PERSPECTIVES

Institute of Materials Research and Engineering
A*STAR
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Research, Development and Commercialisation

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CORPORATE NEWS

Making the leap from lab to market

A unique plastic barrier film — 1000 times more impervious to moisture and air than current commercial materials — is set to make waves.

A breakthrough barrier technology from IMRE protects sensitive devices like organic light emitting diodes (OLEDs) and solar cells from moisture 1000 times more effectively than any other technology available in the market. The film is opening up new opportunities for the up-and-coming plastic electronics sector.

IMRE's film uses a process that employs nanoparticles in its barrier films. The unique barrier film design effectively plugs the minute gaps and cracks in the oxide layer, making for a more impermeable layer. The nanoparticles also absorb and retain the water and oxygen molecules. The innovation reduces the number of barrier stacks or layers to just two or three, much less than in other films, thus using less materials and making it less costly to produce.


IMRE's barrier film can be used in portable solar cells

The team is working with partners like G24Innovations, a thin film solar cell manufacturer and KISCO (Asia), a subsidiary of the Japanese parent company KISCO Ltd., to develop, commercialise and market the barrier films in the Asia Pacific region.

For more information about the barrier films, please contact
Mr Senthil Kumar Ramadas
rs-kumar@imre.a-star.edu.sg

Painless injections using microneedles technology.

The potential for simple mass production and the unique microneedle designs were some of the factors that led to the birth of Micropoint Technologies Pte Ltd.

Micropoint is the newest spin-off from IMRE, established in August 2008 to develop and market microneedle technology with partner Sumitomo Corporation Asia. The microneedles — miniature needles which are 10 to 20 times smaller and half the diameter of a regular needle — are used to inject and extract body fluids painlessly. This can be done because the needle does not penetrate the skin deep enough to trigger the pain receptors.

The needles can be made from plastics as well as other conventional materials such as silicon and metal, and come in a variety of designs. This includes a side-port design that allows for smoother drug delivery and body fluid extraction, as opposed to regular microneedles that have a single opening at the tip.

The microneedles can be made cheaper and have unique designs to increase effectiveness

For more information about microneedles and Micropoint, please contact
Mr Lim Chee Yen
emailus@micropoint-tech.com

IMRE and Azimuth tie-up for more affordable Atomic Layer Deposition (ALD) technology.


The IMRE-Azimuth team behind the new, sleek and affordable ALD

IMRE's materials expertise enabled Azimuth Technologies Pte Ltd (AZT) to build affordable, high-tech, highly precise atomic layer deposition (ALD) coating systems.

IMRE and AZT have teamed up to develop an ALD that can be available to a wider range of users and manufacturers. This will open up a host of precision deposition technology applications to industries that could previously not afford the high cost of conventional ALD systems.

For more information about the ALD system, please contact
Mr Rick Ong
ongr@imre.a-star.edu.sg

IMRE tie-up with Nitto Denko for organic electronic devices research

IMRE signed a research collaboration agreement with Nitto Denko Asia Technical Centre (NAT) for joint research work on organic electronic devices. The signing was in conjunction with the launch of NAT's new R&D centre at Fusionopolis in Singapore on 26 November 2008. Agreements between NAT and A*STAR's Data Storage Institute as well as Nanyang Technological University (NTU) were also signed in a ceremony witnessed by A*STAR's Chairman and Nitto Denko's Chief Technology Officer. Nitto Denko Corporation is investing S$10 million here on ground-breaking research into the use of cutting-edge plastics as substitutes for silicon in electronics.

Start of a new partnership: In the foreground, Dr Lim Khiang Wee (2nd from left), Executive Director, IMRE exchanging agreements with Dr Yasuo Fujimura (2nd from right), Managing Director, Nitto Denko Asia Technical Centre. In the background are the witnesses (l-r), Prof Bertil Andersson, Provost, Nanyang Technological University; Mr Lim Chuan Poh, Chairman, A*STAR; Dr Yasuo Ninomiya, Chief Technology Officer, Nitto Denko Corporation (partially hidden); Mr Tan Choon Shian, Assistant Managing Director, Singapore Economic Development Board.

Leveraging on our capabilities for successful partnerships

IMRE's research capabilities help to structure and focus our efforts, leading to greater innovation for the benefit of our partners.

"Partners for Success" was a showcase of IMRE's research capabilities and how some of these had benefited our collaborators. The event introduced IMRE's capability groups, their innovative materials technologies and R&D methodologies.

To further attest to the benefits of R&D-industry partnerships, IMRE signed a collaboration agreement with ETPL and KISCO on IMRE's world-class barrier film technology. The agreement cleared the way for joint commercialisation and marketing of the barrier films in the Asia Pacific region. Separately, IMRE also inked an agreement with G24Innovations, a thin film solar cell manufacturer, to look into developing the films for use in solar cells.

IMRE's capability groups:

Materials Analysis and Characterisation
- Optical and Electrical
- Microscopy and Microanalysis
- Chemical and Structural
- Scanning Probe Microscopy
- Mechanical and Modelling

Materials Growth
- Solid State Lighting
- Energy Harvesting
- Micro-actuation

Patterning and Fabrication
- Top-down Surface Patterning Techniques
- Molecular-assembly Techniques
- Nanoscale Device Design and System Integration

Synthesis and Integration
- Sensors, drug delivery systems, enabling biomedical and consumer care materials
- Advanced nanocomposites for protecting and reinforcing materials
- Printed electronics and next-generation photovoltaics

SERC Nanofabrication and Characterisation (SNFC)
- This facility forms the hub of SERC's extensive research facilities network, providing easy access to a wide range of research facilities and world-class expertise

Atomically precise manufacturing

The miniaturisation of structures for increasingly smaller devices and components can only go so far, based on current technologies. You can only shrink a transistor that much. That is why scientists are looking at building structures from the bottom-up, 'atom-by-atom'.

The drive towards making devices smaller especially in the field of microelectronics has motivated aggressive research into new nanostructure fabrication methods. Hence the conceptualisation of Atomic Precise Manufacturing (APM) primarily by Zyvex Labs, LLC (USA).

APM is a manufacturing technology that makes atomically precise structures, components or devices. What this means is that a structure is built atom by atom, making use of every available space possible, ensuring a highly ordered, precise component. This technology is expected to lead to the development of direct applications such as productive nano-systems (metrology standards for SEM, quantum computing and sensors) and nanoscale fabrication technologies such as programmable de-passivation for selective atomic growth on semiconductor surfaces, SPM manipulation of molecules and exploitation of biological nano-systems.

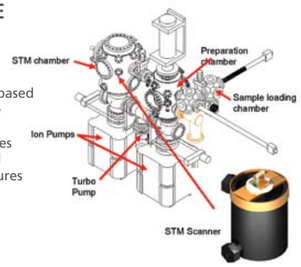
Singapore is becoming the focal point for APM research in Asia. IMRE is working closely with the Atomically Precise Manufacturing Consortium (APMC) which counts APM technology leaders from USA, UK and Australia in its ranks.

The collaboration will see Zyvex investing in hiring researchers and setting up equipment that will be based in IMRE, apart from leveraging on the expertise and advanced tools already available here.

For more information please contact
Dr Ooi Thian Ngan
ooitn@imre.a-star.edu.sg

Zyvex-IMRE UHV-STM system

Developing STM-based atomically precise lithography with ALE methodologies of depositing and growing Si structures in 2D and 3D

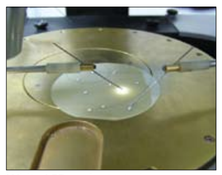


Towards true white light LEDs

Although white LEDs are available, these are made from a combination of different coloured LEDs or coated with phosphors. Making an all-in-one, true white LED could pave the way for next generation consumer lighting.

Compared to the fluorescent lighting in our homes and offices, LEDs is a superior technology. LEDs consume less power, turn on instantly, and are much brighter. Blue, red, green and a multitude of other coloured LEDs adorn devices from PCs to toys. The only colour that is absent from the palette today is the white LED.

Though there are white LEDs torchlights being marketed, these



White LED wafer tested on a probe station

are made using a combination of primary coloured LEDs, or are LEDs coated with a phosphor layer so that it appears white. However, the light given off is not suitable for lengthy use as consumer lighting because it strains the eyes.

At A*STAR's IMRE, researchers have moved a step closer to bringing true white LEDs to fruition. In a paper published in the Applied Physics Letters, Dr Soh Chew Beng et al. used indium-rich InGaN connected-dot nanostructures rather than conventional phosphors to make the LEDs. The team has come up with an LED with truer, brighter white light. The paper entitled "Cool white III-nitride light emitting diodes based on phosphor-free indium-rich InGaN nanostructures" was also featured in the August 08 issue of Compound Semiconductors.

For more information please contact
Dr Soh Chew Beng
cb-soh@imre.a-star.edu.sg

Using ferroelectric ceramic thin films for portable ultraviolet (UV) detector

A prototype of the UV sensor

Miniaturised and portable personal UV detectors are becoming popular as people become more aware of the effects of solar radiation on health.

A prototype UV sensor and dosimeter was fabricated and demonstrated in IMRE. The small and portable device allows individuals to track UV exposure and alert them when the exposure reaches unacceptable levels. This is the result of research which found that a large photovoltage could be generated through a bulk photovoltaic mechanism in ferroelectric films utilising the spontaneous polarisation effect, as opposed to the semiconductor-based interfacial effect (p-n junction). This allowed the researchers to adapt the films for UV sensing. These films give more accurate data under sunlight and can be made at very low cost.

For more information please contact
Dr Yao Kui
k-yao@imre.a-star.edu.sg

Features

- **Large voltage output** — UV detection is obtained via photovoltaic effects in a ferroelectric ceramic thin film, with the capability of outputting large voltage signals up to 7.0 V.
- **Simple structure** — Only one layer of ceramic thin film and one layer of electrode are needed. It does not require the formation of any p-n junction or Schottky barrier as in semiconductor photovoltaic devices.
- **No filter with UV transparency** is required as our ferroelectric thin films are insensitive to visible light.
- **Low cost** due to the extremely simple structure. It does not require any bottom electrode, which is typically made of precious metal.
- **No energy loss** — Light radiation is directly transmitted to the ferroelectric thin film without having to penetrate any opaque top electrode layer as in a conventional sandwich structure.
- **More accurate** — Excellent spatial response characteristics under sunlight.

SPOTLIGHT

Free-standing porous anodic alumina templates for atomic layer deposition of highly ordered TiO_2 nanotube arrays on various substrates

By using a free-standing nanoporous template, we have created dense, uniform, highly ordered and well-aligned arrays of TiO_2 nanotubes on various substrates via atomic layer deposition.

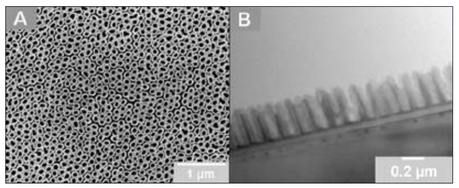
WHO: Dr Gao Han, Ms Tan Lee Kheng, Ms Maria Chong Ai Shing

WHAT: Highly ordered TiO_2 nanotube arrays on various substrates

WHERE: Published in 2008 in the Journal of Physical Chemistry Volume 112, 69-73 (2008)

WHY: Arrays of TiO_2 nanotubes have been demonstrated as excellent semiconducting electrodes in photovoltaic devices. They can be prepared by anodisation of Ti foils in an acidic solution. In this work, we fabricated highly ordered TiO_2 nanotube arrays on various substrates. The nanoarrays supported by substrates facilitate their uses in devices. The conformal film coating and precise wall-thickness control by atomic layer deposition gives rise to dense, uniform, well-aligned, and dimension-tunable TiO_2 nanotube arrays that show size-dependent optical adsorption behaviours and provide an intimate contact with substrates.

OPPORTUNITIES: This is a general method that can be used to fabricate nanotube arrays of various materials on a wide range of substrates. Highly ordered TiO_2 nanotube arrays on various substrates can have applications in sensing, photovoltaics and photocatalysis.



For more information and to view researcher profile, please visit:
Dr Gao Han
http://www.imre.astar.edu.sg/personal/getListing_action.asp?strID=h-gao

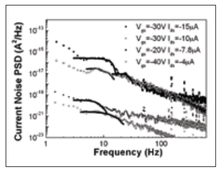
Featured papers & research

Listed below are some of IMRE's featured research papers.

Title of Publication	Author(s)	Name of Journal
Squeeze-Out of Branched Alkanes on Graphite	N. N. Gosvami, S. K. Sinha and Sean O'Shea	Phys. Rev. Lett. 100, 076101 (2008)
Free-standing porous anodic alumina templates for atomic layer deposition of highly ordered TiO2 nanotube arrays on various substrates	Tan LK, Chong ASM, and Gao H	J. Phys. Chem. C, 112 (1): 69, 2008
First-step nucleation growth dependence of InAs/InGaAs/InP quantum dot formation in two-step growth	ZY Yin, XH Tang, JX Zhang, S Deny, JH Teng, AY Du and MK Chin	Nanotechnology, 19: 1, 2008
Octafunctional cubic silsesquioxame (CSSQ)/poly(methylmethacrylate) nanocomposites: Synthesis by atom transfer radical polymerization at mild conditions and the influence of CSSQ on nanocomposites	H Hussain, KY Mya, Y Xiao, CB He	Journal Polymer Science Part A: Polymer Chemistry, 46: 766, 2008

Low Frequency Noise (LFN) spectroscopy to characterise the performances of organic electronic devices

A new characterisation methodology, known as Low Frequency Noise (LFN) spectroscopy, to study the interface, film morphology and the device performances based on organic semiconductors has been established in IMRE. This new methodology has been successfully applied to studying the performance of bottom-contact organic field-effect transistors (FETs) based on Regio-Regular-Poly (3-hexylthiophene). It was found that LFN spectroscopy is very sensitive to device fabrication processes such as the variations in the surface treatments and the degree of crystallinity in the organic semiconductor film. The quality of the interface and density of traps in the active device can be evaluated using the LFN spectroscopy. The better understanding of the device performance and stability can be utilised to optimise the fabrication process. This new methodology can also be applied to studying the properties of other organic electronic devices such as OLEDs and organic photovoltaics.



Low frequency noise behaviour for OTFT devices pretreated with HMDS working at varies Ids. The solid lines show the lorentzian fitting for the interface trap and deep level trap peaks.

A recent research article entitled "Impact of self-assembled monolayer on low frequency noise of organic thin film transistors" was published in Appl. Phys. Lett. 93, 153507, 2008.

This paper was highlighted for the November 3, 2008 issue of Virtual Journal of Nanoscale Science & Technology.

For more information please contact
Dr Karen Ke Lin
karen-kl@imre.a-star.edu.sg

VISITS & EVENTS

Marine Fouling Prevention Workshop

30 October 2008

A first-of-its-kind Marine Fouling Prevention Workshop

IMRE, together with ICES and TMSI, NUS organised a joint workshop on Marine Fouling Prevention: Industry, Science and Technology on 30 Oct 08. The first-of-its-kind workshop was aimed at tackling marine bio-fouling through research.

IMRE Open House for JC students

A showcase of demonstrations based on materials science concepts

10 September 2008

IMRE's Outreach team organised an Open House entitled "A Materialistic World". The event was a showcase of demonstrations based on materials science concepts using mainly materials that are easily available and safe so that the students could conduct their own experiments.

X-periment Exhibition

15 to 17 August 2008

Researchers from IMRE took part in X-periment 2008 held in Marina Square Shopping Mall, a regular event of the annual Science Month organised by the Singapore Science Centre. IMRE showcased how different materials surfaces affect the speed and trajectory of a moving object.

X-periment 2008 held in Marina Square Shopping Mall

AWARDS

Bumper crop of winners from IMRE attachment students at the Singapore Science and Engineering Fair (SSEF) 2008

JC students on IMRE attachments bag 2 Golds, 3 Silvers, 3 Bronze and 1 Merit prize.

The SSEF serves as a platform for future scientists to showcase their research projects, some of which are done under the guidance of A*STAR's research institutes. It is jointly organised by A*STAR and the Singapore Science Centre. The SSEF is affiliated to the annual INTEL International Science and Engineering Fair (ISEF). Winners from SSEF will be selected to represent Singapore in the ISEF.

Honorary mention in Virtual Instrumentation Applications Contest 2008

Regional contest conducted by National Instruments.

IMRE's Dr Johnson Goh received an honorary mention in the Academic Segment of the Virtual Instrumentation Applications Contest 2008 conducted by National Instruments, USA. His entry entitled "Automated Ballistic Electron Emission Spectroscopy (BEES) Spectra Analyzer" offers users the unique advantage of studying metal/semiconductor interfaces with nanometer resolution. National Instruments is a worldwide instrumentation company.

UPCOMING EVENTS

Diary of upcoming events @ IMRE

To find out more about IMRE's seminars and events, please visit **www.imre.a-star.edu.sg/events.**

Or you can email us at **events@imre.a-star.edu.sg.**

Past issues of our newsletters are available on our website at
www.imre.a-star.edu.sg

PATENTS FILED & GRANTED

Listed below are some recent IMRE patents filed and granted. To know more about our patents, please write in to enquiry@imre.a-star.edu.sg.

IMRE Patents filed from Jan - Aug'08

No.	PATENT TITLE	INVENTORS	Description
1	Portable contactless conductivity electrophoretic analyser	Isabel Rodriguez, Kambiz Ansari Mahabadi, Lim Chee Yen	The invention relates to a method and apparatus to analyze one or more ionic compounds in a microfluidic device by electrophoresis in combination with capacitatively coupled contactless detection with increased sensitivity.
2	Method to effectively disperse particles on a substrate	Liu Kai Yu, Sharon Roslyn Oh Su Yin, Zhang Nan, Zhou Xiaodong	The invention relates to a method to effectively disperse the nanospheres on a large area of glass substrate, so as to produce a large number of gold nanostructures through dispersed nanosphere lithography for LSPR applications.
3	Method of making atomic force microscopy cantilevers with integrated spherical tips	Erik J. Cox, Loke Yee Chong, Yeong Kuan Song	The invention relates to the development of a new technique of batch producing cantilevers with cohering colloidal spheres via microfabrication and indirect sintering approach. The spherical tip cantilever can be used in force measurements, friction measurement, contact electrification studies and casimir force measurement.
4	A method of making an imprint on a polymer structure	Low Hong Yee, M.S.M. Saifullah, Richard Khoo Teng Thuan	The invention relates to a method to increase throughput in Nanoimprint Lithography (NIL) through the use of soft mold. The invention can be used in fabrication of MEMs and LED devices.
5	Method of forming multilayered structures on a polymer	Isabel Rodriguez, Low Hong Yee, Tanu Suryadi Kustandi	The invention relates to a method to fabricate butterfly multilayered nanostructures using Nanoimprint Lithography (NIL) and Shear Patterning Technique.
6	User powered wireless remote control system	Tan Chin Yaw, Yao Kui	The invention relates to a wireless remote control system by means of a transmitting unit powered by the mechanical energy supplied by the user.
7	Array of microcapsules for controlled loading of macromolecules, nanoparticles and other nanoscale items and a method of fabricating it	Gleb Sukhorukov, Karen Chong, Low Hong Yee, Maria Antipina, Maxim Kiryukhin	The invention relates to a method to pattern microdepots for controlled loading of the [bio]macromolecules, nanoparticles and other nanoscale items. The invention can be applied for developing multiplex immunoassays, protein microarrays, biocatalytic and chemical sensors and sensor arrays for the detection of water soluble analytes, purification of industrial wastewater etc.
8	An electrically conducting structure for a light transmissible device	Liew Pooi Kwan, Ng Ging Meng, Zhu Furong	The invention relates generally to the transparent conductive electrode, and more particularly to the TCO-based transparent cathode for application in organic photovoltaic cells, light-emitting diodes, transistors, memory, and other optoelectronic devices.
9	Sensor chip for biological and chemical sensing	Liu Hong, Zhou Xiaodong	The invention relates to a method of fabricating a low cost and very stable microfluidic biosensor integrated with LSPR spectroscopy. The invention can be applied in environmental monitoring system, clinical diagnostic system, biomedical analysis system and bio-detection system.
10	Graded high barrier inorganic film structure	Senthil Ramadas, Shwe Zin Ma	The invention relates to the design of graded barrier structure by introduction of thin nitride film in between barrier structure to reduce the intrinsic stress during the barrier film growth process. The graded barrier structure can be employed in multi-layer barrier stack coatings on to R2R plastic substrates for the plastic electonics applications.
11	A light emitting diode structure, a lamp device and a method of forming a light emitting diode structure	Chua Soo Jin, Norman Ang Soo Seng, Teng Jinghua	The invention relates to a new structure and method to make broad area side-emitting semiconductor light emitting diodes, more specifically, Ga(In)N/Sapphire based LEDs, to enhance the light extraction efficiency, increase thermal conductivity, and render more lamp design freedom for highpower and backlighting application.
12	Ferroelectric poly(vinylidene fluoride) film on a substrate and method for its formation	Yao Kui, Chen Shuting, Francis Tay Eng Hock	The invention relates to a dense ferroelectric poly(vinylidene fluoride) (PVDF) homopolymer thin film deposited on a substrate and the preparation method through a chemical solution coating process. The invention can be applied to piezoelectric device applications.
13	Multilayer film for encapsulating oxygen and/or moisture sensitive electronic devices	Chua Soo Jin, Ke Lin Karen, Senthil Ramadas	The invention relates generally to encapsulation technology, more particularly to multilayer films for encapsulating oxygen and/or moisture sensitive electronic devices.
14	Low Shrinkage Multifunctional SSQ Resins	Adrian Yap U Jin, Alan Sellinger, Soh Mui Siang	The invention relates to the synthesis, development and formulation of low shrinkage multifunctional silsesquioxanes (SSQ) resins. The SSQ resins can be potentially applied as low shrinking nanocomposites based dental materials.
15	High purity film on insulator utilising a dual-function diffusion-blocking turned insulating layer	Aaditya Sridhara, Chi Dongzhi, Chia Ching Kean, Dong Jianrong	The invention relates to the introduction of a dual-function AlxGa1-xAs interfacial layer in between the GaAs and Ge (or SiGe) interface as a diffusion-blocking turned insulating layer for forming high purity GaAs on insulator (AlxOy) on Ge/SiGe substrates. The invention can be potentially applied in materials integration for microelectronics and optoelectronics applications.

IMRE Patents granted from Jan - Aug'08

No.	PATENT TITLE	INVENTORS	Description
1	Device and method of detecting mutations and polymorphisms in DNA	Robelek Rudolf, Sean O'Shea, Su Xiao Di, Wolfgang Knoll	The invention relates to a method for detecting mutations in DNA involving as little as one base change or a single base addition to, or deletion from the wild-type DNA sequences with the use of resonator sensors. The method is useful for diagnosing a variety of disease states or susceptibilities and detecting the presence of a mutated oncogene.
2	Poly(arylenevinylene) and Poly(heteroarylenevinylene) Light Emitting Polymers and Polymer Light-Emitting Devices	Chen Zhi Kuan, Huang Chun	The invention involves conjugated polymeric materials, their preparation methods, and their application in polymer light emitting diodes. The conjugated polymers comprise poly(arylenevinylene) based homopolymers and their copolymers. The proposed polymers can be used as the emissive layer for polymer light emitting diode and can be fabricated into LED devices through solution process.
3	Microneedles and microneedle fabrication	Chen Mei Ma, Joyce Tan Pei Ying, Li Zhong Li (Julie), Lim Chee Yen, Xu Yuan	The invention relates generally to a fabrication process for microneedles, involving electroplating metals on polymeric moulds. The invention involves essentially the techniques of making master moulds and their subsequent polymeric moulds thereof, which help overcome the size limitation that may be faced by other microfabrication technologies. As such, the invention caters to various sizes of microneedles, especially but not limiting to microneedles that have extreme slenderness or aspect ratios, i.e. having lengths that are more than 1mm.
4	Distributed feedback and distributed Bragg reflector semiconductor lasers	Chua Soo Jin, Dong Jian Rong, Teng Jing Hua	The invention relates to a distributed feedback (DFB) laser and a distributed Bragg reflector (DBR) laser, and a tuneable distributed DBR laser with dielectric grating. The dielectric grating will provide a much higher coupling coefficient as well as a gain coupling in a DFB laser. A one-step self-aligned quantum well intermixing is applied to shift the band gap energy of the reflector section in a DBR laser or a tuneable DBR laser to be transparent to the laser wavelength.
5	Novel water-soluble nanocrystals comprising a polymeric coating reagent, and methods of preparing the same	Han Ming Yong, Wang Fu Ke	The invention relates to the methods of making water soluble nanocrystals. The nanocrystals comprise of a metal core and capping reagent attached to the surface of the core, and a water soluble polymer covalently coupled with the capping reagent to form a water soluble polymer shell over the nanocrystal core. The nanocrystals can be used in the detection of analytes such as nucleic acids, proteins or other biomolecules.
6	Silicide formed from ternary metal alloy films	Chi Dongzhi, Chua Soo Jin, Rinus Lee Tek Po	The invention relates to a method for fabricating semiconductor structures and more particularly to a method of forming a high quality and reliable NiSi silicide on a silicon semiconductor device. The proposed process is commercially applicable to the fabrication of 0.1um and sub-0.1um CMOS silicon devices.
7	Nanostructures and method of making the same	Chen Peng, Chua Soo Jin, Wang Yadong	The invention relates to an integrated fabrication process for ordered semiconductor nanostructures on a patterned substrate surface whereby the ordered nanopatterns from a porous template is transferred to a mask-film followed by a selective growth of the semiconductor in a material deposition system. The invention could be used for the fabrication of semiconductor-based low-dimensional optoelectronic and microelectronic devices.
8	Nitride-based semiconductor epitaxial substrate, method of manufacturing the same, and HEMT substrate	Chen Peng, Chua Soo Jin, Eiryo Takasuka, Katsushi Akita, Masaki Ueno	The present invention provides a nitride-based semiconductor epitaxial substrate capable of ensuring electrical insulation between a device layer and a GaN single substrate, and capable of suppressing the diffusion of Mg added for controlling conductivity to the device layer side.The invention could be used in light emitting diodes for displays.
9	Reliable contacts	Chi Dongzhi, Lee Ka Yau, Liew Siao Li, Rinus Lee Tek Po, Yao Hai Biao	The invention relates to a method to prevent or inhibit the occurrence of agglomeration in nickel monogermanide film by structural, and alloy engineering so that the adversary effect of agglomeration in the germanide layer to the electrical property could be reduced. The invention could be implemented or built from the existing platform of Ni silicide processing without much modification.
10	Variable focus microlens	Isabel Rodriguez, Khaw Aik Hau, Peter Moran, Saman Dharmatilleke	The invention relates to a method to change the curvature of a lens formed by a liquid droplet or a membrane filled with liquid by application of pressure to achieve a wide focal range. Microlenses have a broad range of photonic applications as components in optical devices used in telecommunications, data storage, sensing, manufacturing and medicine.