In This Issue

Japan Nanotech 2009  P.1
Russia Singapore Nanotech Conference 2009  P.1
NSTI Nanotech 2009  P.1
A*STAR-RIKEN Joint Symposium 2009  P.2
SOLARCON Singapore 2009  P.3
Catalyst Patterns for Large-Scale Densely Aligned SWCNT  P.3
ITRI Developing World Leading Flexible Display Technologies  P.4
Research Progress on Organic Dye-Sensitized Solar Cell  P.4
NRF Research Fellowships  P.4
NRF TRD Grant  P.5
NRF UIF  P.5
NRF IDEAS Fund  P.5
SPRING TECS Update  P.5
SPRING BCM Programme  P.5
Upcoming Events  P.6
EVENT NEWS

I. Nano tech 2009 International Nanotechnology Exhibition & Conference
Nano tech 2009 took place in Tokyo, Japan on February 18 – 20, 2009. 47,272 visitors came to visit and 603 exhibitors, including 208 overseas exhibitors from 20 countries around the world, came to participate in total of 909 booths. Nano tech 2009 was a very significant event for Singapore to be internationalized and obtain global visibility among academic and industrial players and investors from all over the world. Detail of the exhibition report can be viewed at www.nanotechexpo.jp/en/show.html.

Singapore Pavilion showcased Singapore Nanotechnology Ecosystem which consists of government (funding/policy), R&D facilities & infrastructure, R&D highlights in Clean Technology, Biomedical Technology and Electronics/ICT, and Nanotechnology industrial players. Singapore Pavilion was positioned strategically among the top Japanese industrial players namely Mitsubishi Corporation, Fujitsu and Toshiba Machine. Its strategic location had invited many people to visit the booth and it was estimated that among the visitors, 67% of them were industrial players such as Panasonic Japan, Sony Japan, Kobe Steel Japan, and People & Technology Korea, and 21% of them were academic players.

General interests expressed include nanotechnology development in Singapore and Singapore’s business environment to further commercialize nanotechnology. Main interest was on OLED component technologies as well as bio-nanotechnology such as tissue scaffold and tissue regeneration.

II. Russia – Singapore Nanotechnology Conference 2009
Drawing close to 200 participants from industry executives, investors to government officials, scientists and entrepreneurs, the inaugural Russia-Singapore Nanotechnology Conference 2009 held on 4 March 2009 in Biopolis showcased the Singapore Nanotechnology commercialization landscape as well as the Russian government nanotech commercialization initiative – Russian Nanotechnology Corporation (RusNano, a 5 Billion USD fund - the world largest nanotech commercialization fund). The event was jointly organized by the Singapore Economic Development Board (EDB), Singapore Business Federation (SBF), Russian Business Incubator “FUTURUS” (RBI) and Singapore leading nanotechnology consultancy NanoGlobe Pte Ltd. It is the first in a series of events to raise awareness of Russian nanotech R&D partnership opportunities.

With more than 15 speakers from Russia and Singapore governmental organization, venture capital, Nanotech companies and industry, this full-day conference provided valuable insights into Russia-Singapore business commercialisation opportunities in the Nanotechnology field, and positioned Singapore as an ideal nanotech R&D hub in Asia Pacific region. The conference closed with an insightful panel discussion on “Opportunities for Cooperation in Nanotechnology R & D and Commercialization”. Leaders from both sides expressed enthusiasm in partnership and recognized that there is synergy and great potential in working together in area of Nanotechnology commercialization. Details of the event program and speakers profile can be viewed at www.nano-globe.biz/rusnanosg2009.

III. NSTI Nanotech Conference & Expo 2009
NSTI (Nano Science and Technology Institute) Nanotech Conference & Expo 2009 was the 12th annual NSTI nanotech conference and trade show with over 250 exhibitors and 4,000 visitors participating in the event. Held on 3-7 May 2009 in Houston, Texas, USA, NSTI Nanotech 2009 covered hundreds of presentations from leaders in nanotechnology research, business, and investment, Nanotech exhibition featuring hundreds of nanotech companies, research institutions, and government agencies, and symposia on many aspects of nanotechnology, including medicine & biotech, electronics & microsystems, energy & environment, advanced materials, fabrication, characterization and tools, and business & strategy. It also included Nanotech Ventures the largest forum for “seed” to “early-stage”
companies to showcase their technologies, market advantages, and search for funding and Nano Industrial Impact Workshops, eighteen one-day workshops presented by leading experts in their respective fields. Collocated with Nanotech 2009 were Clean Technology Conference & Expo 2009 and TechConnect Summit 2009, and TechConnect World Conference & Expo 2009.

NSTI Nanotech was an excellent place to learn the latest development in almost everything one should learn about nanotechnology and clean technology, in the areas of basic research, application, commercialization, business strategy and investment opportunities. Most importantly, it was a place to discover the world most dynamic and advanced start-ups and a fantastic networking platform to connect with the US nanotechnology leaders. The largest number of parallel conference tracks covering the state-of-the-art R&D updates in all nanotechnology disciplines including business and strategy, special symposia and workshops, as well as TechConnect has made NSTI Nanotech distinctive from the rest of nanotech events held in all other countries including Tokyo Nanotech 200X.

Highlight from NSTI Nanotech 2009 included RusNano, an organization operating 5 billion USD nanotechnology commercialization initiative which joined the event and was a platinum sponsor. Rusnano has been aggressively promoting its organization and reaching out for global partnerships. Nanotechnology application (catalyst for example) in oil and gas seems to be an obvious priority for Rusnano investments. Areas such as Photovoltaic, optoelectronics and nuclear medicine for cancer treatment are of great interest to Rusnano. Dr Anatoly Chubais, Rusnano CEO, especially emphasized that Rusnano focuses on business to help the growth of nanotech impact in economy and is non political. Rusnano is not targeting

at profit but revenue to create employment and innovation.

To our surprise, two graphene companies, Angstron Materials and Vorbeck Materials, participated in TechConnect 2009 that showed how advanced commercialization of graphene has achieved today. Angstron, which produces Nano Graphene Platelets (NGP) and Vorbeck, which produces functionalized graphene claimed their mass production in scale of tons. Exciting graphene’s applications have been shown including conductive ink for printed electronics, graphene additives for strong conductive plastics/rubber composites, and functionalized graphene battery electrodes for high powered and long lasting battery. More exciting applications including interconnects, conductive thin films and others are being developed. More detail about NSTI Nanotech 2009 can be found at www.nsti.org/Nanotech2009/

IV. A*STAR – RIKEN Joint Symposium 2009

Attended over 100 researchers, academia and industry players, the 2nd A*STAR – RIKEN Joint Symposium or the 1st SERC of A*STAR & ASI of RIKEN Joint Symposium held on 18-19 May 2009 at The Matrix Biopolis, Singapore has successfully strengthened partnership between Singapore and Japan in common research areas of interest for the long term. This event was intended to foster scientific exchange among scientists from both countries and research collaborations between the researchers at A*STAR and RIKEN.

The 2-day joint symposium focused on four research topics: physical materials & devices, photonics & nano-optics, synthesis & catalysis, and biomaterials & devices. The first day was highlighted with plasmonics metamaterials and terahertz (THz) technology. Exciting scientific breakthroughs presented include 3D plasmonic materials with a spatial resolution of 100nm that was fabricated by two-photon induced metal-ion reduction technique, and vertical Silicon nanowires array based on self limiting oxidation process that can potentially lower the power requirement with reduction of 70% in circuit area and 50% in device area. This means that we can push CMOS based technology beyond Moore’s regime. Plasmonic-effect based imaging technique opens door for high resolution optical imaging, which was previously restricted by the diffraction limit of the probing light. Super-high resolution of 4nm has been
demonstrated by combined mechanical effect Tip-Enhanced Raman Spectroscopy (TERS). Terahertz (THz) technology as an emerging technology holds great potential for various applications as THz radiation can penetrate a wide range of materials such as human tissue, clothing, paper, wood, plastic and ceramics, and it is non-ionising (unlike X-ray). Extensive study is being conducted on THz wave generation, sensing and imaging.

Catalysis and biomaterials/devices underline the second day. Focus has been on developing effective catalysts for olefin polymerization as olefin involves significantly in petrochemical industry. Green chemistry also highlighted the day where benign design and green chemical are emphasized especially in chemical industry. Further improvement longevity and quality of life calls for devices that can integrate sample handling and analysis in a “sample-to-answer” system, point-of-care diagnostics, to where the next generation of bioelectronic microdevices are heading.

The symposium was closed with both A*STAR and RIKEN agreed on moving forward to call for concrete research collaboration projects among researchers from both organizations. Further detail of the symposium programme can be viewed at www.a-star.edu.sg/A-STAR-RIKEN_Symposium2009/symposium_programme.

V. SOLARCON Singapore 2009

The first SOLARCON Singapore was launched by SEMI (Semiconductor Equipment and Materials International) on 20-22 May 2009 at Suntec International Convention & Exhibition Centre, Singapore, together with SEMICON Singapore 2009. The introduction of SOLARCON Singapore addressed the expanding market especially in Southeast Asia for and rising interest in photovoltaic (PV) manufacturing technology. It allowed SEMI to address issues, showcase technologies, and develop programs focused on PV manufacturing in a forum specifically dedicated to the needs of the PV industry. SOLARCON Singapore showcased products and technologies aimed at the growing solar/photovoltaic (PV) market in Southeast Asia.

The 2-day Solar PV conference was enriching, informative and educative with 13 experts in Solar PV shared their view and insight on the state-of-the-art, development, market perspective, standardization, benefit, cost, and safety measures in Asia PV market. Keynote discussions were the issues and challenges for PV Market Development in Asia Pacific & Middle East, which was presented by Mr Daniel Rosa from Conergy Renewable Energy Singapore on the first day, and Photovoltaic technology: present and future, which followed on the second day and presented by Prof. Joachim Luther from Solar Energy Research Institute of Singapore.

Located side by side with SEMICON Singapore exhibition, SOLARCON Singapore exhibited quite a number of players involved in the entire PV value chain, including the equipment suppliers, materials providers, cell manufacturers, and module & end-product integrators. Details of the event programmes, speakers and presentation slides are available at www.semiconsingapore.org/ProgrammesandEvents/index.htm.

TECHNICAL NEWS

I. Catalyst Patterns for Large-Scale Densely Aligned SWCNT at Almost No Cost

A research group at the School of Materials Science & Engineering, Nanyang Technological University (NTU), Singapore, led by Assistant Prof. Hua Zhang has come up with an extremely simple, fast, almost no cost and environmentally friendly technique called “Needle-Scratching” Method (NSM) to generate catalyst patterns used for growing large-scale densely aligned single-walled carbon nanotubes (SWCNTs) arrays as recently published online in Small, http://dx.doi.org/10.1002/smll.200900654.

NSM is a technique to produce uniform and high-density catalyst nanoparticles by simply scratching the substrate with the sharp tip of a common syringe needle. The high density of SWCNTs can then grow from the catalyst patterns after consequent chemical vapor deposition (CVD). Started with Si/SiOx substrate, Zhang and his team have demonstrated the growth of densely aligned SWCNT arrays on quartz substrates with controlled pattern location, spacing and direction by NSM with a micro-manipulator. The aligned SWCNT arrays successfully grew from the scratched areas with the density as high as 10 tubes μm-1 and length up to 0.5 mm.

NSM has overcome various limitations found in the traditional lithography methods (e.g. photolithography, e-beam lithography, micro-contact printing) used to prepare catalyst patterns. Catalyst patterns generation is a crucial step in growing high density and well aligned SWCNT, which is an ideal material for constructing high performance thin film transistors due to its multiple transport pathways and absence of tube-tube overlapping junction problems. Furthermore, the process can be readily scaled up by using multiple needle arrays. NSM provides a very convenient route to produce high density, high quality SWCNT arrays that may create great impact on further study of their applications as well as the fabrication of CNT-based nanodevices.

An SEM image of densely aligned SWCNT arrays grown from the NSM-generated catalyst stripe on quartz substrate.
II. ITRI Developing World Leading Flexible Display Technologies

Leading in flexible display technologies, ITRI (Industrial Technology Research Institute) Taiwan has developed the world’s largest area bistable Cholesteric LCD (Ch-LCD), a 24 cm by 300 cm display with reflectance over 30% and resolution of 30dpi (dots per inch). This display can be manufactured roll-to-roll, which means faster, lower-cost production, and also removes limits on display size. The display width of 24 cm was limited by the production equipment, but there is theoretically no upper limit on display length.

In 2008 ITRI has developed a 10.4 inch single layer color Ch-LCD that features thickness reduced by 60% compared to traditional three-layer designs (Red-Green-Blue or RGB), resolution of 40 pixel-per-inch, and reflectivity of 30%, which already meets the global standard for three-layer color Ch-LCD reflectivity of 25-30%. ITRI’s single layer color Ch-LCD is made by dividing the single layer into three vertical sub-pixels, then using Pixelized Vacuum Filling or Ink-Jet Printing to put all three colors in each pixel. Thus the colors are all in a single layer and do not mix. The advantages of this single layer structure include no pixel alignment problem, reliable production, low cost driver system, increased flexibility, and it does not need color filter, raising light reflection efficiency.

In 2009, ITRI aims to get the resolution up to 100 ppi (current notebooks are 70-100ppi). If these color flexible screens can get up to notebook standards, then E-books can really become a killer application that will drive further technology evolution. Further enquiries can be directed to Jia-Xing Lin, Display Technology Center, ITRI < jxl@itri.org.tw>.

III. Research Progress on Organic Dye-Sensitized Solar Cell

Recently, a research group in the Changchun Institute of Applied Chemistry, Chinese Academy of Sciences (CAS), China has made significant progress in organic dye-sensitized solar cells. Results were published online in the United Kingdom Chemical Society “chemical communication” (Chem. Commun.).

The paper reported an organic dye C217 with high absorption coefficient, with a photoelectric conversion efficiency of 9.8% in the solvent acetonitrile electrolyte devices. The long-term light and heat-stable dye-sensitized solar cells were achieved with a photoelectric conversion efficiency of 8.1% when combined with solvent-free ionic liquid electrolyte. These two indicators are the best results in organic dye-sensitized solar cells. The performance is very close to the ruthenium dye. This work was reported in “Technology Review” in March 12, 2009, and reproduced in other media. The results of this study will further facilitate the development and applied research on wide-spectrum, high efficiency, low-cost pure organic dye-sensitized solar cells. This study has been funded by the National Natural Science Foundation, major national scientific research plan, the Chinese Academy of Sciences “Hundred” program, and the CAS Knowledge Innovation Program.


FUNDING/GRANT UPDATES

I. NRF Research Fellowships

Ten outstanding young scientists awarded the NRF Research Fellowship on 14 January 2009 out of 186 applications received from around the world. The award will provide each Research Fellow with up to US$1.5 million in research funding support over three years to perform cutting-edge research in Singapore, with the possibility of receiving a second round of three-year funding. This is the second group of Research Fellows that NRF has attracted to Singapore. The inaugural group of Research Fellows has already started their research in Singapore. Details of the awarded Research Fellows and update on the inaugural group of Research Fellows can be viewed at www.nrf.gov.sg/nrf/uploadedFiles/News_and_Events/Press_Release/2009/RF%20press%20release.pdf.
II. NRF Translational Research and Development (TRD) Grant

On 11 May 2009, a new TRD grant of S$25 million was announced to fund translational research and development at the five polytechnics in Singapore. This grant is under the S$360 million – National Framework for Innovation and Enterprise (NFIE) that was announced by the Singapore Prime Minister in March 2008. TRD grant provides the polytechnics with resources that will enable them to develop commercial products using intellectual property (IP) from the universities and research institutes. It will also match downstream development at the polytechnics with upstream university research. TRD grant scheme aims to support at least 10 projects per year at steady state with up to S$500K per project. The grant will be given in two tranches: the first tranche of S$15 million will be made available for the first three years, and pending a satisfactory review in the third year, the second tranche of S$10 million will be released for the scheme. Complete coverage on this grant is available at www.nrf.gov.sg/nrf/uploadedFiles/News_and_Events/Press_Release/2009/NRF-TRD%20Media%20Release_final.pdf.

III. NRF University Innovation Fund (UIF)

S$22 million initial fund was announced on 19 May 2009 to support academic entrepreneurship efforts in the three local universities – the Nanyang Technological University (NTU), the National University of Singapore (NUS) and the Singapore Management University (SMU). UIF aims to catalyze innovation and facilitate the creation of high tech start-up companies to bring R&D results from the lab to the market. The S$50 million UIF is one of several initiatives under NFIE which together with existing efforts at the respective universities will enable each to build up a strong, vibrant and sustainable innovation ecosystem. This grant will support activities in the universities relating to innovation and enterprise that include entrepreneurship education programmes, platforms to encourage startup formation, guidance to aspiring entrepreneurs, and activities that promote entrepreneurship. S$9 million out of the initial budget was given to NUS, while NTU and SMU received S$6.5 million each. The remaining S$28 million of UIF will be reserved to support future proposal from the universities. In addition, each university has set up a high level Enterprise Board, which comprises members from the universities’ respective Board of Trustees and includes strong representation from industry. The Enterprise Board will lead academic entrepreneurship efforts in the universities and be responsible for the use of the UIF grants at each university. Further details can be found at www.nrf.gov.sg/nrf/uploadedFiles/News_and_Events/Press_Release/2009/UIF%20Press%20Release.pdf.

IV. NRF Incubator for Disruptive Enterprise And Startups (IDEAS) Fund

NRF and Innosight Ventures Pte Ltd, a Singapore-based venture capital firm announced on 27 May 2009 the launch of a new incubator fund for early-stage startup companies that have high potential for disrupting existing markets and creating new ones. IDEAS Fund leverages the research of Prof. Clayton Christensen, a widely-recognized authority on the topic of disruptive innovation. It will screen startups according to their disruptive innovation potential, and will leverage the disruptive innovation framework to guide companies through their early stages. IDEAS Fund plans to incubate 25 startup companies over the next 3 years. Further details can be viewed at www.nrf.gov.sg/nrf/uploadedFiles/News_and_Events/Press_Release/2009/IDEAS_press%20release_27May2009.pdf.

V. SPRING Technology Enterprise Commercialisation Scheme (TECS) Update

SPRING awarded about S$8 million funding support to 21 winning projects under TECS Proof of Concept and Proof of Value on 4 June 2009. This was the second batch of winners under TECS. Last year, 17 projects were awarded with total of S$6 million in grants. TECS, launched in April 2008, is to provide technology startup companies and enterprising public sector researchers with early-stage funding support. It aims to provide S$75 million in grants to about 100 projects in five years. Total applicants received since the first call last year, were over 400. Collaborating with IDA, this year SPRING added new sector, information and communication technology (ICT), to be included under TECS in addition to electronics, photonics and device technologies, and biomedical sciences. At the award ceremony, it was announced that SPRING now accepts TECS applications all year round from entrepreneurs. Details about TECS can be found at www.spring.gov.sg/tecsportal.

VI. SPRING Business Continuity Management (BCM) Programme

Announced on 10 June 2009, the national Business Continuity Management (BCM) programme is a five-year S$30 million initiative funded by SPRING Singapore to get small companies onto the BCM bandwagon early. BCM programme is a one-stop shop for companies to get access to BCM certification and funding, among other things. This
programme, run by the Singapore Business Federation (SBF), aims to raise awareness of BCM among organizations, especially among small and medium-sized enterprises. One advantage of the national BCM programme is that local companies can apply for government funding. Up to 70% of the costs of the BCM training and certification can be defrayed if the companies meet the requirement listed by SPRING. More detailed coverage is available at www.spring.gov.sg/Content/ModulePage.aspx?group=sph&id=566891ec-250b-4a73-8a49-aa42a268e909.

UPCOMING EVENTS

Singapore

Singapore International Water Week
22-26 June 2009, Suntec Singapore International Convention & Exhibition Centre, Singapore
http://www.siww.com.sg/

International Conference on Materials for Advanced Technologies (ICMAT)
28 June-3 July 2009, Suntec Singapore International Convention & Exhibition Centre, Singapore

3rd Industrial Symposium on Nanoimprint Lithography “in conjunction with ICMAT 2009
2 July 2009, Suntec City Convention Centre, Rm 302, Singapore
http://www.imre.a-star.edu.sg/events

3rd Singapore Scanning Probe Microscopy (SingSPM) Symposium
13 July 2009, Institute of Materials Research and Engineering (IMRE), Singapore
http://www.imre.a-star.edu.sg/events

Dr. Lerwen Liu’s Book Launch cum Seminar titled “Emerging Nanotechnology Power- Overview on Nanotechnology Application in Energy, HealthCare & ICT and Development in Asia Pacific Region”
29 July 2009, ISEAS Seminar Room, 30 Heng Mui Keng Terrace, Singapore
http://www.worldscibooks.com/nanosci/7224.html

ICBN 2009: International Conference on Biotechnology and Nanotechnology
26-28 August 2009, River View Hotel, Singapore
http://www.waset.org/wcset09/singapore/icbn/

Worldwide

NANO KOREA 2009, The 7th International Nanotech Exhibition in Korea
26-28 August 2009, Korea International Exhibition Center (KINTEX), Korea

ChinaNANO 2009 International Conference on Nanoscience & Technology
1-3 September 2009, Beijing International Convention Centre, Beijing, China
http://www.chinanano.org/

Nanotech Europe 2009
28-30 September 2009, Berlin, Germany
http://www.nanotech.net/content/home

Rusnanotech’09: The 2nd Nanotechnology International Forum
6-8 October 2009, Central Exhibition Complex The Expocentre, Moscow, Russia
http://www.rusnanoforum.ru/cgi-bin/show.pl?option=&id=&lang=ru
Taiwan Nano 2009
7-9 October, Taipei World Trade Center, Taipei, Taiwan
Including series of activities:
Taiwan Nano Exhibition 2009 http://nano.tca.org.tw/index_e.htm

Nanotech Malaysia 2009 (Conference, Forum and Exhibition)
27-29 October 2009, Kuala Lumpur Convention Center, Kuala Lumpur, Malaysia