colloidal crystals for a variety of applications*

IMRE researchers, together with an IMRE-attached PhD student, developed a new method to fabricate non-close packed Binary Colloidal Crystals (BCCs) with extended size ratios and well-ordered crystalline structures as compared to previously reported BCCs fabricated by the conventional convective self-assembly method. The extended size ratios give the BCCs more freedom in terms of the tuning of the bandgap and optical properties. The well-ordered crystalline structure gives better crystal quality, and thus better optical performance.

BCCs have excellent potential in tuning material properties via the control of the size ratio of small to large colloidal spheres (γS/L). IMRE's BCCs are fabricated by co-assembling hydrolysed TEOS with PS spheres. The researchers found that γS/L can be extended to 0.376 by adding TEOS sol into the colloidal suspension. The resulting polystyrene/silica (PS/SiO2) BCCs show distinctive reflections, indicating their well-ordered structure. The extended size ratios render more flexibility in engineering the photonic bandgap structures of BCCs and hence provide a better platform for developing a range of applications such as photonics, spintronics, sensing and bioseparation.



Comparison of BCC fabrication using conventional and improved convective self-assembly methods.

BCCs can be used for sensing, protein patterning, photovoltaics, and in bioseparation. The team used the newly developed BCCs for solvent sensing because of the refractive index changes of different stimuli. The features of the new BCC gives researchers the freedom to tune the bandgap of the 3D photonic crystal structures, which can result in property changes such as getting a broader reflectance than those of conventionally fabricated BCCs.

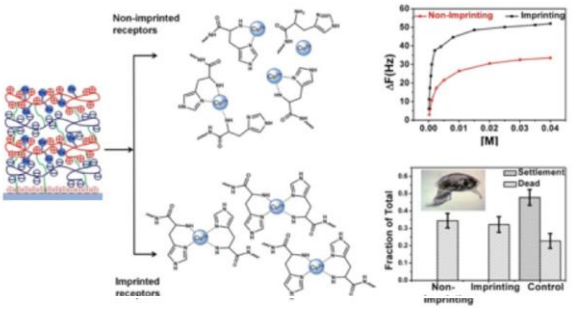
For more information about the publication, please contact: Dr Teng Jinghua, jh-teng@imre.a-star.edu.sg

Publication: Zhongyu Cai, Yan Jun Liu, Xianmao Lu, and Jinghua Teng; "Fabrication of Well-Ordered Binary Colloidal Crystals with Extended Size Ratios for Broadband Reflectance"; ACS Appl. Mater. Interfaces, 2014, 6 (13), pp 10265–10273.

- *New active film for effective marine antifouling*

Researchers from IMRE have developed an imidazole containing peptide, such as L-histidine methyl ester, bound to metal ions that can be used in an active antifouling film. The active film is grafted on polyallyl amine to create an efficient antifouling surface and to improve the performance of antifouling paints.

Antifouling paints reduce hull fouling because they contain copper, among other metals such as zinc and nickel. Copper is a heavy metal that is toxic to marine invertebrates affecting their reproduction, growth, and abundance. It is also a pollutant in the marine environment, especially close to docks and harbours, because it leaches from the hulls of boats into the surrounding water. The research team used the very efficient imidazole containing peptides, such as L-histidine methyl ester grafted on polyallyl amine to construct thin layer by layer (LbL) architectures with high affinity to bind Cu2+ ions. Enhanced binding ability is achieved through a metal imprinting process involving covalent immobilisation of receptors within the film structure in presence of metal ions. Highly cross-linking density groups of methyl esters in the polyanion, can overcome the stability issues of the thin films generally encounters. This is a feature of particular interest in attempts to develop an efficient antifouling surface and improved stability of the films and are highly stable in sea salts environments for prolonged periods, and the copper leaching rate is very slow, for about 90 days, suggesting opportunities to use this covalent cross-linking approach to design functional imprinted films for antifouling and many other applications.



LbL films with the concept of imprinting and non - imprinting approaches and their saturation isotherms of copper loading and antifouling performance against cyprids.

Designing and fabricating new, effective and environmentally friendly coating systems as alternatives to tributyltin (TBT) based antifouling paints is important. The imidazole containing biocide peptide, grafted on polycation to bind metals, shows promise as an alternative antifouling agent that effectively protects against fouling of barnacles and other marine organisms and is also less damaging to the environment than existing formulations. The technology can also benefit metal extraction processes, for example, in the water purification or natural resources recovery industries.

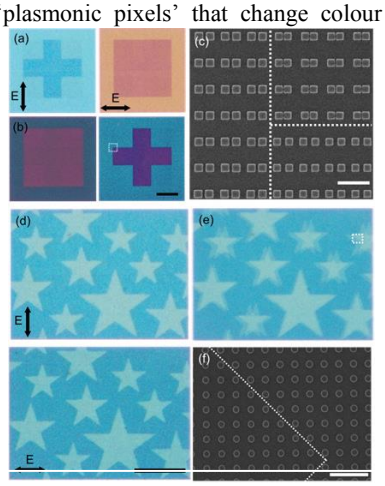
For more information about the publication, please contact: Dr Sreenivasa Reddy Puniredd punireddS@imre.a-star.edu.sg

Publication: Sreenivasa Reddy Puniredd, Dominik Jańczewski, Dewi Pitrasari Go, Xiaoying Zhu, Shifeng Guo, Serena Lay Ming Teo, Serina Siew Chen Lee and G. Julius Vancso; “Imprinting of metal receptors into multilayer polyelectrolyte films: Fabrication and applications in marine antifouling”; Chem. Sci., 2015, 6, 372-383

- *Nanoscale in 3D*

Researchers from IMRE, NUS, and SUTD in Singapore have developed a new approach to printing microscopic stereograms in full colour. The team has created possibly the smallest ever stereogram that does not require the viewer to don special glasses, but creates the 3D effect when viewed through an optical microscope.

Using 'biaxial' nanostructures, the team engineered polarisation-sensitive 'plasmonic pixels' that change colour depending on the polarisation of light illuminating it, allowing the first demonstration of a three-dimensional (3D) plasmonic stereoscopic colour microprint.



Optical microprints of a square and cross printed onto the same area formed from (a) ellipses; (b) coupled nanosquare pixels illuminated under x and y-polarised light. (c) SEM image of boxed region in (b). Nanosquares of the same size and gap widths are separated by the dotted lines. (d) Overlaid images decoupled by polarisers. Scale bar: 20 μm. (e) Overlay of images in (d) forms a stereoscopic image with depth perception. (f) SEM image of boxed region in (e). Scale bar: 1 μm..

To print these 3D images, a layer of hydrogen silsesquioxane was spun on a silicon wafer surface and patterned with a series of holes defined by electron beam lithography. After post-processing, the remaining nano-pillars are capped with aluminium, forming an array of plasmonic pixels. Central to the colour creation are 'plasmon resonances', produced when light hits the thin aluminium layer to interact with the pixels. Each pixel produces a colour, determined by the nanostructure size or shape and the spacing between adjacent nanostructures. By employing ellipses or closely-spaced squares, a different interaction occurs when the pixel is illuminated, where each pixel produces a different colour under each polarisation. A full-colour 'dual image' can then be created by arranging the pixels in a desired pattern; each image only revealed to the observer under the design polarisation.

Stereograms typically comprise two side-by-side images viewed separately by the left and right eye to create the illusion of depth. Examples include red and green prints that reconstruct 3D objects when viewed with a pair of red and green glasses. Here, stereograms were formed using a fade-free colour printing method, which also enables multiple colour microprints to be printed and viewed within the same area without using red and green filters. Moreover, compared to laser printers which print images using droplets of ink spaced about 20 micrometers apart, this approach shrinks the separation to 400 nanometers - roughly 50 times smaller than its commercial counterparts to produce an ultra-high resolution print of 62,500 dpi.

The research was published in the journal Nature Communications.

For more information about the research, please contact: Dr Goh Xiao Ming, gohxm@imre.a-star.edu.sg

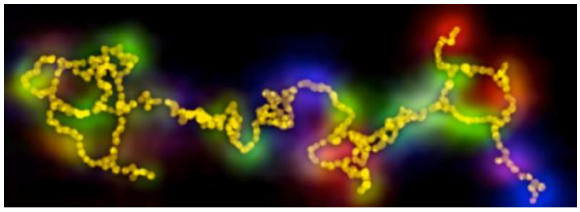
- *Steering light along tiny golden bead strings*

A multidisciplinary team of IMRE and CEMES scientists have demonstrated that long chains and networks of gold nanoparticles can be used to confine light energy and guide it over long distances. In an article published in the journal, Nature Materials, the team of researchers applied a recently developed technique called 'monochromated STEM EELS', which can observe optical phenomena with unprecedented detail.

The behaviour of light at nanometer length scales is impossible to observe with light microscopes, which is why the researchers used monochromated electron microscopy. Large networks of gold particles with diameters of only ~10 nm were made using the chemical expertise at CEMES (see image). These long bead strings were then carefully fused together and measured in Singapore. It was shown that these networks form pathways along which the light energy can travel in the form of 'surface plasmons'.

The sizes of the networks can vary from very small (containing only a few dozen beads) to lengths of several micrometers. The colours on the chain indicate locations where light of different colours are concentrated. The distance from left to right is about 750 nm, which itself is only one hundredth the width of a human hair.

The work opens up the possibility to control light energy and its travel distance by tuning the shape and size of the bead string networks. The findings in this work show that different colours of light are concentrated at specific points in the networks. In a larger effort to further miniaturise and speed-up functional circuits, these networks should prove very useful, since it has now been demonstrated that light energy can be addressed and accessed at specific nodes in these miniaturised optical networks.



A network of gold beads, each 10 nm in diameter. From left to right, this network is 750 nm long. The colours around the network show where different light energies are localised. Blue represents 0.38 eV, red 0.70 eV and green 0.89 eV of energy. The energy map and network image were obtained using electron microscopy.

Publication: A. Teulle, M. Bosman, C. Girard, K. L. Gurunatha, M. Li, S. Mann, E. Dujardin; "Multimodal Plasmonics in Fused Colloidal Networks"; Nature Materials, 2014, DOI: 10.1038/NMAT4114

- *Reference table for quick estimation of concentration and size of nanosilver*

One of the limitations to the use of silver nanoparticles is an easy method to calculate concentrations, to allow non-destructive analysis. Current methods could for example, require the use of expensive and time consuming equipment such as ICP-MS. With the creation of the table, it is possible to obtain a good concentration estimate using just a UV-vis spectrometer, and the research community could conduct easier and more productive research with silver nanoparticles. The developed methods are also applicable to other types of nanoparticles or structures.

IMRE scientists have created a standardised table of extinction coefficient data for silver nanoparticles, which allows for easy and quick estimation of the concentration and size of modified and mono-dispersed silver nanoparticles from their optical spectra. The data was obtained by determining the silver content of citrate - stabilised silver nanoparticles, using sodium cyanide-mediated etching. Quantification of silver ion concentration enabled the calculation of extinction coefficients. In this case, experimentally calculated extinction coefficients are in good agreement with collated literature values. The results are also in good agreement with the theoretical calculations using Mie theory.

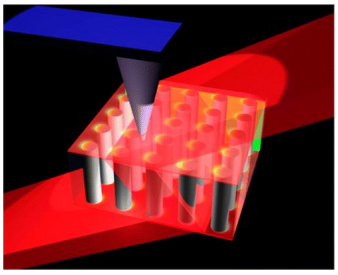
Silver nanoparticles, much like gold, have become popular for applications such as in vitro diagnosis, and have great potential for vivo applications. Silver nanoparticles also have antimicrobial properties, and as such the use of 'nanosilver' has in recent years been popularised in consumer products. Current and future applications include, their use in clothing, fabrics, personal care/health products, and antimicrobial surfaces.

For more information about the publication, please contact : Dr Paul Francis Free,freepf@imre.a-star.edu.sg.

Publication: D. Paramelle, A. Sadovoy, S. Gorelik, P. Free, J. Hobley and D. G. Fernig; "A rapid method to estimate the concentration of citrate capped silver nanoparticles from UV-visible light spectra"; Analyst, 2014, 139, 4855-4861

Taiwan (Source: NPNT)

- *Looking into Meta-Atoms of Plasmonic Nanowire Metamaterial*



Nanowire-based plasmonic metamaterials exhibit many intriguing properties related to the hyperbolic dispersion, negative refraction, epsilon-near-zero behavior, strong Purcell effect, and nonlinearities. We have experimentally and numerically studied the electromagnetic modes of individual nanowires (meta-atoms) forming the metamaterial. High-resolution, scattering-type near-field optical microscopy has been used to visualize the intensity and phase of the modes. Numerical and analytical modeling of the mode structure is in agreement with the experimental observations and indicates the presence of the nonlocal response associated with cylindrical surface plasmons of nanowires.

Publication: Kun-Tong Tsai, Gregory A. Wurtz, Jen-You Chu, Tian-You Cheng, Huai-Hsien Wang, Alexey V. Krasavin, Jr-Hau He, Brian M. Wells, Viktor A. Podolskiy, Juen-Kai Wang, Yuh-Lin Wang, and Anatoly V. Zayats

Nano Letters, 2014, 14 (9), pp 4971–4976

EVENTS - 2014

Date	Avenue	Events
Jan.28-31	Tokyo, Japan	**Nanotech Japan 2015 (The 14th International Nanotechnology Exhibition & Conference)** www.nanotechexpo.jp/
Feb. 8-12	Nelson, **New Zealand**	**Advanced Materials and Nanotechnology 7 (AMN7)** www.macdiarmid.ac.nz
Mar. 8-11	Kish Island, **Iran**	**Asia Nano Forum Conference 2015 (ANFC2015)** www.anfc2015.net/
Mar.11-14	Delhi, India	**4th International Conference on Current Developments in Atomic, Molecular, Optical and Nano Physics with Applications (CDAMOP 2015)** http://www.cdamop.com/
Jun.39-Jul.3	Nagoya, Japan	**The 16th International Conference on the Science and Application of Nanotubes (NT15)** www.nt15.jp/
Jul.1-3	Seoul**, Korea**	**NANO KOREA 2015 "Nanotechnology, the Engine of Creative Economy"** http://sympo.nanokorea.or.kr/2015/eng/main/
August 3-5	Singapore	**5th Molecular Materials Meeting (M3)** website
Aug. ,	**Singapore**	**Asia Nano Forum Summit 2015**
Aug.,	**Singapore**	**Asia Nanotech Camp 2015**