

Table of Contents

NEWS	3
✧ ANF Events	3
✧ Partnerships/Collaborations	5
✧ Commercialization and Business	11
✧ New Education/Research Programs	14
RESEARCH BREAKTHROUGH	17
NEW PUBLICATIONS.....	25
EVENTS.....	30

NEWS

✧ ANF Events

◆ *Asia Nano Forum Summit 2011*

ANFoS2011 was successfully held on the 8-9 October 2011 at Evin Hotel, Tehran, Iran. This event was hosted by Iran Nanotechnology Initiative Council and co-organized with Asia Nano Forum.

Forty invited delegates from government funding agencies, research institutes, and industries in 10 Asia Nano Forum network economies (Indonesia, Iran, Japan, Korea, Malaysia, New Zealand, Singapore, Taiwan, Thailand and Vietnam), and 3 observer economies (Austria, Sri Lanka and Russia), gathered at this summit and updated their latest advancement in nanotechnology initiatives, R&D and commercialization highlights, and progress in education, safety and standardization as well as internationalization activities. Dr Teruo Kishi (former President of NIMS, Japan, who has transformed the largest materials research institute in Japan into one of the most international and innovative R&D institutions during his presidency 2001-2009) was elected to be the 3rd President of ANF to drive organization growth during 2012-2013. Japan is a founding member economy of ANF and the members anticipate a strong leadership and support from Japan in the coming two years. The summit also set strategic directions for development and regional collaboration in nanotechnology among the member economies, especially topics contributing to sustainable development including nanotechnology application in energy, water, health care, standardization, safety, and education. Currently, Thailand and Iran have adopted the nanoMark system pioneered by Taiwan and nanoMark will be further adopted by more ANF members as agreed during the summit; Thailand, Korea, Indonesia, and Malaysia have either adopted or inspired by the nano cartoon education materials pioneered by Taiwan. Japan initiated the responsible development of nanotechnology in Asia addressing Nano safety, governance and public acceptance in 2005 and today most ANF member economies have launched similar initiative addressing especially nano toxicity regional collaborative research efforts. Although strong desires expressed during the summit on strengthening bilateral/multilateral research programs towards sustainability, concrete measures are yet to be worked out and leadership is needed to move forward.

The most successful regional collaborative effort is represented by the ANF active participation at the ISO/TC229 on nanotechnology standardization as a Liaison Member. Dr Tsung-Tsan Su from ITRI Taiwan, who leads the ANF Working Group of Standardization and Risk Management, represents ANF at the ISO/TC229 working group. She coordinates 15 ANF member economies and presents overview of the Asia efforts in nanotech standardization at all ISO/TC229 meetings as well as briefs the ANF members the ISO/TC229 activities at the summit.

Another successful regional activity is the Asia Nano Camp (ANC) started in Japan in 2008 organized by the ANF Japan members AIST and NIMS. The ANC2011 was hosted by Korea, and Dr. S.H.SUH (President of the Korean Nanotechnology Researchers Society) briefed camp activities which included lectures and lab visits, demonstrations, group competitions, social activities and poster session.

Taiwan has been actively promoting global nanotech innovation through its Global Nano Innovation Contest Initiative (POP NANO). POP NANO 2011 has become a truly global event, 5 out of 6 awarded projects are from USA, Canada

ASIA NANO FORUM SOCIETY NEWSLETTER

ISSUE No.16 April 201

and UK. Korea is aggressively promoting Green to accelerate the adoption of nanotechnology and focus public/private investment towards sustainability. Iran is racing forward to promoting sustainable development of nanotechnology with holistic approach with impressive achievements in science (ranked No.1 among muslim countries in nano publication) and commercialization (total of 130 nanotech companies today) and particularly in education with its Nano Olympiad involving 70,000 high school students (majority of female students) during 2008-2011.

The ANF summit meeting ended with the decision of the next summit to be hosted by Thailand, the country of Smile in Nov. 2012.

✧ Partnerships/Collaborations

Australia – from ANU

- ◆ *New Publication: Nanotechnology in Australia: Showcase of Early Career Research [Hardcover]*

The Australian Nanotechnology Network held a trial of a new workshop program for the professional development of early career researchers (ECRs, including research students).

This book showcases the professional talents and high-quality writing of ECRs and also describes the workshop program, organized under the auspices of the Australian Nanotechnology Network, designed to facilitate this.

The nanotechnology research topics include plasmonics, the building blocks of plasmonic circuits; the use of metal nanoparticles to improve infrared light trapping in solar cell applications; methods for the bulk synthesis of graphene; synthesis of nanorods of vanadium compounds for energy storage; nanodiamonds, superparamagnetic nanoparticles and synthesis of hollow nanostructured silica, along with a discussion of their applications; molecular dynamics modelling of self-cleaning coatings; metal nanostructure-enhanced fluorescence and its biological applications; luminescent nano-bioprobes for bioassays and bioimaging; biomimicry leading to olfactory nano-biosensors; and superparamagnetic nanoparticles as MRI contrast agents. [Link](#)

- ◆ *Government Engagement Activities*

National Enabling Technologies Strategy (NETS) Expert Forum - The NETS Expert Forum is comprised of eight members with expertise in biotechnology, nanotechnology, regulation and foresighting. The Expert Forum assists the Department with developing policies to ensure the responsible uptake of enabling technologies, focused particularly on new forms of nanotechnology and biotechnology. Since its appointment in November 2010, the Expert Forum has undertaken a range of activities including: foresighting workshops focused on industry uptake of enabling technologies; a public foresighting event on the theme "three technologies that may change the way we live"; and a report on current and future enabling technologies and how they may contribute to addressing Australia's national challenges.

Stakeholder Advisory Council (SAC) - The SAC was established in November 2010 to consider important issues that may arise in the development or use of enabling technologies and provide advice and information to Government. The Council members are from a diverse group of stakeholders, including industry, research, non-government organisations, ethicist, unions and social scientists. The current focus of the SAC is reviewing policy decisions and providing advice on current activities being undertaken by government with particular focus on regulation, social and economic impacts of new technologies.

Health, Safety and Environment Working Group (HSEWG) - The HSEWG assists in facilitating a whole of government approach on health, safety and environment issues. The HSEWG meets at least twice a year to determine gaps in systems and knowledge, to facilitate a coordinated whole of government approach on issues of concern and support all agencies work in the area.

Networking Activities - NETS provides funds for the Australian Nanotechnology Network (ANN). Recently, the ANN supported the International Conference on Nanotechnology and Nanoscience (ICONN) held in Perth in February 2012. NETS also recently funded Flinders Centre for NanoScale Science and Technology, Flinders University, to undertake NanoConnect a Pilot Program to demonstrate a new model for commercialisation of nanotechnology and enhance links between universities and industry. NanoConnect was launched on 24 January 2012. A National Nanotechnology Research Strategy (NNRS), commissioned under NETS, is being undertaken by the Australian Academy of Sciences. At ICONN in February 2012, the eight discipline groups presented their initial thoughts. It is anticipated that a draft of the NNRS will be released in May 2012. The launch of the Research Strategy is planned for September-October 2012.

India – from ARCI

◆ *SLINTEC- NFCL Tie Up*

HYDERABAD: Nagarjuna Fertilizers and Chemicals Limited (NFCL- A global leading chemical & fertilizer company) from India and Sri Lankan Institute of Nanotechnology (SLINTEC) Pvt. Ltd. has signed a new 1 billion\$ US tie-up for the advance research in field of Nanotechnology- based plant nutrition solutions. This deal set up the research collaboration for manufacturing and sales of 2nd and 3rd generation nano- based plant nutrition products along with commercialization of 1st generation nano plant nutrition products. This partnership gives the benefits in terms of capital to farmers as well as to agro business and bolster the economy of two countries. ([Source](#))

◆ *TERI- Deakin University Has Inaugurated New Nano-biotechnology Lab in Gurgaon*

Gurgaon: The Energy & Resource Institute (TERI), India and Deakin University, Australia have recently inaugurated new centre named as “TERI-Deakin Nano-biotechnology Research Center” near Gurgaon under MoU signed between two organizations. This centre will cumulate the proficiencies of Scientists from both regions to headway nanotechnology in the fields like biomedical & biotech applications, designing of new nanomaterials, synthesis of nanomaterials from waste products, synthesis of eco- friendly nanoparticles using plants and microbes, DNA- based nanocarriers etc.

Other initiative is to provide facilities for both Researchers and Ph D scholars from Deakin Univesrity (under Deakin India Research Initiative scheme) to perform research in India. ([Source](#))

Malaysia – from NND

◆ *NanoMalaysia Young Scientists Meeting 2011*

This meeting was attended by about 100 young scientists. Through lecture and discussion, the convention has successfully raised awareness and fostered interest and involvement of young scientists in nanotechnology.

◆ *Workshop on Applications of Nanotechnology in Industry: Opportunity of Integration among IDB Member States*

The workshop was held at the National Research Center (NRC), Cairo Egypt on 29-31 January 2012 under the auspices of Prof. Dr. Ashraf Shalaan, President of the NRC. Eminent scientists from Indonesia, Malaysia, Pakistan, Bangladesh, Kazakhstan, Turkey, Kuwait, Oman Sultanat, Morocco, Algeria, Tunisia, Sudan, Nigeria, and Albania were invited to share this event with their Egyptian colleagues from the research institutions and universities. Prof.

Mostafa El-Sayed from Georgia Tech USA was present to present the first plenary lecture in the workshop. The representatives discussed on strategies to encourage nanotechnology R&D collaboration among member states and the possibility of forming the OIC-Nanotechnology Chapter in the near future. Prof. Dr. Halimatun Hamdan presented a paper on NanoMalaysia Programme during the conference.

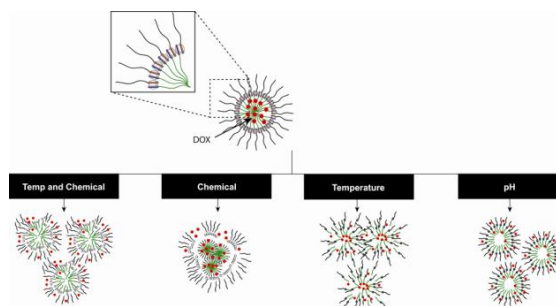
◆ *Workshop on drafting the National Strategic Direction Study and NanoMalaysia Policy*

This workshop was held during 16–18 February 2012 in Grand Seasons Hotel, Kuala Lumpur, Malaysia. It was conducted to obtain final Technical Inputs toward the Draft National Nanotechnology Strategy and Policy Document. It was attended by members of Main Committee Nanotechnology.

Singapore – IMRE

◆ *Anti-cancer Smart ‘Bomb’ Scientist Elected Fellow at Fitzwilliam*

Dr Loh Xian Jun, a researcher from A*STAR’s Institute of Materials Research and Engineering (IMRE), was recently elected a Fellow of the University of Cambridge’s Fitzwilliam College. Some of the College’s very notable alumni include Nobel Prize winner Albert Szent-Györgyi, who discovered Vitamin C and Singapore’s first Prime Minister, Mr Lee Kuan Yew, who is an honorary Fellow at the college. Dr Loh is also a Visiting Professor at the Melville Laboratory for Polymer Synthesis in the Department of Chemistry, University of Cambridge, where his study on the anti-cancer smart biomaterials is being done.



Dr Loh is developing an anti-cancer biomaterial drug delivery system that limits collateral damage to healthy cells during cancer treatment. Made up of tiny multi-stimuli responsive exploding bubble-like micelles, these anti-cancer smart ‘bombs’ can be guided to their target to release chemotherapeutic drugs, just like how today’s precision munitions work. The main difference here is that Dr Loh’s anti-cancer smart ‘bombs’ can differentiate friend from foe, and explode only at sites with cancerous cells, limiting damage to healthy cells.

“Cancer cells have characteristics which differentiate them from normal cells. For example, the interior of a cancer cell is more acidic and is chemically different compared to normal cells,” explained Dr Loh. “By exploiting these properties, I designed capsules which can more accurately target suspected cancer tumour sites,” said Dr Loh, adding that his *cucurbituril*-based biomaterial is more stable and is able to better form single, discrete drug-carrying parcels than other drug delivery systems such as currently available *cyclodextrin*-based biomaterials.

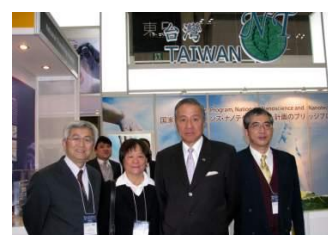
Dr Loh is currently doing post-doctoral work at the University of Cambridge under the A*STAR Graduate Scholarship. “Joining Fitzwilliam College has been a very humbling and exciting appointment that has given me the opportunity to be part of the unique pedagogic faculty at Cambridge. Together with my research experiences, this exposure has enabled me to gain personal insight into the eclectic and vibrant culture here,” said Dr Loh.

Dr Loh was awarded the Singapore National Science Talent Search (NSTS) Merit Award in 1999 and the NSTS / NSS (BS) Scholarship in 2002. He completed his Bachelor degree in Applied Chemistry at National University of Singapore (NUS) with First Class Honours in 2006. After a research attachment at IMRE, he went on to pursue his PhD studies under the A*STAR Graduate Scholarship in 2007. Following the completion of his PhD studies in Dec 2009, he was deployed to IMRE. He was awarded the A*STAR Graduate Scholarship (Postdoctoral Fellowship) in Oct 2010 to pursue post-doctoral training at Cambridge.

Taiwan – from NPNT

◆ 2012 Nanotech, Japan

In Nanotech 2012, Taiwan had built an eye-catching pavilion with 13 units, 63 team members, and 20 R&D outcomes in the exhibition. One of the units, ITRI, even won the “Green Nano Technology Award” among all exhibitors this year. Photo source: National Nanotechnology Bridge Program



◆ 2012 South Africa/Taiwan Joint Committee and Bilateral Workshop, South Africa

The purpose of this trip was to follow up and to reconfirm the previous collaborative agreement between the two nations. A Joint Committee was held to strengthen the relationship and a bilateral workshop was taken a place as an act of friend and partnership. Photo source: National Program on Nanotechnology

Thailand – from NANOTEC

◆ Thailand represented at nanotech 2012, Japan

The Thai delegation led by Prof. Pairash Thajchayapong, Chairman of NANOTEC Executive Board, Prof. Sirirug Songsivilai, NANOTEC Executive Director, and representatives of the Thai Board of Investment (BOI) Tokyo office, and IRPC officially



opened the Thailand Pavilion “Nanotechnology for Natural Disaster Mitigation” on Feb 15. This is the second year that Thailand is represented at nanotech Japan. The event was coined “the biggest show and tell of nanotechnology” by the global nano related industries.

The Thai delegations’ objectives for participating at nanotec 2012 was to build global awareness to Thai nanotechnology development, promote R&D collaboration, and explore market opportunities for NANOTEC related research output. The Thailand Pavilion attracted a large number of visitors including medias who are interested in the use of nanotechnology for natural disaster and the status of Thailand's nanotechnology research development.

This year, NANOTEC presented the research highlights at Thailand Pavilion as follow:

1. SOS Clean Water (filtration device for drinking water)
2. Mosquito repellent (nano bednet and lotion)
3. Leptospirosis test kit (medical application)

4. nSack (as replacement for sand bags)
5. nClean (products for use in Big-Cleaning Day activities after flood)
6. iGuard (for air-condition filtration system)
7. e-Nose (smell detection device)
8. Research and Development of ABS Specialty Prototypes (by IRPC)
9. New rice variety with flash flooding tolerance and non-photoperiod sensitivity
10. Magic Pants (use for hygienic purpose during walking in flood water)

The Thailand Pavilion attracted a large number of visitors including medias who are interested in the use of nanotechnology for natural disaster and the status of Thailand's nanotechnology research development.

◆ *EU-Thailand science initiatives*

Journalists from eight leading European newspapers arrived in Bangkok to get a first-hand knowledge of the status of Thai research and development. On hand to welcome the journalist was Dr. Thaweesak Koanantakool, President of NSTDA. Dr. Thaweesak informed that both Thailand and the EU have enjoyed bilateral relations and cross continent cooperation. In the early years the emphasis was on crop diversification and boosting farmers' income. The current focus is now on e-science, renewable energy and development of novel drugs to combat wide range of infectious diseases.



The trip was organized under the umbrella of the FP7 funded SEA-EU-NET project (www.sea-eu.net), in which NSTDA is a partner, and the ASEAN-EU Year of Science, Technology and Innovation 2012.

NANOTEC researchers joined in giving presentation on current research activities. Dr. Ubonthip Nimmannit, Team Leader of Nano-cosmeceuticals Lab gave a talk on “Increasing the value of natural cosmeceutical products (for Hair Growth)”, Dr. Uracha Ruktanonchai, Team Leader of NANO Delivery System Lab gave a presentation on “Fighting against mosquito” focusing on Nano Bednet and Mosquito-repellent Nanoemulsion lotion, and Dr. Chamorn Chawengkijwanich, Researcher at Hybrid Nanostructure and Nanocomposites Lab gave a talk on “Clean drinking water in time of crisis” focusing on the portable solar operated system (SOS) approach.

◆ *The 3rd Korea-Thailand Joint Symposium on Nanobiotechnology*

The 3rd Korea-Thailand Joint Symposium on Nanobiotechnology kicked off at Mountain Condominium, High 1 Resort, South Korea. The objective of the two days seminar was to strengthen research collaboration between researchers, follow up on existing research projects, and explore the opportunity to seek research funding from National Science Foundation of Korea.



The seminar is divided into 2 sessions: Nanomedicine, and Nanobiosensing/Nanosafety. A total of 14 researchers from NANOTEC, KRIBB, KIST, KRISS, KAIST participated as speakers.

“The Korea-Thailand Joint Symposium in 2010 was an important seminar for me as a researcher” said Dr. Warayuth Sajonsang, NANOTEC research. “It was from this seminar that I had the opportunity to know Prof. Sang Jeon Chung, Principal Investigator of BioNano Technology Research Center at KRIBB and to discuss research collaboration in anticancer drug delivery. It was through Prof. Chung that we were introduced to the Korea National Research Foundation (NRF) where I received the 2011 NRF Postdoctoral Fellowship grant covering the period from August 2011 – July 2012 to work under the supervision of Prof. Chung in KRIBB in the area of tumor pH and temperature responsive nanopolymeric micelles”.

The idea to organize the Korea-Thailand Joint Symposium was initiated in 2010 when NANOTEC research team participated at NanoKorea 2010 and visited several Korean research institutes including KRIBB where a half day seminar was organized.

✧ Commercialization and Business

Australia – from ANU

◆ *Business and nanotechnology patents survey in Australia*

NETS commissioned KPMG to undertake a Business Survey on the industry uptake of Enabling Technologies; the report will be available on the department's website, www.innovation.gov.au.

Thomson Reuters, was also commissioned by NETS to undertake a *Nanotechnology Patent Survey* to investigate trends in nanotechnology patents both in Australia and worldwide, from 2000-2008. The Patent Survey will be publically released and published on the department's website.

India – from ARCI

◆ *Jabra SUPREME UC: New Generation Unified Communication Headsets*


BENGALURU: 'Jabra' one of the leading Telecom firms of India has announced about launching a new product named Jabra SUPREME UC. This product can line up with a nano- based Bluetooth USB adapter which can connect it with PCs for Unified Communications (UC) supported calls and with traditional mobile phones/ tablets. This unique product also helps in cutting down the surrounding noise which is heard by the person while using the headsets. The company is planning to make it compatible to work with all upcoming UC applications like Microsoft, Cisco, Avaya, and Skype etc. The Jabra SUPREME UC will be available in market from May 2012 at a suggested retail price of \$149. ([Source](#))

◆ *ACNSMM Found New Way to Cure Cancer*

KOCHI: A nano-based cancer medicine "Cancer NanoPhotomedicine" has been successfully developed by the conjoint effort of Amrita Centre for Nano Sciences and Molecular Medicine (ACNSMM), India and Nano4Therapy, Netherlands. This product was successfully launched on the occasion of '2nd International Conference on Nanotechnology at the Biomedical Interface- NANOBIO 2012', which was held on 21-23 Feb. 2012 at Kochi, India. This product has been cleared for its safety requirements in pre- clinical studies and now it is ready to enter in a clinical phase. (Source: Feb 18, 2012 Times News Network)

Taiwan – from NPNT

◆ ITRI's , Non-toxic Fire Resistant Composite Material, Wins Aviation Week's A&D SIC Awards




Aviation Week, an authoritative aviation magazine in the U.S., holds 2012 Aerospace & Defense Supplier Innovation Challenge (IC) Awards ceremony on March 7th in recognition of best-in-class and game-changing innovations in aviation industry. Industrial Technology Research Institute (ITRI) of Taiwan won the award in Other Category for its  , non-toxic fire resistant composite material. Dr. Jonq-Min Liu, Executive Vice President of ITRI, represents the institute to accept the honor in Washington, D.C. Other winners include Rockwell Collins, Air New Zealand Technical Operations and BridgetNet International. ITRI is the only winner of the awards from Asia.

Under an intensified competition participated by up to 165 technologies worldwide, ITRI stands out among others with crux technique of the environmental protecting incombustibility material, and wins an enthusiastic applause from 34

nominated teams when the Executive Vice President of ITRI, Dr. Jonq-Min Liu receives the Innovation Award from Gregory Hamilton from the President/Group Publisher of Aviation Week. In addition to ITRI, there are teams from Holland, Germany, and New Zealand rewarded simultaneously.

Anthony Velocci, editor-in-chief of Aviation Week & Space Technology, who serves as one of the judges indicates, the nominated technique must be related with aerospace domain; as to the judging standard, it shall lay stress on conditions that the technique has to be simple, and able to decrease cost and increase the product value. He gives a high affirmation to ITRI's technique, and assumes that the outstanding technology to control the environmental protecting incombustibility material is not only unique, but also crossing several categories to create values for customers, therefore, the first prize of "Others" category shall be awarded.

Dr. Jonq-Min Liu further points out, Reddex had won the "R&D 100 Awards" from R&D Magazine in 2010, and winning the 2012 A&D SIC Awards is a further testimony of innovativeness of

. It is characterized by its ignition resistance, non-melting, non-toxic properties. Even in temperatures higher than 1,000 degrees Celsius, it can still protect substance coated with it for about 60 minutes, lowering its temperatures to under 300 degrees Celsius. Because of 's excellent bonding property and robustness even after being torched by fire for an extended period of time, steel frames coated with the  in a building can still maintain strong



structural adherence to the main structure, and thus protecting a building from catching fire or being damaged by fire. It meets the environmental codes of the European Union. It has a wide range of applications such as for making partition

The Executive Vice President of ITRI, Dr. Jonq-Min Liu receives the Innovation Award from Gregory Hamilton from the President/Group Publisher of Aviation Week. *source: ITRI website Week.*

and compartment materials inside an airplane, fuselage insulation materials, chair cushion fabrics, construction and building materials, as well as industrial and daily-use products.

Thailand— from NANOTEC

◆ *Brighter, sharper and cost effective color copying from Double A*

Brighter, sharper and cost effective color copying will soon be added to consumers' benefit from Double A. Double A and the National Nanotechnology Center (NANOTEC), signed a research collaboration agreement to focus on nanotechnological analysis of toner impact on paper, the results will be brighter, sharper and lower toner costs per color copy print. Signing for NANOTEC was Prof. Sirirung Songsivilai, Executive Director and Mr. Thirawit Leetavorn, Senior Executive Vice President for Double A.



"Our commitment to office paper consumers is to continue to innovate and to bring the best in office paper quality at a fair value. Double A's collaboration with NANOTEC is an example of our continued efforts to be at the forefront in technology that enables best quality printing for consumers of Double A. We believe this research will benefit consumers with brighter, sharper and lower toner costs for their colour copying needs", revealed Mr. Thirawit Leetavorn, Double A senior executive VP.

“One of NANOTEC’s mandates is to work on research projects that involve private sector input” said Prof. Sirirug. “The research collaboration we are under taking will utilize the expertise of Double A as a major marketer of pulp and paper products, and NANOTEC’s research capabilities in nano coating and formulation.”

Double A and NANOTEC will conduct a 6-month research program to develop the properties of Double A paper and improve its overall performance from printing, copying, scanning to any related products and services by using the capabilities of nanotechnology to analyze the relationship between structure and property of paper and the interaction of toner and paper in nano scale. The goal is to better understand both the physical and chemical changes and develop a better paper that has a sharper colour and brighter copy to meet the various demands and high standards of customers.

Mr. Leetavorn added “Consumers today are more aware of the different quality paper available in the market and their demand for high quality paper is increasing due to the growth of technological advancement. They are calling for the paper that does not jam, can be used in multi-function printer, and can bring out the great colours and other god qualities, of which Double A paper can meet these requirements”.

Double A is continuously searching to expand through product offering and geographically. Since the world is a global community, word of Double A’s quality quickly spreads and the consumers’ demand for premium quality paper is there which DoubleA aims to fulfil. Double A will continue to bank on Research and Development (R&D) and innovation to create a better paper and a better environment for everyone. Researchers from NANOTEC and Double A have been working “informally” in the past. This signing ceremony will make the partnership formal.

◆ *Bacteria helps fight soil erosion*

Mr. Atipat Patharagulpong, a third year biochemist and a NANOTEC scholar at Imperial College is a member of the Imperial College London iGEM team “Project AuxIn: engineering bacteria to help fight soil erosion” that won the 1st Runner Up prize for the World Championship Jamboree at iGEM 2011 which was held during November 5-7 at MIT, Cambridge, MA.



“Soil erosion is a massive problem world wide and is often the root cause of desertification” said Atipat. “Under the project AuxIn, we hope to engineer bacteria to accelerate plant root development via a 3 phase modules: Phyto-Route (plant root exudates), Auxin Xpress (promote root growth), and Gene Guard (prevent horizontal gene transfer). The modules will follow the synthetic biology engineering cycle”.

The team collaborated with the WITS-CSIR team from South Africa. An in-dept details report on this research can be reviewed in http://2011.igem.org/team:imperial_college_london (Human Practice).

Atipat received the NANOTEC Scholarship in 2006. He hopes to continue his studies and receive his PhD in Genomics/Nanobiotechnology in 2016. Atipat will join NANOTEC research team after receiving his PhD.

Mr. Atipat Patharagulpong is the 2nd from left (front row)

✧ New Education/Research Programs

Australia – from DIISR

◆ *National Enabling Technologies Strategy Public Awareness and Community Engagement (NETS-PACE)*

Major activities being undertaken by the Australian Government's National Enabling Technology Strategy's Public Awareness and Community Engagement (NETS-PACE) program, include research into public opinion towards nanotechnologies and consumer products, distribution of public awareness, engagement and education materials via numerous media including social media, and the development of the Science and Technology Engagement Pathways (STEP) framework .

◆ *Research in public attitudes towards nano-sunscreens*

In January 2012 NETS-PACE undertook research into the Australia public's awareness and attitudes to nanosunscreens through an online poll of 1,000 people. The findings showed that one in three Australians had heard or read stories about the risks of using nano-sunscreens. Of this group, 13 percent were concerned or confused enough about the issue that they would be less likely to use any sunscreen at all, thereby putting themselves at increased risk of developing skin cancer. The research highlights the need for more information on the issue of nanotechnology in sunscreens. The details of this and other NETS-PACE research can be found at <http://www.innovation.gov.au/NETS-PACE-Research>.

◆ *Science and Technology Engagement Pathways (STEP)*

STEP is a community engagement framework developed through a multistakeholder process involving business, government, researchers and the community to provide best practice guidelines on community engagement in relation to decision making on science and technology. The framework outlines principles, processes and models for conducting engagements. The framework is designed to be responsive and develop over time. The STEP website provides opportunities to participate in STEP engagements, for details visit www.innovation.gov.au/STEP.

◆ *TechNyou Outreach*

NETS-PACE's primary public outreach service is techNyou, a partnership program undertaken with the University of Melbourne (www.techNyou.edu.au). The program engages the public through media, including online media on Facebook (www.facebook.com/talkingtechnology) twitter, (www.twitter.com/technyou) and YouTube (www.youtube.com/technyouvids).

The techNyou videos channel has received particular public attention for its six-part series on critical thinking (<http://youtu.be/iSZ3BUru59A>), which have been viewed over 400,000 times in the first four months since posting. The videos encourage scientific and critical thinking, and link to an online video competition encouraging the Australian public to develop their own critical thinking skills in sharing and arguing their case on various new technology issues, including nanotechnology. See www.technyou.edu.au/competitions for more details.

◆ *TechNyou Science Education Resources*

The videos also link to a critical thinking education resource on the techNyou Science Education Resources website (www.techNyou.edu.au/education). The web site provides high school science teachers with educational resources relevant to the fields of nanotechnology and biotechnology, with the capacity to add more resources as the fields

develop. The resource also offers the flexibility for teachers to download and edit the materials to suit their classroom needs, and even contribute to the resource through online discussion and developing new material.

India— from ARCI

◆ *Department of Science & Technology (DST) Further Extended the Nanomission Program*

HYDERABAD: DST has extended the research program NANOMISSION beyond April 2012 which was announced in the annual meet of 'ICONSAT 2012' organized by ARCI on 20-23 Jan. 2012 at Hyderabad. They said that more loans will be provided to support the industries which are directly involved in nanotechnology to strengthen the research activities. They also mentioned that India is now placed at the 6th position in the field of nanoscience at global level.

◆ *JNTU is Going to Introduce A New PG Diploma Course on 'Nanotechnology'*

HYDERABAD: JNTU (Jawaharlal Nehru Technological University) is going to open a new Post Graduate Diploma course on Nanotechnology from 2012 academic session. Its curriculum will offer the opportunities to both experienced and newcomers who want to exploit the field of nanoscience as career. This is an evening session program designed as one year diploma course to give benefits to professionals.

◆ *New 'Nano Ex Centre' at Indian Institute of Technology (IIT), Hyderabad HYDERABAD:*

A new breakthrough in nanotechnology across India, IIT Hyderabad has recently opened a new centre devoted to Nanoscience 'Nano Ex Centre' which was inaugurated by Dr. C.N. R. Rao. This centre will mainly focus on new research advances in field of nanotechnology pertaining to medical science, engineering and other applied sciences.

Korea – from KoNTRS

◆ *Science Ambassador on Nanotechnology*

The Science Ambassador on nanotechnology Program has been carried out by KoNTRS (Korea Nano Technology Research Society) under the sponsorship of KFASC (the Korea Foundation for the Advancement of Science and Creativity).

This program aims to provide our younger generation with an opportunity to have a direct contact with scientists, so that they can build healthy perspectives on the positive future of science and technology, and to provide the general public with a social and cultural environment where they can accept science as an integral part of popular culture.

Many scientists in the field of nanotechnology are participated in the program.

The NT Scientists come to the city and country and introduce the nanotechnology.

The program in nanotechnology consists of Special lecture of NT, fabrication of nano-model and synthesis experiment of metal nanoparticles and catalysis.

Through this program, middle & high school students think nanotechnology is fun and useful.



Geangsang high school in Deagu City, Korea

Malaysia- from NND

♦ *Awarded R&D Top-Down Research Grants (NanoFund)*

The NanoFund was established to encourage the implementation and development of expertise and excellence in nanotechnology research, especially in priority areas established in the roadmap.

NanoFund encourages cooperation among institutions and multidisciplinary in nature. A total of 20 R&D projects have been selected and awarded NanoFund grants amounting to RM 7 million for 2-3 years.

Thailand – from NANOTEC

♦ *Award*

Dr. Kajornsak Faungnawakij of NANOTEC recently received the 2011 Outstanding Royal Golden Jubilee Alumni Award which was presented by HRH Princess Maha Chakri Sirindhorn at Suan Chitlada Palace on November 23. The event was organized by the Thailand Research Fund (TRF). A total of 8 researchers received the award this year.



The annual award ceremony is presented to researchers who have received research grant under the TRF Royal Golden Jubilee Ph.D Program in the past and who have continued to demonstrate outstanding research output which have contribute to the advancement of science and technology in Thailand.

While pursuing his Ph.D in Chemical Engineering at Chulalongkorn Univetsity, Dr. Kajornsak's Ph.D. research project received sponsorship from the TRF Royal Golden Jubilee Ph.D Program in 2000. The research project was in the area of design and application of plasma reactors for the treatment of polluted water and air. Currently, Dr. Kajornsak is a senior researcher and Group Leader of Nanomaterials for Energy and catalysis Lab at NANOTEC. He has published over 30 articles in recognized international journals and has been invited to present keynote talks at several national international conferences. For his dedication to R&D, Dr. Kajornsak was awarded the 2011Yound Scientist Award by the Foundation for the Promotion of Science and Technology under the Patronage of His Majesty the King.

For information on TRF and the Golden Jubilee Ph.D Program, please log on <http://rgj.trf.or.th/eng/rgje11.asp>

RESEARCH BREAKTHROUGH

India – from ARCI

◆ *Forging Ahead with Batteries: AMRITA SMART*

KOCHI: Dr. Shanti Nair and his team from Amrita Centre for Nanoscience has launched new super capacitors which can replace existing batteries. This smart device has been developed by applying the nanotechnology to store solar energy which can be used even in nights to power up mobile phone and laptops. It is also very light in weight to replace normal heavy batteries. This solar device is designed in such a manner that it has a storage span up to 7 days and life span of 20 years (while normal batteries will die off in 3-4 days only). This product was now handed over to Dr. G Sundararajan, Director, International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad for further research in nanosolar photo-voltaic devices. (Source: Times News Network (TNN) Feb 26, 2012)

◆ *No More Daily Insulin Injection for Diabetic Patients*

NEW DELHI: In India, maximum diabetic patients have hyperglycemia with some vascular complications. This exigency of diabetes demands for a novel agent but within safety boundaries. At the cutting edge, Dr. Avadhesh Surolia and his team from National Institute of Immunology (NII) has innovated a new nano based formulation for insulin molecule to treat Type I diabetes. Dr. A. Surolia said that now there will be some relaxation for diabetic patients especially those who are completely dependent on insulin therapy. This new formulation contains nano-based oligomers which will give sustained action in the body. In this novel approach millions of insulin molecules are clubbed together to form a bunch called oligomers and these are released one by one when the need arises. This formulation has already been cleared in the pre-clinical phase. A US-based firm 'The Life Science Pharmaceuticals' in Darien, Connecticut, will work further on this product for its development and probably in next couple of years this nano-formulation will be in the market after passing the clinical trials. ([Source](#))

◆ *Nanosilver: A Newfangled Approach to Treat Filariasis*

NEW DELHI: Filariasis, one of the leading problems of developing countries, is caused by nematode parasites like *Wuchereria bancrofti*, *Brugia malayi*, and *Brugia timori*. This is characterized by edema beneath the skin and underlying tissues. These worms occupy the lymphatic system, including the lymph nodes, and in chronic cases these worms lead to the disease called Elephantiasis. In this line, Prof. D Dash and his group from Department of Biochemistry, Institute of Medical Sciences, Banaras Hindu University, has suggested the role of nanosilver as an adjuvant against lymphatic filariasis. Silver Nanoparticles are already known for antibacterial potential by causing apoptosis in cells. This study proves that silver nanoparticles in low concentration acts in same manner (by mechanism of apoptosis) in lymphatic filariasis also. They also suggested that nano silver may act synergistically with present effective drug Di-ethyl carbamazepine for filariasis after considering all the safety parameters. (Source: Dash et al., International Journal of Nanomedicine 2012;7 1023–1030. <http://dx.doi.org/10.2147/IJN.S28758>)

Japan— from Nanonet Japan

◆ *Enabling the Development of Multi-functional Device by Graphene on Silicon*

Research Institute of Electrical Communications of Tohoku University announced on November 8, 2011 that a research group of the Institute has succeeded in providing metallic or semiconducting prop-erty to the graphene layer grown on silicon substrate (graphene on silicon, GOS) by selecting crystallo-graphic orientation of the substrate. Details were published in Applied Physics Express*.

Graphene is a promising material for next generation electronic and photonic devices because of its superior properties such as high carrier mobility of 100 times of silicon. GOS is grown by sublimating Si atoms from the surface of the SiC thin film formed on a Si substrate. Researchers wanted to find out unique technology, which will be realized solely by GOS.

GOS samples were prepared on Si substrates with various crystallographic orientations to character-ize surface/interface structure and energy band by photoelectron spectroscopy and low-energy electron microscopy at SPring-8. Interface layer between graphene and SiC is found in GOS grown on SiC(111)/Si(111) surface and the GOS is Bernal-stacked with a band splitting (semiconducting). To the contrary, no interface layer is observed in GOS on SiC(111)/Si(110) or /Si(100) surface, and the GOS is turbostratically stacked without a band splitting (metallic). Anisotropic etching of Si produces various regions with different crystallographic orientations on a single substrate, and GOS on the substrate possesses both metallic and semiconducting regions. Metallic graphene is mainly applied to photonic devices, while semiconducting graphene to electronic devices. Researchers suggest that this will make it possible to develop multi-functional devices and GOS integrated circuits.

◆ *Positive electrodes of high-power lithium batteries by few-walled carbon nanotubes - Free from rare metals and ceramics*

The University of Tokyo announced on December 7, 2011 that Professor Atsuo Yamada, Department of Chemical Systems Engineering and his colleagues succeeded in developing self-standing positive electrodes for light-weight and high-power lithium (Li) batteries by oxidized few-walled carbon nanotubes (CNT). The success was based on the cooperation with Associated Professor Yang Shao-Horn, MIT and details were published in Energy & Environmental Science*.

Positive electrodes of current Li batteries are made from ceramic materials such as LiCoO_2 , LiNiO_2 , LiMn_2O_4 . In order to reduce cost and expected metal toxicity, organic molecules such as $\text{Li}_x\text{C}_6\text{O}_6$ ($2 < x < 6$) are proposed as possible alternatives for electrode materials and MIT group has shown that oxidized CNT is able to yield high voltage when used for electrodes of Li batteries. The optimum number of the wall was expected to be three, because the outermost wall is oxidized and inner two walls retain electrical properties of CNT.

The research group has assembled binder-free and self-standing carbon nanotube (CNT) electrodes of tens of microns in thickness via a vacuum-filtration process of oxidized few-walled CNTs (FWNTs). Sub-millimeter long FWNTs of three walls can provide high electrical conductivity and mechanical strength in self-standing porous networks. The gravimetric capacity of FWNT electrodes in Li cells is enhanced by increasing oxygen functional groups on FWNTs. These self-standing FWNT electrodes are free of binder/additive and current collector, and provide a high

gravimetric energy of 200 W h/ kg at a high power of 10 kW/ kg, showing promise as the positive electrode for light-weight, high-power Li batteries.

◆ *Narrow-line-width 1.31- μ m wavelength tunable quantum dot laser*

National Institute of Information and Communication Technology (NICT) announced on December 13, 2011 that Senior Researcher Naokatsu Yamamoto and his colleagues succeeded in developing a wavelength-tunable laser light source for a new optical communication band around 1.31 μ m by using quantum-dot gain media. Details were published in Optical Express*.

Long-haul fiber-optic communication systems currently use the light of the wavelength at 1.55 μ m with signal bandwidth around 10 THz, because of the lower loss and reduced distortion. However, increasing demand of data transmission urges the expansion of available wavelength.

In response to the requirement, the research group of NICT demonstrated a wide wavelength tunable quantum dot (QD) external cavity laser operating in the waveband of 1.31- μ m with expected signal bandwidth of 70 THz. A high-density, high-quality InAs/InGaAs QD was sandwiched between quantum wells separated by sub-nano separator layer. Newly developed sub-nano separator growth technique has made it possible to get uniform QD layer without condensation as is often observed in conventional QD layers. A compact and robust external cavity system was constructed with QD for optical gain media, multiple optical band-pass and etalon filters for active optical mode selection. A wide wavelength tunability of 1.265-1.321 μ m and a narrow line-width of 210 kHz were successfully achieved. The laser also achieved an error-free 10-Gb/s photonic data transmission over an 11.4-km-long holey fiber.

◆ *Synthesis of Prussian Blue Nanoparticles with Enhanced Cesium Adsorption ---Hollow Interior by Controlled Chemical Etching---*

National Institute for Materials Science (NIMS) and Japan Science and Technology Agency (JST) announced on December 19, 2011 that researchers of International Center for Materials Nanoarchitectonics (MANA), NIMS succeeded in introducing high-density nanopores in Prussian Blue (PB) nanoparticles to enhance Cesium (Cs) adsorption. Details were published online in German journal of chemistry, "Angewandte Chemie International Edition".

Although adsorption ability of PB has been expected to increase by making it mesoporous or fine particles, conventional synthesis procedures have resulted in reduced effective surface area by degraded crystallinity.

The researchers have found a facile route to prepare PB hollow particles by chemical etching. Cubic shape PB particles of uniform size around 190 nm were synthesized as starting materials and dissolved into water solution of poly (vinylpyrrolidone). Addition of appropriate amount of acid induced chemical etching in the interior of PB particles to make subnanometer-sized hollow cavities with the surface protected by the polymer to keep the crystallinity of PB. The hollow cavities and particle sizes could be tuned by changing the synthetic conditions.

Effective surface area of the synthesized PB nanoparticles reached up to 330 m²/g, and showed Cs adsorption as large as 8 times of the commercial PB. The researchers are trying another enhancement of adsorption by applying the present method to analogous materials with Co-Fe or Mn-Fe.

◆ *Metal-Insulator Transition Mechanism in Ferromagnetic State Clarified by Synchrotron X-Ray Diffraction Experiment*

Chiba University, the High Energy Accelerator Research Organization (KEK), and the University of Tokyo announced on December 22, 2011 that Associated Professor Yukinori Ohta of Chiba University and his collaborators from these organizations have clarified metal-insulator transition mechanism of hollandite $K_2Cr_8O_{16}$ in ferromagnetic state by synchrotron X-ray diffraction experiment at Photon Factory (PF) of KEK. Details were published in Physical Review Letters*.

While most of the ferromagnetic materials are metallic, Professor Yutaka Ueda of the University of Tokyo, a member of the present research team, and his colleagues had discovered metal-insulator transition in ferromagnetic hollandite $K_2Cr_8O_{16}$ with nano-sized tunnel structure. However, the origin of the transition has not been cleared. In addition, this kind of oxides are attracting attentions as a functional material with tunnel structure and also for associated magnetic frustration due to lower dimensionality of its crystal structure.

The research team examined crystal structures during the metal-insulator transition of ferromagnetic hollandite $K_2Cr_8O_{16}$ by synchrotron X-ray diffraction. Crystal structure was found to change from the tetragonal to monoclinic phase, yielding distortion in a lower dimension crystal structure. Detailed electronic structure calculations demonstrate that the metal-insulator transition is caused by Peierls instability in the quasi-one-dimensional columnar structure consisting of four coupled Cr-O chains running in the c-direction, leading to the formation of tetramers of Cr ions.

Present result provides a rare example of the Peierls transition of fully spin-polarized electron systems. It will also open a way to create new materials with novel coupling of electronic and magnetic properties.

Malaysia – from NND

◆ *Nano-Sized hydroxyapatite particles reinforced ultra-high molecular weight polyethylene (UHMWPE) for biomedical applications*

Project objective was to develop a new UHMWPE composites formulation for biomedical implant applications, which has the potential to be commercialized. The utilize of UHMWPE composite were increased with the improvement of its processability, mechanical, bioactivity and biocompatibility properties which provided extra advantage compared to the present composite. In this work, UHMWPE was blended with HDPE together with small amount of PEG in order to develop composite with excellent performance in terms of processability, mechanical and wear properties, also with enhanced of HA dispersion. It was found that the elastic and flexural modulus of UHMWPE/HDPE blends increased at the expense of tensile strength, flexural strength and impact strength values with increasing content of HDPE.

Contact: Associate Professor Mat Uzir Wahit, Enhanced Polymer Research Group, Universiti Teknologi Malaysia (UTM); Office: +607-553 5909; H/p: +6012-701 2001; Email: mat.uzir@cheme.utm.my

◆ *Development of a nanoparticle based electrochemical biosensor system for the detection of Vancomycin Resistance Enterococci (VRE)*

The objectives of the project were to design the vanA-D gene specific primers in order to generate shorter specific amplicons from vancomycin resistant enterococci (VRE); to optimize a cold-chain free thermo stabilized multiplex PCR for the detection of VR; to design disposable screen printed electrode and pencil graphite electrode systems for

the detection of VRE; to optimize the biosensor system using PCR amplicons hybridized with gold nanoparticle labelled probe; and to compare the sensitivity and specificity of the biosensor results with conventional PCR results. These objectives were achieved as VanA-D gene specific primers was successfully designed in order to generate shorter specific amplicons from vancomycin resistant enterococci (VRE). In addition, specific primers for ddl gene to speciate/identify *E. faecium* and *E. faecalis* for different medication were included in the system and Cold-chain free thermostabilized multiplex PCR was optimized for the detection of VRE. A disposable screen printed electrode and pencil graphite electrode systems were designed for the detection of VRE and the biosensor system using rapid enzyme was optimized based on electrochemical labelled PCR amplicons electrochemical genosensor. Thus, the sensitivity and specificity of the biosensor results were compared to conventional PCR results.

Contact: Dr. Chan Yean Yean, Universiti Sains Malaysia (USM), Office: +609-767 6258 ; H/p: +6012-901 1066

Email: yeancyn@yahoo.com

◆ *Degradable biocements based nano hydroxyapatite / alginate-gel protein for bone healing*

Project objective was to develop a non-toxic, biodegradable and also bioactive cement based hydroxyapatite in order to enhance the bone healing. Alginate which was extracted from sea weed was added to produce good injectability cement system with an improvement of mechanical properties. Protein aided in accelerating the setting of the cement and also improved the mass of the bone cell. This cement system shows a good bioactivity by adding a small amount of silicon. A combination of hydroxyapatite (HA) and dicalcium phosphate dihydrate (DCPD) with the formulation of 60%DCPD - 40%HA - 1% alginate - 1% soy protein - 0.8% silicon gave the optimum properties of the cement. The ratio of liquid to powder (L/P) used to obtain a good injectability was 0.30 ml g⁻¹. The cement produced is non-toxic and potentially used as bioactive bone cement.

Contact: Dr. Roslinda Shamsudin, School of Applied Physics, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, Office: +603-8921 3405, H/p: +6019-387 7331, Email: linda@ukm.my/roslinda.shamsudin@gmail.com

Singapore – from IMRE

◆ *Next generation plastics promises fresher foods and medicines and better protection for surfaces*

Food that stays fresher for longer and varnishes that keep furniture looking new is the goal of new plastic technologies to be developed by a consortium set up by A*STAR's IMRE and its industry partners. In its first industry-themed project, the new ICAP consortium will develop transparent plastics that better protect foods and medicines from oxidation and keep them fresher for longer by blocking oxygen, moisture and UV rays.

“Plastics make up about 40% of most packaging materials with the market set to grow at a faster rate than any other packaging material used today. However, current plastic packaging has its limitations as it allows diffusion of oxygen, moisture and UV light compared to materials like aluminium or tin. This oxidises and degrades perishables like food and pharmaceuticals”, says Dr Li Xu, the IMRE senior scientist who is leading the first ICAP project. “The ICAP team will be using IMRE's advanced capabilities to develop new technologies to overcome these limitations. The plastics we develop should also require less energy to produce and allow consumers to see the actual perishable products

compared to today's opaque aluminium-plastic packaging materials. The same technology may also be used to make paints and varnishes that protect surfaces with air-tight coatings and block oxidising UV and near infrared rays", adds Dr Li. The technology can also be adapted to make transparent surface coatings with improved hardness, UV blocking and oxidation-resistant for use in paints and varnishes.

"Today, consumers want everything cheap and good; this translates to research demands. We need a new generation of food packaging that go beyond their usual functions. For example, packaging that helps food stay fresh and last longer, or with a built-in security feature that deters tampering or even one that lights up when food turns sour!", says Prof Andy Hor, IMRE's Executive Director. "The secret may lie in IMRE's novel layer-by-layer technology of stacking of modified clay sheets. ICAP members will have access to that", adds Prof Hor.

ICAP was conceived in response to the needs of packaging and coating manufacturers who were seeing an increasing demand for high-performance, customised packaging and coatings for critical components and equipment, consumer care, automotive, aerospace, oil and gas industries. Through such a partnership, new and innovative technologies like IMRE's packaging and coating can be placed directly into the hands of relevant companies thus shortening the time-to-market of new products. The consortium currently comprises core member companies including Nestle R&D Center (Pte) Ltd, Daibochi Plastic And Packaging Industry Berhad, Texplora Co., Ltd. (subsidiary company of SCG Chemicals Co., Ltd), Nipo International Pte Ltd and Piaget Chemicals & Manufacturing Pte Ltd.

"We are very impressed with the tech-level of the research and we are excited about the prospects of the application of this technology. We are confident that this technology can grow our business in modified clay additives and create endless possibilities for new materials", said Mr Chua Leng Keong, Managing Director of Piaget Chemicals & Manufacturing Pte Ltd.

"The modified-clay technology that IMRE is developing can potentially enhance the heat insulation and UV protection when applied to building surfaces", said Ms Amanda Khoo, Director of Nipo International Pte Ltd.

"We will now have greater options for using easily processable, flexible, transparent and resource-friendly plastics compared to the conventional aluminium and metal-based films in keeping food fresher for longer", said Mr Thomas Lim, Managing Director of Daibochi Plastic And Packaging Industry Berhad.

Companies have shown great interest and support for this initiative as the ICAP consortium will serve as a platform that enables companies to reduce R&D risks and investments in new coating and packaging technologies by pooling R&D resources in joint projects.

"This consortium presents an opportunity to interface with highly skilled technical and commercial professionals to produce a great platform for new products and applications", commented Dr Suracha Udomsak, Managing Director of Texplora Co., Ltd.

The ICAP project for the new plastics will span one and a half years. Some of ICAP's future projects may include coatings that are highly precise and uniform to fit any shape; abrasion and scratch-resistant hard coatings; heat shielding and sound attenuation coatings; and coatings for deep sea environments. The ICAP consortium will be

launched on IMRE's Industry Day, held on 18 Jan 2012, which is an event that recognises IMRE's industry partners and the success of various industry R&D joint projects over the past year.

◆ *T-rays technology could help develop Star Trek-style hand-held medical scanners*

Scientists who have developed a new way to create a type of radiation known as Terahertz (THz) or T-rays - the technology behind full-body security scanners - say their new, stronger and more efficient continuous wave T-rays could be used to make better medical scanning gadgets and may one day lead to innovations similar to the "tricorder" scanner used in Star Trek.

In a study published recently in Nature Photonics, researchers from the Institute of Materials Research and Engineering (IMRE), a research institute of the Agency for Science, Technology and Research (A*STAR) in Singapore and Imperial College London in the UK have made T-rays into a much stronger directional beam than was previously thought possible and have efficiently produced T-rays at room-temperature conditions. This breakthrough allows future T-ray systems to be smaller, more portable, easier to operate, and much cheaper.

The scientists say that the T-ray scanner and detector could provide part of the functionality of a Star Trek-like medical "tricorder" - a portable sensing, computing and data communications device - since the waves are capable of detecting biological phenomena such as increased blood flow around tumorous growths. Future scanners could also perform fast wireless data communication to transfer a high volume of information on the measurements it makes.

T-rays are waves in the far infrared part of the electromagnetic spectrum that have a wavelength hundreds of times longer than visible light. Such waves are already in use in airport security scanners, prototype medical scanning devices and in spectroscopy systems for materials analysis. T-rays can sense molecules such as those present in cancerous tumors and living DNA as every molecule has its unique signature in the THz range. T-rays can also be used to detect explosives or drugs, in gas pollution monitoring or non-destructive testing of semiconductor integrated circuit chips. However, the current continuous wave T-rays need to be created under very low temperatures with high energy consumption. Existing medical T-ray imaging devices have only low output power and are very expensive.

In the new technique, the researchers demonstrated that it is possible to produce a strong beam of T-rays by shining light of differing wavelengths on a pair of electrodes - two pointed strips of metal separated by a 100 nanometre gap on top of a semiconductor wafer. The unique tip-to-tip nano-sized gap electrode structure greatly enhances the THz field and acts like a nano-antenna that amplifies the THz wave generated. The waves are produced by an interaction between the electromagnetic waves of the light pulses and a powerful current passing between the semiconductor electrodes from the carriers generated in the underlying semiconductor. The scientists are able to tune the wavelength of the T-rays to create a beam that is useable in the scanning technology.

Lead author Dr Jing Hua Teng, from A*STAR's IMRE, said: "The secret behind the innovation lies in the new nano-antenna that we had developed and integrated into the semiconductor chip." Arrays of these nano-antennas create much stronger THz fields that generate a power output that is 100 times higher than the power output of commonly used THz sources that have conventional interdigitated antenna structures. A stronger T-ray source renders the T-ray imaging devices more power and higher resolution.

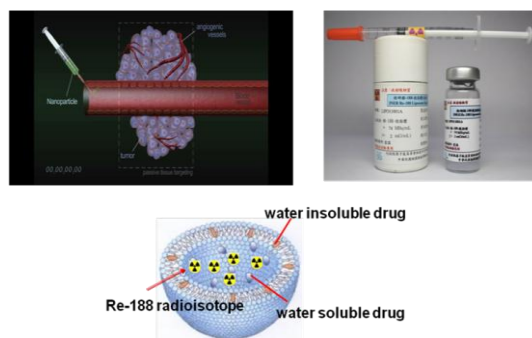
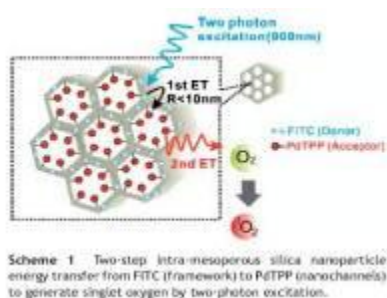
Research co-author Stefan Maier, a Visiting Scientist at A*STAR's IMRE and Professor in the Department of Physics at Imperial College London, said: "T-rays promise to revolutionise medical scanning to make it faster and more convenient, potentially relieving patients from the inconvenience of complicated diagnostic procedures and the stress of waiting for accurate results. Thanks to modern nanotechnology and nanofabrication, we have made a real breakthrough in the generation of T-rays that takes us a step closer to these new scanning devices. With the introduction of a gap of only 0.1 micrometers into the electrodes, we have been able to make amplified waves at the key wavelength of 1000 micrometers that can be used in such real world applications."

The research was led by scientists from A*STAR's IMRE and Imperial College London, and involved partners from A*STAR Institute for Infocomm Research (I2R) and the National University of Singapore. The research is funded under A*STAR's Metamaterials Programme and the THz Programme, as well as the Leverhume Trust and the Engineering and Physical Sciences Research Council (EPSRC) in the UK.

Taiwan – from NPNT

- ◆ *Exploratory Investigational New Drug (eIND) Study for Re-188-liposome Nanoparticle Human Clinical Trial: The world's first in vivo radiation of nano-cancer therapy in human clinical trial*

Liposomes coupled with therapeutics are more easily distributed into leaky tumor-associated blood vessels, through so-called "enhanced permeation retention" (EPR), leading to preferable accumulation of liposomal drugs within tumor microenvironment. ¹⁸⁸Re-liposome is a novel liposomal therapeutic coupling radioisotope, ¹⁸⁸Re, developed by Institute of Nuclear Energy Research (INER). In preclinical studies, it displayed therapeutic effect on subcutaneous tumor growth of murine CT26 and human LS174T colon cancers. The inhibitory effect was also shown in lung (and peritoneal) metastatic models of CT26. Given the encouraging results of preclinical efficacy and toxicity studies, an exploratory investigational new drug study for evaluation of distribution, pharmacokinetics and safety of ¹⁸⁸Re-liposome is proposed for treatment of metastatic cancer patients who failed or cannot tolerate standard chemotherapy.



NEW PUBLICATIONS

Australia

1. Nick Fletcher and Andrew Bartholomaeus (Food Standards Australia New Zealand) “Regulation of Nanotechnologies in Food in Australia and New Zealand”, International Food Risk Analysis Journal, 2001, Vol. 1, No. 2, 33-40.
2. Safe Work Australia, “Safe Handling and Use of Carbon Nanotubes” March 2012. <http://www.safeworkaustralia.gov.au/AboutSafeWorkAustralia/WhatWeDo/Publications/Documents/664/Safe%20Handling%20and%20Use%20of%20Carbon%20Nanotubes.pdf>
3. The Centre for International Economics (For Department of Innovation, Industry, Science and Research), “Feasibility of Implementing a Mandatory Nanotechnology Product Registry”, December 2011. <http://www.innovation.gov.au/Industry/Nanotechnology/NationalEnablingTechnologiesStrategy/Documents/FeasibilityMandatoryNanotechProductRegistry.pdf>
4. The Complexity of Public Engagement, Nature Nanotechnology, February 2012 ([Link](#)).
5. Going Solar. A PhD’s quest for affordable energy, [Link](#).
6. Mission Possible: Graphene, [Link](#).

India

1. S. K. Singh, M. K. Singh, P. P. Kulkarni et al, “Amine-Modified Graphene: Thrombo- Protective Safer Alternative to Graphene Oxide for Biomedical Applications”, ACS NANO, 6(3), 2731–2740, 2012.
2. R.K. Srivastava, S. Srivastava, T. N. Narayanan et al, “Functionalized Multilayered Graphene Platform for Urea Sensor” ACS NANO, 6 (1), 168–175, 2012.
3. P. Prabhu, R. Shetty, M. Koland et al, “Investigation of nano lipid vesicles of methotrexate for anti-rheumatoid activity”, INTERNATIONAL JOURNAL OF NANOMEDICINE, 7, 177–186, 2012.
4. S. K Singh, K. Goswami, R. D. Sharma et al, “Novel microfilaricidal activity of nanosilver”, INTERNATIONAL JOURNAL OF NANOMEDICINE, 7, 1023–1030, 2012.
5. C. B. Singh, S. Sarkar, V. Singh et al, “Ion-induced secondary electrons emission measurement from MgO films deposited on multiwalled carbon nanotubes”, MATERIALS LETTERS, 76, 131–134, 2012.
6. V.P. Dinesh, P. Biji, M. Kumaravel et al, “Synthesis and Characterization of Hybrid ZnO@Ag Core-Shell Nanospheres for Gas sensor Applications”, MATERIALS SCIENCE FORUM, 710, 768-773, 2012.
7. N. Viswanadham, S.K. Saxena, J. Kumar et al, “Catalytic performance of nano crystalline H-ZSM-5 in ethanol to gasoline (ETG) reaction”, FUEL, 95(1), 298-304, MAY 2012.

8. S. Sain, J. Bhattacharjee, M. Mukherjee et al, "Microstructural, magnetic and optical characterizations of nanocrystalline Zn1-xMnxO dilute magnetic semiconductors synthesized by mechanical alloying", JOURNAL OF ALLOYS AND COMPOUNDS, 519, 112-122, APR 5 2012.
9. S. Kabi and A. Ghosh, "Structural investigation on silver phosphate glasses embedded with nanoparticles", JOURNAL OF ALLOYS AND COMPOUNDS, 520, 238-243, APR 15 2012.
10. S. T. Mukherjee, V. Sudarsan, P. U. Sastry et al, "Annealing effects on the microstructure of combustion synthesized Eu3+ and Tb3+ doped Y2O3 nanoparticles", JOURNAL OF ALLOYS AND COMPOUNDS, 519, 9-14, APR 5 2012 .
11. S. S. Khan, A. Mukherjee, N. Chandrasekaran, "Adsorptive removal of silver nanoparticles (SNPs) from aqueous solution by Aeromonas punctata and its adsorption isotherm and kinetics", COLLOIDS AND SURFACES B-BIOINTERFACES, 92, 156-160, APR 1 2012.
12. S. M. Roopan, A. Bharathi, R. Kumar et al, "Acaricidal, insecticidal, and larvicidal efficacy of aqueous extract of Annona squamosa L peel as biomaterial for the reduction of palladium salts into nanoparticles", COLLOIDS AND SURFACES B-BIOINTERFACES, 92, 209-212, APR 1 2012.
13. K. Amarnath, J. Kumar, T. Reddy et al, "Synthesis and characterization of chitosan and grape polyphenols stabilized palladium nanoparticles and their antibacterial activity", COLLOIDS AND SURFACES B-BIOINTERFACES, 92, 254-261, APR 1 2012.
14. V. Chawla and S. A. Saraf, "Rheological studies on solid lipid nanoparticle based carbopol gels of aceclofenac", COLLOIDS AND SURFACES B-BIOINTERFACES, 92, 293-298, APR 1 2012.
15. S. M. Tamboli, M. V. Kulkarni, R. H. Patil et al, "Nanowires of silver-polyaniline nanocomposite synthesized via in situ polymerization and its novel functionality as an antibacterial agent", COLLOIDS AND SURFACES B-BIOINTERFACES, 92, 35-41, APR 1 2012.
16. S. Chakraborty, S. Stalin, N. Das et al, "The use of nano-quercetin to arrest mitochondrial damage and MMP-9 upregulation during prevention of gastric inflammation induced by ethanol in rat", BIOMATERIALS, 33(10), 2991-3001, APR 2012.
17. F. Dilnawaz, A. Singh, S. Mewar et al, "The transport of non-surfactant based paclitaxel loaded magnetic nanoparticles across the blood brain barrier in a rat model", BIOMATERIALS, 33(10), 2936-2951, APR 2012.
18. M. U. A. Prathap, B. Kaur, R. Srivastava, "Hydrothermal synthesis of CuO micro-/nanostructures and their applications in the oxidative degradation of methylene blue and non-enzymatic sensing of glucose/H2O2", JOURNAL OF COLLOID AND INTERFACE SCIENCE, 370, 144-154, MAR 15 2012.
19. R. Chadha, N. Biswas, G. B. Markad et al, "Interaction of reduced graphene oxide with free radicals and silver clusters", CHEMICAL PHYSICS LETTERS, 529, 54-58, MAR 9 2012.
20. S. Krishnan, S. C. S. Sandeep, R. Philip et al, "Two-photon assisted excited state absorption in multiferroic YCrO3 nanoparticles", CHEMICAL PHYSICS LETTERS, 529, 59-63, MAR 9 2012.

ASIA NANO FORUM SOCIETY NEWSLETTER

ISSUE No.16 April 201

21. G. Praveen, P. R. Sreerekha, D. Menon et al, "Fibrin nanoconstructs: a novel processing method and their use as controlled delivery agents", NANOTECHNOLOGY, 23(9), Article Number: 095102, MAR 9 2012.
22. Y. Chen, K. Balani, A. Agarwal, "Do thermal residual stresses contribute to the improved fracture toughness of carbon nanotube/alumina nanocomposites?", SCRIPTA MATERIALIA, 66(6), 347-350, MAR 2012.
23. A. Sidpara and V. K. Jain, "Nano-level finishing of single crystal silicon blank using magnetorheological finishing process", TRIBOLOGY INTERNATIONAL, 47, 159-166, MAR 2012.
24. Q. Saquib, A. A. Al-Khedhairy, M. Siddiqui et al, "TiO₂ nanoparticles induced cytotoxicity, oxidative stress and DNA damage in human amnion epithelial (WISH) cells", TOXICOLOGY IN VITRO, 26(2), 351-361, MAR 2012.

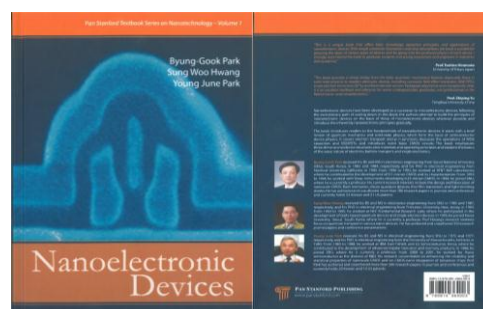
Japan

1. H. Fukidome, S. Abe, R. Takahashi, K. Imaizumi, S. Inomata, H. Handa, E. Saito, Y. Enta, A. Yoshigoe, Y. Teraoka, M. Kotsugi, T. Ohkouchi, T. Kinoshita, S. Ito, and M. Suemitsu, "Controls over Structural and Electronic Properties of Epitaxial Graphene on Silicon Using Surface Termination of 3C-SiC(111)/ Si", Applied Physics Express Vol. 4, No.11, p. 115104 (2011) (3 pages) published online Nov. 9, 2011
2. T. Toriyama, A. Nakao, Y. Yamaki, H. Nakao, Y. Murakami, K. Hasegawa, M. Isobe, Y. Ueda, A. V. Ushakov, D. I. Khomskii, S. V. Streltsov, T. Konishi, and Y. Ohta, "Peierls Mechanism of the Metal-Insulator Transition in Ferromagnetic Hollandite K₂Cr₈O₁₆", Physical Review Letters, Vol. 107, No. 26, p. 266402 (2011) [5 pages] DOI:10.1103/PhysRevLett.107.266402 published 20 December 2011
3. Ming Hu, Shuhei Furukawa, Ryo Ohtani, Hiroaki Sukegawa, Yoshihiro Nemoto, Julien Reboul, Susumu Kitagawa and Yusuke Yamauchi, "Synthesis of Prussian Blue Nanoparticles with a Hollow Interior by Controlled Chemical Etching", Angewandte Chemie International Edition, Early View. First published online: 16 DEC 2011 DOI: 10.1002/anie.201105190
4. Naokatsu Yamamoto, Kouichi Akahane, Tetsuya Kawanishi, Yu Omigawa, Hideyuki Sotobayashi, Yuki Yoshioka, and Hiroshi Takai, "Narrow-line-width 1.31- μ m wavelength tunable quantum dot laser using sandwiched sub-nano separator growth technique", Optics Express Vol. 19, No. 26, pp. B636-B644 (2011)
5. Seung Woo Lee, Betar M. Gallant, Youngmin Lee, Noboru Yoshida, Dong Young Kim, Yuki Yamada, Suguru Noda, Atsuo Yamada and Yang Shao-Horn, "Self-standing positive electrodes of oxidized few-walled carbon nanotubes for light-weight and high-power lithium batteries", Energy & Environmental Science, 2012, Advance Article DOI: 10.1039/C1EE02409D. First published on the web 06 Dec. 2011.

Korea

Book: "Nanoelectronic Devices", Byung-Gook Park, Sung Woo Hwang, Young June Park, Pan Stanford Textbook Series on Nanotechnology – Volume 1, 2012. March

Preface: The purpose of this book is to provide the readers with the fundamentals of nanoelectronic devices. The book starts with a brief review of quantum mechanics and solid-state physics that can form the basis of semiconductor physics. The



Copyright © 2007-2012 Asia Nano Forum (ANF). All Rights Reserved.

ASIA NANO FORUM

basic physics of electron transport and p–n junctions, as they relate to the fundamental principles of MOSFET and other nanoelectronic devices, are covered. From there, the basic operations of MOS capacitor and MOSFET are developed and some basic CMOS circuits are introduced. The nanoelectronic devices are categorized into three types: quantum well, quantum wire, and quantum dot devices depending on the dimensionality of their active region (in most cases, the channel). Three-dimensional device structures, new materials and new operating principles based on quantum mechanics or discreteness of charge are emphasized. The last chapter is devoted to the nanotechnology application of field effect transistors, focusing on the chemical and biochemical sensors.

This book is suitable for use as a textbook by senior undergraduate or graduate students in nanotechnology, nanoscience and electrical engineering. We wanted the book to be self-contained, considering its introductory nature. For practicing engineers and scientists involved in research and development in the IC industry, this book may serve as an introductory reference for them to stay up to date in this field. Nanoelectronic devices are too huge a subject to be covered in one book. We have chosen to cover only the fundamental aspects here.

Taiwan

1. Lin, Cheng-Huei; Chang, Yao-Yuan; Hung, Jui-Yi; Lin, Chih-Yuan; Chi, Yun; Chung, Min-Wen; Li, Chia-Li ; Chou, Pi-Tai; Lee, Gene-Hsiang; Chang, Chih-Hao; Lin, Wei-Chieh. (2011) Iridium(III) Complexes of a Dicyclopentadienyl Phosphite Tripod Ligand: Strategy to Achieve Blue Phosphorescence Without Fluorine Substituents and Fabrication of OLEDs. *Angew. Chem. Int. Ed.* SCI IF: 11.829
2. Chou, Pi-Tai; Chi, Yun; Chung, Min-Wen; Lin, Chao-Chen. (2011) Harvesting Luminescence via Harnessing the Photophysical Properties of Transition Metal Complexes. *Coord. Chem. Rev.* in press SCI IF: 11.225
3. Higuchi, Akon; Ling, Qing-Dong; Ko, Yi-An; Chang, Yung; Umezawa, Akihiro. (2011) Biomaterials for the Feeder-Free Culture of Human Embryonic Stem Cells and Induced Pluripotent Stem Cells. *Chem. Rev.* SCI IF: 36.438
4. Chan, Han-Sung; Hsieh, Zhi-Ming; Liang, Wei-Hong; Kung, A. H.; Lee, Chao-Kuei; Lai, Chien-Jen; Pan, Ru-Pin; Peng, Lung-Han. (2011) Biodistribution and pharmacokinetics of ¹⁸⁸Re-liposomes and their comparative therapeutic efficacy with 5-fluorouracil in C26 colonic peritoneal carcinomatosis mice. *Int J Nanomed* SCI IF: 4.97
5. Peng, Cheng-Liang; Shih, Ying-Hsia; Lee, Pei-Chi; Hsieh, Thomas Mon-Hsian; Luo, Tsai-Yueh; Shieh, Ming-Jium. (2011) Multimodal Image-Guided Photothermal Therapy Mediated by ¹⁸⁸Re-Labeled Micelles Containing Cyanine-Type Photosensitizer. *ACS NANO* SCI IF: 9.855
6. Cheng, Shih-Hsun; Hsieh, Cheng-Chih; Chen, Nai-Tzu; Chu, Chia-Hui; Huang, Ching-Mao; Chou, Pi-Tai; Tseng, Fan-Gang; Yang, Chung-Shi; Mou, Chung-Yuan; Lo, Leu-Wei. (2011) Well-defined mesoporous nanostructure modulates three-dimensional interface energy transfer for two-photon activated photodynamic therapy. *Nano Today* SCI IF: 11.75
7. Chang, Microsugar; Yang, Chung-Shi; Huang, Dong-Ming. (2011) Apatmer-Conjugated DNA Icosahedral Nanoparticles as a Carrier of Doxorubicin for Cancer Therapy. *ACS Nano* SCI IF: 9.855

8. Chung, T. H.; Kuo, M. Y.; Chen, J. K.; Huang, D. M. (2012) YC-1 rescues cancer cachexia by affecting lipolysis and adipogenesis. Int J cancer in press SCI IF: 4.926
9. Chien, C. C.; Kepmson, J. M.; Hwu, Y. K.; Chen, N. Y.; Lee, T. K.; Petibois, C.; Tsai, K. C.; Liu, M. S.; Chang, K. Y.; Yang, C. S.; Margaritondo, G. (2012) A microradiological methodology reveals fundamental aspects of tumor angiogenesis and yields an array of quantitative parameters for its characterization. Biotechnol Adv in press SCI IF: 7.600
10. Wu, T. H.; Hsu, Y. Y.; Lin, S. Y. (2012) A Redox-Switchable Au₈-Cluster Sensor. Small Accepted SCI IF: 7.336

ASIA NANO FORUM SOCIETY NEWSLETTER

ISSUE No.16 April 201

EVENTS

Date	Avenue	Events
Apr. 18-20, 2012	Singapore	InnovFest 2012 Website: http://www.innovfest.sg/
May. 8-11, 2012	Tsukuba, Japan	INC8 - The 8th International Nanotechnology Conference on Communication and Cooperation Website: http://www.inc8.jp/
Jun.4-5, 2012	Tokyo, Japan	Nanofibers 2012 , Japan http://nanofibers2012.com/
Jun.10-13, 2012	Zhubei City, Taiwan	The 4th International Symposium on Microchemistry and Microsystems (ISMM 2012) Website: http://www.ismm2012.org/
Jun.24-29, 2012	Brisbane, Australia	NT12 - Thirteenth International Conference on the Science and Application of Nanotubes Website: http://www.nt12.org/
Jul. 1-6, 2012	Singapore	International Conference of Young Researchers on Advanced Materials (ICYRAM 2012) Website: http://www.mrs.org.sg/icyram2012
Jul. 2-4, 2012	Sydney, Australia	3rd International NanoMedicine Conference Website: http://www.oznanomed.org/
Jul.6, 2012	Arak, Iran	Third International Zeolite Conference Website: http://www.3zc.ir
Aug. 16-18, 2012	Seoul, Korea	Nano Korea 2012 - The 10th International Nanotech Symposium & Nano-Convergence Expo Website: www.nanokorea.or.kr
Sep. 3-7, 2012	Queensland, Australia	International Organic Excitonic Solar Cells Conference Website: http://www.uq.edu.au/iceanconference/index.html
Sep. 13-15, 2012	Suzhou, China	CHInano 2012 Conference&Expo Website: http://chinanoconf.com/
Oct.2, 2012	Hsinchu, Taiwan	2012 CNSI/NPNT Joint Workshop on Nano Technology Event Contact: Ms. Sharon Huang (sharonhuang96@nctu.edu.tw)
Oct. 3-5, 2012	Taipei, Taiwan	2012 Taiwan Nano Week Website: http://nano.tca.org.tw/
Oct. 4-8, 2012	Tehran, Iran	Iran Nano 2012 Website: www.anm2012.com
Oct. 17-19, 2012	Chennai, India	4th International Conference on Advanced Nanomaterials (ANM 2012) Website: www.anm2012.com
Oct. 18-19	Pune, India	The International Conference on Nanotechnology : NANOCON 2012

ASIA NANO FORUM SOCIETY NEWSLETTER

ISSUE No.16 April 201

		Website: http://www.nanocon2012.com/
Oct. 22-25, 2012	Brisbane, Australia	ICEAN-2012:International Conference on Emerging Advanced Nanomaterials Website: http://www.uq.edu.au/iceanconference/index.html
Oct.30-Nov.2, 2012	Kobe, Japan	2012 International Microprocesses and Nanotechnology Conference Website: http://imnc.jp/
Oct.30-Nov.2, 2012	Ha Long City, Vietnam	6th International Workshop on Advanced Materials Science and Nanotechnology (IWAMSN2012) Website: http://iwamsn2012.ac.vn/
Nov. 4-7, 2012	Bangkok, Thailand	The 6th IEEE International Conference on Nano/Molecular Medicine and Engineering (IEEE-NanoMed 2012) Website: http://www.ieee-nanomed.org/2012/
Feb. 11-15, 2013	Auckland, New Zealand	The 6th International Conference on Advanced Materials and Nanotechnology (AMN6) http://www.amn-6.com/
Jun.30-Jul.5, 2013	Singapore	International Conference on Materials for Advanced Technologies (ICMAT 2013) For more information: eileenso@mrs.org.sg
Aug.13-16, 2013	Nanjing, China	The 4th International Conference of Bionic Engineering(ICBE 2013) website: http://www.icbe2013.cn