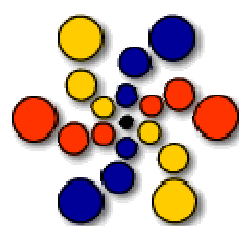
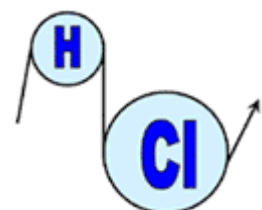
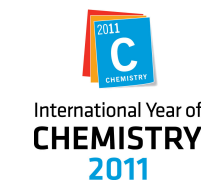


# InForm Partners

InForm  
Integrating Nanomaterials in Formulations



For more information on InForm  
please visit:

[www.nanoformulation.eu](http://www.nanoformulation.eu)

NanoFormulation2011

*Fact-finding  
Mission*

*27<sup>th</sup> June 2011*

*ICES,  
Jurong Island,  
Singapore*



# NanoFormulation2011

## Notes

### About InForm

InForm stands for Integrating Nanomaterials in Formulation. As a partnership between 17 world-leading institutions bringing together formulation scientists from Europe, USA and Asia-Pacific, InForm creates appropriate platforms for dissemination between researchers working in academia, public research laboratories and industry to identify and enhance complementary interests.

The topic of InForm will be the new challenges of formulation related to the use of nanomaterials.

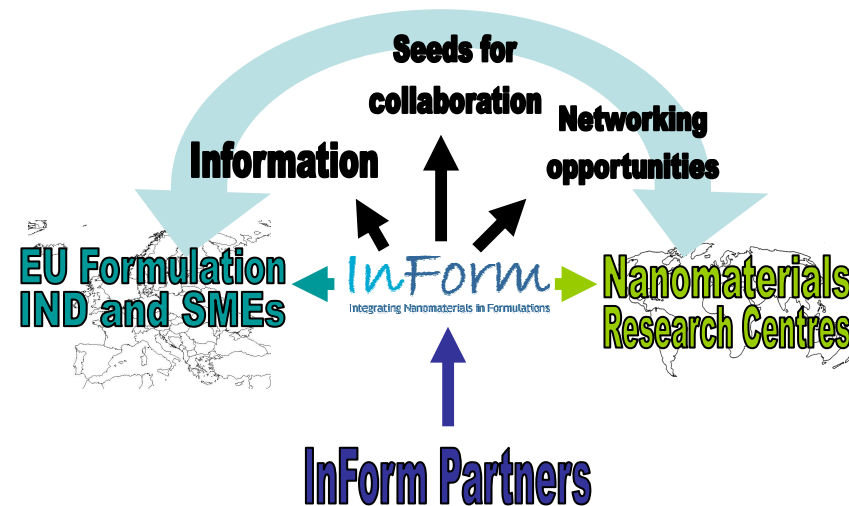
Each InForm partner has been selected for their knowledge of nanomaterials, their affiliation with key formulation and nanotechnology advances and their passion for making this knowledge available for the benefit of all.

For more information:

Website: [www.nanoformulation.eu](http://www.nanoformulation.eu)

Email the InForm Project Manager: [helen.dutton@manchester.ac.uk](mailto:helen.dutton@manchester.ac.uk)

InForm has been funded by the European Commission through the European Union Framework 7 programme.



### NanoFormulation2011: 26 June - 1 July 2011

NanoFormulation2011 is the second of three international events organised under InForm held in Suntec City, Singapore. As an independent event integrated within the ICMAT framework, NanoFormulation2011 will be inaugurated with a fact finding mission to ICES laboratories in Jurong Island showcasing the industrial applications of nano-research in Singapore. In addition to a traditional conference program, with themes fundamental to formulation sciences, NanoFormulation2011 will also facilitate 1:1 networking sessions between the delegates. A training day at the Institute of Materials Research and Engineering (IMRE) on nanomaterial characterisation concludes the event. NanoFormulation2011 is an official event recognised by the International Year of Chemistry.



## Notes

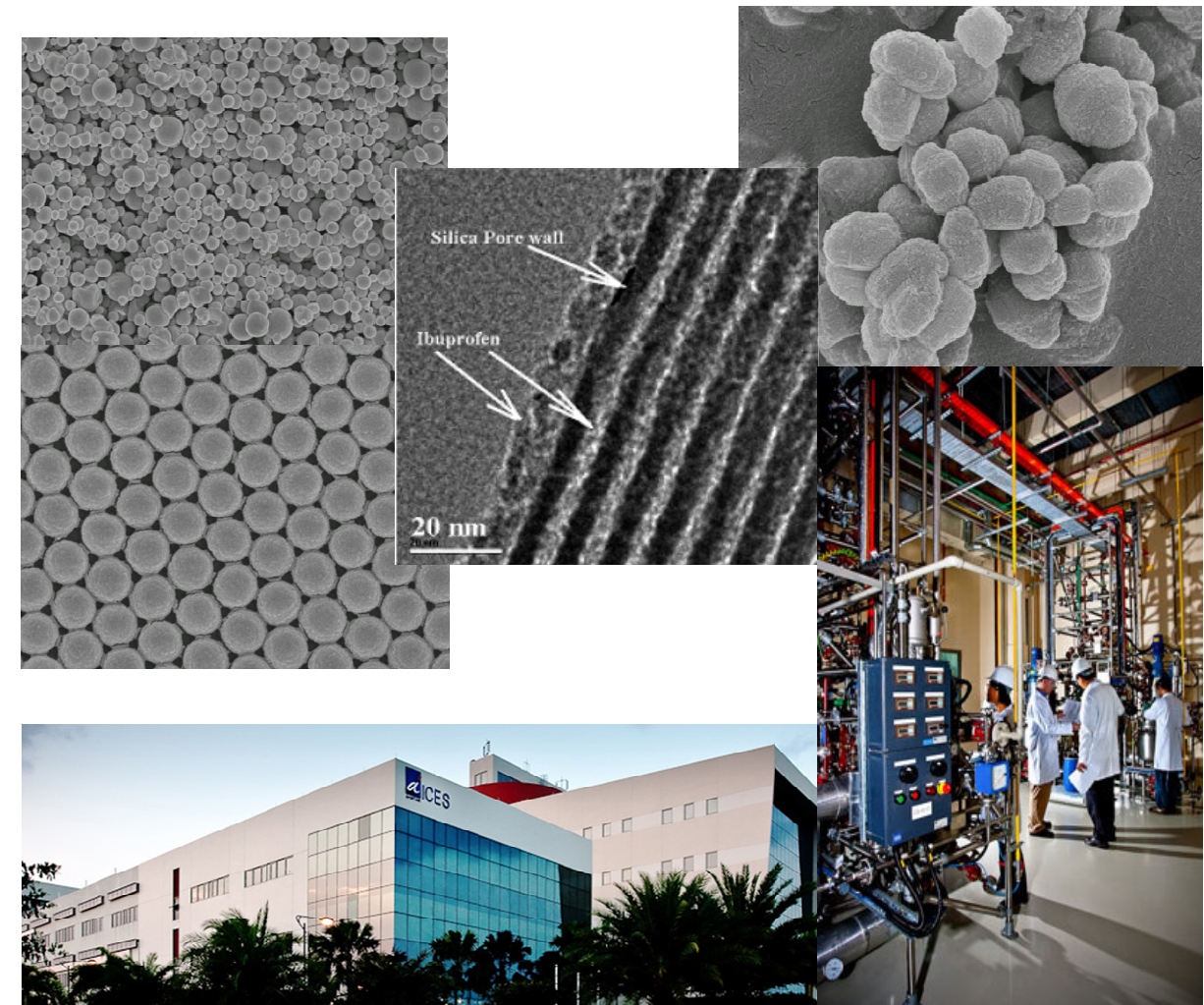
## ICES Laboratories Visit: An InForm Fact-Finding Mission

### Fact-finding mission in Singapore

InForm has organised a fact-finding mission for researchers and industrialists to a research institute in Singapore. The aim of this fact-finding mission is to showcase excellent nanoscience research within Singapore and offer researchers from all research institutions the chance to visit the Institute of Chemical and Engineering Sciences which is located in Jurong Island, the heart of Singapore's Energy and Chemical Hub.

The fact-finding mission will:

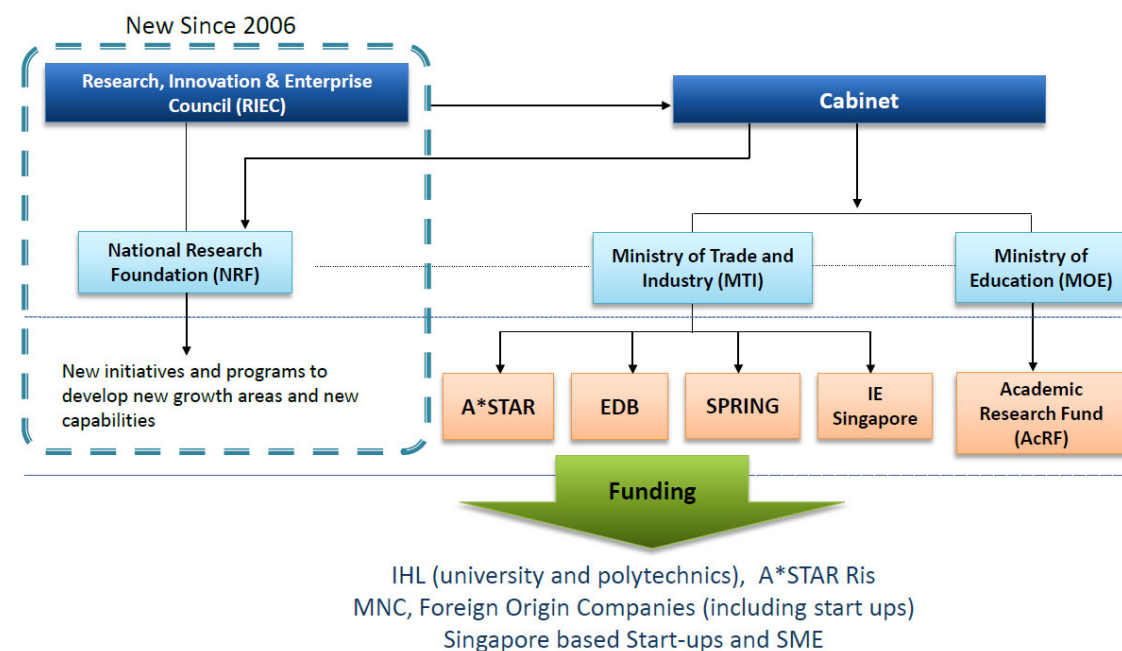
- Allow the researcher an insight into one of Singapore's world-leading institutes.
- Offer the opportunity to experience how nano-research is carried out in the industry using current advances in nanotechnology for formulated products.
- Facilitate exchange of ideas and knowledge.
- Gather together scientists from various fields and expertise.
- Create avenues for possible future collaborations.



## Nanotechnology in Singapore

### Introduction

Nanotechnology is recognised as a key enabler to sustain future development of the Singapore economy and Singapore agencies have put more and more emphasis on it since the late 1990s in response to growing awareness of nanotechnology worldwide. The Singapore government spent about US\$300 million between 2003 and 2007 on nanotechnology-related research and development (R&D) and manpower development. Today, Singapore is home to one of the largest nanotech community in the region. Currently the nanotechnology community in Singapore includes more than 50 companies and research organisations with over 1,000 researchers, scientists and engineers challenging the frontiers of size.



### Research Infrastructure

Research in nanotechnology mainly takes place in the two technological universities in Singapore namely, National University of Singapore (NUS) and Nanyang Technological University (NTU) and Agency for Science, Technology and Research (A\*STAR) Research Institutes (RIs).



#### Nanyang Technological University (NTU)

**NanoCluster** is a network of 5 research centres in NTU with shared facilities for nanofabrication, nanocharacterisation, and with applications in nanodevices, energy & catalysis, nanobiotechnology, nanomaterial synthesis, organic, molecular electronics and nanomagnetism & photonics. Major facilities include three cleanrooms with a nett total area of 1,000 m<sup>2</sup> for semiconductor processing, microelectromechanical systems (MEMs), bio/organic/glass/metal fabrication/processing, advanced characterisation such as transmission electron microscopy (TEM), focused ion beam (FIB) surface analysis, and advanced materials synthesis. In addition, the Computational Nanoelectronics Initiative in NTU coordinates nanoelectronic modelling work among the IHLs and RIs. <http://www3.ntu.edu.sg/NanoCluster/>

## Nano-Funding in Singapore



### National Research Foundation (NRF)

The National Research Foundation (NRF) was set up on 1 January 2006 as a department under the Prime Minister's Office. It was set to perform the following:

- To provide secretariat support to the Research, Innovation and Enterprise Council (RIEC), chaired by the Prime Minister,
- To coordinate the research of different agencies within the larger national framework in order to provide a coherent strategic overview and direction,
- To develop policies and plans to implement the five strategic thrusts for the national R&D agenda, and
- To implement national research, innovation and enterprise strategies approved by the RIEC, and to allocate funding to programmes that meet NRF's strategic objectives.

<http://www.nrf.gov.sg/>



### Singapore Economic Development Board (EDB)

EDB is the lead government agency responsible for planning and executing strategies to enhance Singapore's position as a global business centre and to grow the Singapore economy. EDB works on this in three ways:

- Attracting foreign investments,
- Growing industry verticals, and
- Enhancing business environment.

<http://www.edb.gov.sg/>



### International Enterprise Singapore

International Enterprise (IE) Singapore is an agency under the Ministry of Trade and Industry spearheading the development of Singapore's external economic wing. The mission of IE is to promote the overseas growth of Singapore-based enterprises and international trade.

<http://www.iesingapore.com/>



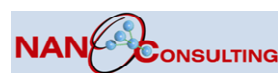
### SPRING Singapore

SPRING Singapore is the enterprise development agency responsible for helping Singapore enterprises grow. SPRING works with partners to help enterprises in financing, capability and management development, technology and innovation, and accessing new markets. As the national standards and accreditation body, SPRING develops and promotes an internationally-recognised standard and a quality assurance infrastructure that builds trust in Singaporean enterprises, products and services, thereby enabling their global competitiveness and facilitating global trade.

<http://www.spring.gov.sg/>



## Nano-Commercialisation in Singapore



### NanoConsulting Pte Ltd

Established in 2008, NanoConsulting Pte Ltd is a boutique consulting firm based in Singapore offering customised services to small technology businesses around the world with growth plans for Asia. NanoConsulting specialises in working with organisations in nanotechnology, energy, water and life science sectors, provides strategic and fund raising support to commercialise promising technologies from around the world in Singapore, and provides real-time market intelligence, strategic assistance, fund raising, business development and match making services to nanotechnology based companies.

<http://www.nanoconsulting.com.sg/>



### NanoGlobe Pte Ltd

NanoGlobe is a nanotechnology consultancy based in Singapore and provides business development services to corporate, entrepreneurs, government and research institution clients based on its unparalleled understanding of nanotechnology in Asia. NanoGlobe is recognised as a world class consultancy by government agencies, research institutions, large global corporations, early stage companies and investment firms.

<http://www.nano-globe.biz/>

## Nano-Funding in Singapore

### Key funding agencies:



### Agency for Science, Technology and Research (A\*STAR)

The Agency for Science, Technology and Research (A\*STAR) is Singapore's lead government agency dedicated to fostering world-class scientific research and talent. A\*STAR supports Singapore's key economic clusters by providing intellectual, human and industrial capital to its industry partners. It also supports extramural research in local universities and hospitals, and with other local and international partners. A\*STAR's Biomedical Research Council (BMRC) and the Science and Engineering Research Council (SERC) oversee and promote impactful public sector R&D in biomedical sciences, and physical sciences and engineering respectively. Together, the capabilities of A\*STAR's 14 research institutes, seven consortia and one centre span the spectrum of scientific disciplines from developmental and cell biology to engineering and info-comm technology. With a strength of 2,300 scientists from more than 50 countries around the world, A\*STAR boasts of a truly international character.

<http://www.a-star.edu.sg/>



### National University of Singapore (NUS)

The **National University of Singapore Nanoscience and Nanotechnology Initiative (NUSNNI)** provides the focal point for nanotechnology related activities in six strategic areas namely: nanobiotechnology, nanomagnetics and spintronics, nano/microfabrication, nanophotonics, sustainable energy and health, and environmental impacts of nanomaterials. It consists of 14 research labs and five research centres across science and engineering faculties. One of these research centres is the Singapore Synchrotron Light Source (SSLS) which provides synchrotron radiation-based fabrication and characterisation services to academia and industry around the world. The Centre for Ion Beam Applications (CIBA) has a proton beam radiation source which can be used to fabricate high aspect ratio 3D nanostructures and to image deep tissues. Some state-of-the-art labs in NUS include the Organic Nano Devices Laboratory (ONDL), Silicon Nano Devices Laboratory (SNDL) and Surface Science Laboratory (SSL). In 2008, NUS launched **NanoCore** – an embedded entity within NUSNNI - to build a focused group of interdisciplinary labs of excellence in selected areas such as oxide electronics, grapheme electronics, active plasmonics, spintronic materials, optoelectronics, ion-beam imaging and fabrication, and bionanotechnology. **NanoCore** has state-of-the-art infrastructure like the Orion helium-ion sub-nanometer microscope and e-beam writer.

<http://www.nusnni.nus.edu.sg/>

<http://www.nanocore.nus.edu.sg/>

<http://www.physics.nus.edu.sg/~ondl/>

<http://www.ece.nus.edu.sg/sndl/>

<http://www.physics.nus.edu.sg/~surface/>



### A\*STAR Research Institutes

Among the 14 A\*STAR RIs, nanotechnology related research is concentrated in the Institute of Bioengineering & Nanotechnology (**IBN**), Institute of Materials Research & Engineering (**IMRE**), Singapore Institute of Manufacturing Technology (**SIMTech**), Institute of Chemical & Engineering Sciences (**ICES**), Institute of Microelectronics (**IME**), and Data Storage Institute (**DSI**). The Science and Engineering Council (SERC) in A\*STAR has setup the Nanofabrication and Characterisation Facility (SNFC) in IMRE making available its fabrication and characterisation facilities to the nano-tech community in Singapore.

### Institute of Bioengineering and Nanotechnology (IBN)

Established in 2003, IBN has created new knowledge and technology platforms of high commercial and translational impact in 4 research areas namely, Drug & Gene Delivery, Cell & Tissue Engineering, Biosensors & Biodevices, and Pharmaceuticals Synthesis & Nanobiotechnology.

<http://ibn.a-star.edu.sg/>

## Nanotechnology in Singapore

### Institute of Material Research Engineering (IMRE)

Established in 1997, IMRE leverages on its capabilities in materials analysis, characterisation, materials growth, patterning, fabrication, synthesis & interrogation, to establish various R&D programs. These programs include research on organic solar cells, nanocomposites, flexible organic light-emitting diodes (OLED), solid-state lighting, nanoimprinting, microfluidics, and next generation atomic scale interconnect technology.

<http://www.imre.a-star.edu.sg/>

### Singapore Institute of Manufacturing Technology (SIMTech)

Formed in 1993, SIMTech's manufacturing expertise in nanotechnology is in the field of nanopowders and nanomaterials, manufacturing processes (such as coating, joining, forming, and machining), as well as nanometrology.

<http://www.simtech.a-star.edu.sg/>

### Institute of Chemical and Engineering Science (ICES)

Established in 2002, ICES's research areas cover chemistry and chemical engineering science, combined with advanced analytical characterisation and measurement to develop state-of-the-art technology for the petrochemical, general chemical, fine chemical and pharmaceutical industries. A few examples of ICES's nanotech research activities include nanostructured hydrogen storage materials, polyolefin catalyst nanocomposites, nanoparticle formulations, and sustainable green chemistry.

<http://www.ices.a-star.edu.sg/>

### Institute of Microelectronics (IME)

Conceived in 1991, IME currently engages in research on nano-scale devices, micro/nanofluidics, bioelectronics, advanced assembly & packaging processes, systems in package design, simulation & measurements, radio frequency (RF)/mm waves and low-power mixed-signal integrated circuit (IC) & system designs.

<http://www.ime.a-star.edu.sg/>

### Data Storage Institute (DSI)

Conceived in 1992, DSI's vision is to be a vital node in a global community of knowledge generation and innovation, nurturing research talent and capabilities for world-class R&D in the next generation storage technologies. With core competencies in network storage, non-volatile memory and high-density magnetic recording technologies, DSI is equipped with state-of-the-art facilities for advanced R&D as well as system design and prototyping.

<http://www.dsi.a-star.edu.sg/>

## Nano-Commercialisation in Singapore



### Exploit Technologies Pte Ltd

Exploit Technologies is the strategic marketing and commercialisation arm of A\*STAR. It provides access to Singapore's large pool of intellectual property and knowledge generated by over 2,000 researchers at A\*STAR's research institutes, and leverages on A\*STAR's cutting edge biomedical sciences research to help both local enterprises and multinationals increase their competitive advantage in the market.

<http://www.exploit-tech.com/>



### NanoFrontier Pte Ltd

Formed in 2003, NanoFrontier Pte Ltd is wholly owned by NTU's Ventures Pte Ltd. NanoFrontier to date has performed more than 20 commercial projects and has spun-off four start-up companies commercialising the technologies coming out of NTU.

<http://www.nanofrontier.com.sg/>



### Nanoholdings Asia Pte Ltd

Established in 2003 in Connecticut USA, Nanoholdings is a diversified nano-energy company that exclusively licenses, develops and commercialises breakthrough nano-energy discoveries with world-class universities and their leading scientists to address the huge inefficiencies in the global energy market. In the process, Nanoholdings generates sound returns for its investors. Nanoholdings setup its Asian subsidiary in Singapore in 2009.

<http://www.nanoholdings.com/>



### Nanostart Asia Pte Ltd

Nanostart Asia is a subsidiary of Nanostart AG, a leading nanotechnology investment company, founded in 2003 and based in Germany. Nanostart profits from the enormous growth potential of nanotechnology, and the growth in the values of the companies in which it invests. In 2007, Nanostart AG started operations in Singapore.

<http://www.nanostart.de/>



### Small World Group Incubator

Founded in 2006, Small World Group Incubator (SWG I) regularly provides seed funding, mentoring and help to start and grow small companies. SWGI operates under the Singapore National Research Foundation (NRF) Technology Incubation Scheme. SWGI focuses on three areas of technology innovation – clean technology, optical systems and advanced materials.

<http://www.smallworldgroup.com/>



## Nanotechnology in Singapore



### Biomers Pte Ltd

BioMers is a medical device company engaged in developing new engineered materials for numerous biomedical applications using its patented polymer composite manufacturing technology. BioMers' patented technology allows for the fabrication of micro-scale polymer composite products. The products have superior mechanical properties such as high strength, uniform properties throughout the product and excellent surface finishing as compared to products made with other processes. The current products utilise nanocomposites as the matrix material. Founded as a spin-off from the NUS, BioMers is a Singapore-based company with a sales and distribution facility in Washington State, USA.

<http://www.biomersbraces.com>



### Caltron Pte Ltd

Caltron was established in Singapore in 1971, and founded by professors from research institutions and universities. The company has become the leading solution provider in tests, measurements and analyses in the fields of nanotechnology, semiconductors, life sciences and microelectronics.

<http://www.caltron.sg/>



### SuperiorCoat Pte Ltd

SuperiorCoat Pte Ltd was incorporated in 2003 with the company's first prototype machine. After initial market trials and acceptance, the company expanded the service capacity at a pace of one machine every two years. To meet the needs of customers, an in-house R&D division has been set up in Suzhou, China. SuperiorCoat provides various types of coating solutions to meet the requirements of customers and specialises in diamond-like carbon (DLC) coating. The company has gone from providing service to research and development to overcoming various coating issues and problems. The company formerly collaborated with NTU and owns one patent.

<http://www.superior-coat.com/>



### Zyvex Asia Pte Ltd

Zyvex Asia, Pte. Ltd. was formed in 2007 to work with Zyvex Labs, its USA-based partner, to develop Atomically Precise Manufacturing. It works closely with A\*STAR's IMRE to do this work. Zyvex companies are developing the tools to build atomically precise products atom-by-atom, under computer control. Creating such digital matter in massively parallel nanoscale factories will lead to revolutionary new products ranging from simple quantum dots and atomically accurate metrology standards, to powerful energy harvesting and storage devices, and eventually to stunning nanomedicine capabilities.

<http://www.zyvexasia.com>

## Nanotechnology in Singapore

### Nanotechnology Companies



### Bayer MaterialScience Functional Films Research Centre Singapore

Rooted in a strong foundation of innovation culture, Bayer MaterialScience is expanding their global research network and capability for the functional films business in Asia Pacific. After its opening ceremony on 22 June 2010, their Functional Films Research Centre Singapore will be working with customers on tomorrow's products and technologies to develop new, customised grades of films and materials for innovative applications. The Functional Films Research hub in Singapore will not only develop its own core R&D competence but also closely collaborate with local research and development institutions and industry partners across the Asia Pacific.

<http://www.bayermaterialscience.com/>



### NanoBright Technologies Pte Ltd

NanoBright Technologies, incorporated in November 2007, is a spin-off company from a NUS research laboratory. It seeks to commercialise the fluorescent technologies that were developed in the laboratory. NanoBright brings together the best of both worlds, with scientists/technologists from the lab combined with seasoned industrial professionals from the marketplace. They endeavour to develop new applications using their technologies. NanoBright continues to develop downstream applications with cutting-edge technologies while collaborating with the university in upstream research.

<http://www.nanobright.com.sg/>



### Haruna Singapore Pte Ltd

Haruna is one of the emerging building chemicals and paints producers and suppliers. Originating in Singapore, its products have been distributed and used in countries around the region. Haruna offers a large and solution-oriented range of products and distribute a number of speciality products. Haruna is recognised as an innovative, science-based manufacturer by the Startup Enterprise Development Scheme (SEEDS), a wholly-owned investment arm of the Economic Development Board Singapore (EDB).

<http://www.harunapaint.com/>



### Tera Barrier Films Pte Ltd

Tera Barrier Films Pte Ltd (TBF) is dedicated to offer high performance barrier solutions for the flexible, printed and organic electronics industry, including the flexible photovoltaics and flexible OLED displays and lighting industries. The key barrier film technology has been developed since 1999 at A\*STAR's IMRE. Based on the barrier film technology, the company TBF was spun out from IMRE in June 2009 with funding from Applied Ventures.

<http://www.tera-barrier.com/>

## Nanotechnology in Singapore

### **Bilcare** Bilcare Technologies Singapore Pte Ltd

**Technologies** Bilcare Technologies is part of Bilcare Ltd., one of the world's leading providers of integrated solutions to the global pharmaceutical industry with facilities in USA, UK, Germany, Italy, India and Singapore. The original anti-counterfeiting technology was developed at A\*STAR's IMRE. In mid 2005, Singular ID Pte Ltd was spun-off from the institute to commercialise the technology, led by Dr. Adrian Burden and Dr. Peter Moran, the founding directors. Singular ID was later acquired by Bilcare in late 2007, and Bilcare Technologies was formed. Now fully integrated into the Bilcare family, Bilcare Technologies provides its flagship product nonClonable™ to a growing number of customers across an array of industry and government sectors.

<http://www.bilcaretech.com/>

### **Curiox Biosystems Pte Ltd**

**CURIQX** Curiox is a bioinstrumentation company spun-off from A\*STAR's IBN. Curiox is a leader in the development and commercialisation of innovative assay platforms, based on its expertise in surface chemistry and engineering. The company's present offerings include the DropArray™ system, product development programmes and R&D collaborations. Curiox's vision is to accelerate the progress of life sciences, drug discovery and diagnostics through the miniaturisation and improved automation of bioassays.

<http://www.curiox.com/>

### **Nanofilm Technologies International Pte Ltd**

**NTI NanoFilm** Nanofilm Technologies International Pte Ltd is an internationally recognised authority in the field of Filtered Cathodic Vacuum Arc (FCVA) technology. Founded in May 1999, Nanofilm Technologies was a high-technology spin-off from Singapore's Nanyang Technological University, Dr. Shi Xu founded the company based on his award winning and patented FCVA technology. Since that invention, Nanofilm Technologies has successfully utilised the FCVA technology in the hard disk drive (HDD) industry to provide ultra-thin protective layer of amorphous diamond (TAC) overcoat, setting new records and benchmarks in the world-wide coating industry. Equipped with its multiple patented process and technologies, Nanofilm Technologies is currently the only company in South East Asia capable of designing and manufacturing production coating system using its unique technologies. It provides full systems with production recipes to the HDD industry, as well as full systems with a variety of recipes for hard coatings to the precision engineering and semi-conductor industries.

<http://www.nanofilm.com.sg/>

## Nanotechnology in Singapore



### **NanoMaterials Technology Pte Ltd**

NanoMaterials Technology Pte Ltd (NMT) is a technology-based company founded and incorporated in Singapore in September 2000. NMT specialises in the development, commercialisation, and licensing/contract manufacturing of nanomaterials used in the pharmaceutical, electronic material and speciality chemical sectors. Leveraging on its patented technology platform, called the High Gravity Controlled Precipitation (HGCP) technology platform, NMT's strength lies in the ability to synthesise and mass produce crystalline nanopowders to consistent product quality, narrow particle size distribution, crystal shape and morphology. NMT has been included in "The Nanotechnology Report 2004" by Lux Research as one of seven top Asian private nanotech companies.

<http://www.nanomt.com/>



### **Cima NanoTech**

Cima NanoTech, Inc. is a company commercialising nanomaterial for electronics applications. It has headquarters in St. Paul, Minnesota, staff in Singapore, and a wholly owned subsidiary in Israel. Its technologies and products include silver nanoparticles, conductive inks, and its SANTE line of transparent conductive coatings. The company was named a 2008 Technology Pioneer Award winner by the World Economic Forum, and was recognised as a top 10 Cleantech/Greentech company.

<http://www.cimananotech.com>



### **ShayoNano Singapore Pte Ltd**

ShayoNano is a technology start-up company in India and moved to Singapore in 2007 for commercialisation of the Nanomaterials synthesis process. ShayoNano specialises in the research, development and commercialisation of Nanomaterials products and technologies. Founded on its patented microwave synthesis technology, the company's expertise and strength lies in the ability to synthesise various Nanomaterials using electromagnetic waves as an energy source. This unique synthesis method allows ShayoNano to produce superior quality products at less cost.

<http://www.shayonano.com/>

### **Nanoscience Innovation Pte Ltd**

Nanoscience Innovation Pte Ltd (NSI) is a Singapore registered company and started operating with a pilot plant in Singapore since 2003. NSI has since developed and patented the platform technology - Hybrid System to produce nanopowder in large quantities. NSI also has the capabilities to disperse the produced nanopowder in different solvent systems in production scale. In addition to the nanopowder synthesis, NSI also carries out applications development, such as implant, nanocomposite, coating, catalysts, etc.