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Protective Coatings - Thin Films and Lubricant Materials

Next to the CPU, the hard disk drive (HDD) is by far one of the most important components in a personal computer. Protecting this data storage device that contains all the information and records entered by the user becomes paramount.

At IMRE, we have designed and synthesized novel perfluorinated-based materials which fulfills the industrial requirements for barrier films and lubricants that act to prevent both contamination, corrosion, and wear in computer HDDs. Our studies show that the performance of the barrier films and lubricant materials has much potential as compared to conventional materials.

"IMRE is working towards lubricant materials that can be applied to the next generation of hard disk drives. The success of

the research would lead to the potential development of smaller and higher density disk drives. The results have been very encouraging indeed," said Dr He Chaobin, Cluster Manager for the Molecular and Performance Materials research group, the team that is at the helm of this research work.

In a HDD, a sputtered carbon overcoat and a thin layer of lubricant protect the magnetic medium, which forms the memory or storage component. The HDD's read/write head normally traverses the face of the disk at high speeds and at less than 10 nm from the surface. The thin layer of lubricant helps to reduce friction and thus tear and wear. Reducing friction in turn reduces power consumption and the mechanical distortion of critical parts. The life span of a HDD can be lengthened considerably depending on the lubricant used.

The development of performance materials such as these has been used successfully in a project with Seagate Technology International, with a follow-up second phase recently announced. The second phase will focus on further improving synthetic methods, synthesis of new materials and understanding of structure-performance properties of the materials for use disk drives.

Materials application cuts cross many industrial sectors and lubricant research is only one of many materials R&D conducted at IMRE. IMRE also seeks to leverage on the niche expertise of other sister institutes such as the Data Storage Institute to capitalise on research like thin films and lubricants, and maximise its impact on local industry. 



Protecting the hard disk drive and the data it stores is of paramount importance.



Dr He Chaobin, Cluster Manager for the Molecular and Performance Materials research group.

MRS-S National Conference on Advanced Materials



Prof Chowdari giving the opening address at the conference.

The local materials research community gathered together for its inaugural Materials Research Society of Singapore (MRS-S) National Conference on Advanced Materials, which was jointly organised by MRS-S and

IMRE. Held on 6 August and hosted by IMRE, some 150 participants from local research and tertiary institutes attended a day-long event which included 20 oral presentations on the latest developments in materials science and research in Singapore. A poster competition with a total of 133 poster submissions was also held in conjunction with the conference.



Participants at the conference discussing one of the research posters during the poster session.

“The National Conference provides a suitable platform for all materials scientists, as well as students, to meet, interact and learn about the state-of-the-art materials research that is being conducted in Singapore, such as in research institutes like IMRE,” said Prof BVR Chowdari, Chairman of the Conference, President of the MRS-S and an

Adjunct Associate Principal Scientist with IMRE.

Prof Chowdari added that the conference is being planned as an annual event and to act as a bridge between the MRS-S International Conference on Materials for Advanced Technologies (ICMAT), held every two years and attended by delegates from across the globe. 🌐

Singular ID Technology Takes 2nd Prize in International Business Plan Competition

Singular ID, IMRE’s anti-counterfeiting and brand-protection magnetic fingerprint technology, won second prize in the recently concluded 8th Edition of The Roland Berger - INSEAD Business Plan Competition 2004.

Open to all INSEAD MBA students of both the Singapore and Fontainebleau (France) campuses, the competition saw a record number of entries this year, with only six being selected for the finals. The French-based INSEAD is widely recognised among the world’s top-tier business schools as one of the most innovative and influential.

Working closely with two INSEAD MBA students, Mr Alix Taffle and Mr Bartjan Vanhulten, Dr Peter Moran and Dr Adrian Burden from IMRE, compiled and presented a business plan that sufficiently impressed the international panel of five judges composed of a very distinguished list of successful venture capitalists.

“Counterfeit goods account for approximately five to seven percent of all world trade, creating a rapidly growing problem across the majority of market sectors. Many people are aware of software piracy and fake designer goods, but the issue extends to aircraft and automobile parts, electronic goods, pharmaceuticals, and even household consumables such as shampoo. Being able to identify the original or the genuine remains a problem that has not been satisfactorily solved in the market place. Our *Singular ID* technology and business plan clearly addresses this issue,” said Dr Adrian Burden, one of the inventors of the technology.

Dr Peter Moran, co-inventor, adds “We have worked closely with INSEAD MBA students on several occasions in the past; using this technology offering as a case study for

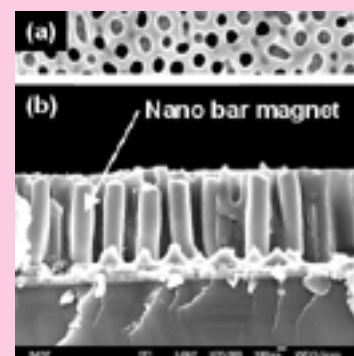
market evaluation discussions and for their course on new business ventures. This interaction provided a valuable independent insight for us on the possibilities of *Singular ID* technology. It was a fitting conclusion, therefore, to work with Alix and Bartjan on a prize winning business plan.”

IMRE is currently looking for partners to invest in a high technology spinout company that will then commercialise this exciting new technology. If you are interested to know more about the business and commercialisation opportunities and want to be a part of this exciting technology, please contact our Business Development Office at bdo@imre.a-star.edu.sg

What is Singular ID?

Singular ID uses nanotechnology to create low-cost magnetic labels that have ‘unique’ fingerprints. These labels are prohibitively difficult to replicate, can be invisible to the naked eye, lightweight and resilient to extreme environmental conditions. The labels can also be mass produced inexpensively.

The most obvious use for the technology is as markers for identification and authentication to prevent fraud and for secure logistical tracking. Consumer applications for *Singular ID* are diverse - labelling of precious articles such as jewellery; counterfeit-proof security passes, passports, identification cards; preventing intellectual property infringement or pirating of goods such as audio and video CDs. For more information about *Singular ID*, please visit <http://www.imre.a-star.edu.sg/singular-id/> 🌐



Scanning electron microscope images of the nano-magnetic fingerprint in (a) plan view of the surface indicating small pores filled with magnetic material and (b) a cross sectional view showing the nano-sized bar magnets embedded in the material.

Candid Quotes

IMRE is privileged to host two world-renowned scientists who will lend their experience and expertise in the field of materials research.

Professor Wolfgang Knoll

Professor Wolfgang Knoll, highly-respected polymer scientist and Director of the Max-Planck-Institute for Polymer Research, Germany, joins IMRE as a Visiting Principal Scientist under the Polymer Science Programme. This programme will leverage on Prof Knoll's invaluable experience and expertise in polymer studies. Prof Knoll is supervising projects that will include semiconducting nanocrystals for optoelectronic applications and biosensing, and surface plasmon diffraction for the characterisation of thin films and interfaces.

His own current research interests include aspects of the structure/order - property/function relationships of polymeric/organic systems, in particular, in thin films and at functionalised surfaces.

Could you tell us more about the Polymer Science Programme and who is involved?

The programme that we are implementing is related to the structural and functional characterisation of supramolecular and nano-structured organic/polymeric materials, where we will mostly focus on thin films and interfacial problems related to polymers. Within the individual projects we will work with IMRE researchers from across the research clusters, including Molecular and Performance Materials, Micro- and Nano- Systems and even Opto and Electronics Systems. The team will also include a number of postdoctoral scientists, research officers, and graduate students from my research group in Mainz, Germany who will

"...a good scientist needs talent, dedication to his projects, and hard work, hard work, and more hard work..."

be here in Singapore for some time.

What is the importance / impact of such a programme? What sort of benefits can we look forward to?

Part of our research aims to measure structural parameters of various materials in different sample formats and correlating the data with the functional characteristics measured additionally or even simultaneously. We are able to apply this to studying organic light emitting diode (OLED), for example. Here we can measure the LC phases of different modifications of the corresponding polymers, identify the whole phase diagram, then show how to best generate a homogeneous alignment, and finally demonstrate the results by measuring the degree of anisotropy of the emitted photons. This basic knowledge then guarantees that one can fabricate devices that are reproducible, reliable, and stable.



Prof Wolfgang Knoll, Director of the Max-Planck-Institute for Polymer Research, Germany, is an well known in polymer science research.

As a distinguished and experienced researcher, what do you think are some of the qualities that make a good scientist?

I think the core values of IMRE are an excellent basis: integrity as a person, aiming for quality in your work, striving for excellence, and respect for individuals. In addition, a good scientist needs talent, dedication to his projects, and hard work, hard work, and more hard work!

Do you have any words of advice for budding scientists?

Whatever you do, do it not only with your mind and your hands – do it with your heart! 🌍



Prof David Srolovitz is a highly respected computational materials scientist from Princeton University, USA.

Professor David Srolovitz

Professor David Srolovitz was invited by IMRE and the Institute of High Performance Computing as a Principal Investigator under A*STAR SERC's Visiting Investigatorship Programme (VIP). He is a distinguished researcher who has done groundbreaking work in the field of computational materials science, has won numerous awards and published more than 300 scientific papers. His current research interests encompass microstructural evolution, film growth, defects in crystals and mechanical deformation.

As Prof Srolovitz's first extended stay in Singapore – the tenure is for three years – he is adjusting well to what he terms "one of the easiest cities to visit in Asia" because of the hospitality of the East coupled with the good mix of Western comforts and

language. Determined to pick up "Singlish", and gradually adapting to the humidity, Prof Srolovitz gives us insights into his work and thoughts.

Could you tell us more about the Visiting Investigatorship Programme and what you will be doing?

The VIP is a three-year project. As part of this, I will be in Singapore two months each year. The project is an initiative that will help A*STAR and the research institutes (RIs) grow local expertise in new areas of computational materials science. Computational materials science is a very powerful tool, integrating the many different scientific disciplines to solve problems in materials synthesis, processing and property prediction. It is one of the emerging areas in which Singapore is keen on developing manpower. Here, the projects that are being conducted in conjunction with IMRE, IHPC and NUS will focus on the growth of film for electronic and opto-electronic applications.

"...Success comes to those who are clever enough to see a research opportunity where nobody else is looking..."

How do you juggle your time between Singapore and the US where you are also the Chairman of the Department of Mechanical & Aerospace Engineering at Princeton University?

The good thing about the distance is the 12-hour time difference. By the time I am done for the day here I have time to catch up on work at Princeton in the evenings. Another advantage is that when I am able to catch up with my email from Princeton, I can skip to the final conclusion of a long chain of communication. Sometimes distance helps!

You have accomplished much as a scientist; a distinguished researcher in the field of computational materials science; numerous awards to your name; research work that sets the standard and benchmark in computer modelling. What does it take to achieve this?

The ability to become completely absorbed by your research. Real advances happen when you cannot stop thinking about a research problem; it is there in the back of your mind when you eat, drink, sleep or watch a movie! I can trace one of my most important research accomplishments to an idea that came to me while I was showering early in the morning!

While hard work is important, being able to identify the "right" problems and creatively solving them is even more so. Success comes to those who are clever enough to see a research opportunity where nobody else is looking. In science, if a research or technology already has a name, you are too late! Look for something else.

Do you have any words of advice for budding scientists?

When I interview candidates for faculty positions, the first question I ask them is, "What keeps you awake at night?" The scientist with the right fire inside will tell me, without hesitation, about the question that bothers him or her. Science should not be work – it should be what keeps you going. The ideal is you have to look forward to coming into the laboratory every morning – the fact that you get paid for it is just a side benefit!

Advice? Do not follow the crowd. Listen to what other scientists are *not* talking about. If you have an idea, start working on it. Later, check the literature to see what others have done. If you try it the other way, it will stymie your creativity. Bottom line - just do it! 🌍

NSS Scholars in IMRE

A*STAR's National Science Scholarship (NSS) aims to nurture Singapore's bright, young and passionate research talents for the challenges of a research career in science. The scholars selected for the programme are some of the most talented in Singapore and have the opportunity to study in selected world-class universities. Some of the scholars were in IMRE for short attachments during their summer holidays, while others were preparing to begin their studies overseas. Here's what they had to say:

Ms Shireen Goh, 22,
2nd year undergraduate, majoring in
Engineering Physics, Cornell University, USA

"IMRE was my choice for a summer attachment because I was interested in the many different research areas, especially nanofabrication and photonics. I enjoyed my stint here and have learned that research involves a lot of creative thinking for new ideas and flexibility in approaching, and troubleshooting problems."

"For new scholars I suggest to start learning about research early, maybe even try for an undergraduate research programme in the second semester of your freshmen year. It will help you know more about research, gain valuable experience, allow interaction with your professors on a more personal level as well as help you choose your area of specialisation in the future."

Mr Vincent Ho, 22,
2nd year undergraduate, majoring
in Chemical Engineering, University of
Illinois at Urbana-Champaign, USA

"Research is not a bed of roses and it entails lots of hard work. You may not figure out what the problem is, even if you are pretty sure that you have got it figured out."

"New scholars should read widely, ask more questions and talk more to researchers, professors and their peers about their research interest so as to be able to discover for themselves where their real interests lie. They have to be passionate about their research to be able to make a genuine contribution to the world of R&D."



Ms Xu Weiyin, 19,
1st year undergraduate,
majoring in Chemical
Engineering, University of
Michigan, USA

"Because of my interests in materials science, I did an attachment with the micro- and nano- systems research group on sensors technology, where I discovered the importance of being patient and to be thorough in research work."

Ms Tan Rui Zhen, 21,
2nd year undergraduate, majoring in
Engineering Physics, Cornell University, USA

"I was in IMRE during the summer holidays to catch up on materials characterisation research and application, where I had the chance to do hands on experimental work and to interact with researchers to get a better feel of research work."

"The NSS has presented me with good opportunities and I think would-be scholars should make use of the chance to study overseas to maximise their potential, learn to be independent and discover their passions in life."

**Mr Kedar
Hippalgaonkar, 20,**
2nd year undergraduate,
majoring in Mechanical Engineering,
Purdue University, USA

"Pursuing a Mechanical Engineering degree has inclined my interests towards application of mechanical systems at the micro- and nano- levels."

This interest encompasses various fields like MEMS and sensors for biotechnology based on such systems. IMRE has a variety of projects in these areas and I wanted to have a feel of what the cutting-edge research was like here."

"To new scholars, I say, Enjoy your research and have fun!"

Visits and Events

SEMICON Singapore 2004

4-6 May 2004

IMRE together with SIMTech, IME, IHPC and ETPL, participated in SEMICON 2004 held from 4-6 May 2004 at the Singapore International Convention and Exhibition Centre. The purpose of the participation was to highlight the SERC RI research in semiconductor related activities.

Meet-the-Scientist Talk - Singapore Science Centre

8 May 2004

Mr Kong Yen Peng, Senior Research Officer with IMRE's Micro- and Nano- Systems research group, presented a talk on nanotechnology entitled, "Alice in Nanoland" at the Singapore Science Centre. About 40 members from the public and students attended the talk about nanotechnology research from a layperson's perspective.

MPM Industry Symposium 2004

21 May 2004

A Symposium on Molecular & Performance Materials (MPM) was held on 21 May 04, that was targeted at related industries to create awareness and showcase IMRE's capabilities in molecular and performance materials research.

Materials Science and Characterisation (MSC) - Surface Analysis Workshop

24 June 2004

On 24 June, IMRE's Materials Science and Characterisation Laboratory organised a Surface Analysis Workshop that highlighted the importance of the surface analysis technique in materials science. The workshop described the principles and applications of X-ray Photoelectron Spectroscopy/Electron Spectroscopy for Chemical Analysis (XPS/ESCA) and Time-of-Flight Secondary Ion Mass Spectrometry (TOF-SIMS) surface analysis techniques, presented by Dr Pan Jisheng and Dr Nikolai Yakovlev, respectively.

Materials Science and Characterisation - "Thin Film Nucleation, Growth, & Microstructure Evolution" short course

15 July 2004

IMRE's Materials Science and Characterisation Laboratory organised a short course on "Thin Film Nucleation, Growth, & Microstructure Evolution",

conducted by renowned scientist, Prof Joseph E Green, D.B. Willett Professor of Materials Science and Physics from the University of Illinois, USA. The full-day course centred on understanding the primary experimental variables and surface reaction paths controlling nucleation/growth kinetics and microstructural evolution during vapor-phase deposition as well as developing an appreciation of the advantages / disadvantages of competing growth techniques.



IMRE's research attracts interest from a visitor at SEMICON 2004.



A participant of the MPM Industry Symposium talking to Dr He Chaobin (right), Manager of the MPM cluster.



Dr Nikolai Yakovlev (second from right), a researcher with the materials characterisation group, briefing some of the Surface Analysis Workshop participants on the use of ToF-SIMS.



An IMRE researcher briefing the NSS students on the microneedle research work.



Participants arriving for the MRS-S National Conference on Advanced Materials.

A*STAR National Science Scholarship (NSS) Students Visit IMRE

27 July 2004

Some 15 BS-PhD NSS scholars of A*STAR's Graduate Academy visited IMRE on a familiarisation tour of the SERC Research Institutes. After an introductory briefing the scholars were brought on a tour of IMRE's laboratories that highlighted research on opto- and electronics systems, OLEDs, fuel cell development, microneedles and materials characterisation.

IMRE-SIMTech Joint Symposium on Materials and Process Integration for Micro- & Nano-Systems

29 July 2004

IMRE and SIMTech held a Joint Symposium that outlined the research performed in IMRE, SIMTech and IME in the field of micro/nano systems technology with emphasis placed on industrial applications. The topics discussed included *Oxide Ceramic Films and Multilayers for Sensor and Actuator Applications*, *Development of a MEMS-Based Microcombustor*, *Lab-on-a-Chip for DNA & RNA Analysis*, *Vacuum Sealing of MEMS Devices*, *BioMEMS Devices for Drug Discovery*, *Microneedle Fabrication Technology*.

MRS-S National Conference on Advanced Materials

6 August 2004

IMRE together with the Materials Research Society of Singapore (MRS-S) co-organised the MRS-S National Conference on Advanced Materials on 6 August 2004. The conference was open to all MRS members and those interested in joining the society. Some 150 participants, mainly from the local research institutes and universities attended the conference, which included talks on the latest developments in materials science and research in Singapore. (Read related page 2 article).

Patents and Publications

Patents Granted

A novel immunodiagnostic test method for veterinary disease

The invention is related to an apparatus and method for performing immunodiagnostic testing for veterinary disease. In particular it is related to the detection of the presence of viral or bacterial antigens by measuring specific antibodies in animal body fluid in which viral or bacterial proteins serve as the antigens.

Inventors: Sam Li, Su Xiaodi, Jimmy Kwang, Sharon Low, Wei Liu

Date granted: 30-Apr-04

Country granted: Singapore

Buried hetero-structure opto-electronic device

The invention provides a cost-effective method for producing optoelectronics devices with improved current blocking characteristics under high temperature and high output power operations.

Inventors: Wang Zhijie, Chua Soo Jin, Wang Wei, Zhou Fan

Date granted: 31-May-04

Country granted: Singapore

Blue electroluminescent materials for polymer light-emitting diodes

This invention discloses a new structure of semiconducting polymer for realising blue light emission. The polymers may be used as emissive materials in the fabrication of blue light-emitting diodes (LEDs).

Inventors: Huang Wei, Yu Wanglin, Pei Jian, Chua Soo Jin

Date granted: 30-Jun-04

Country granted: Singapore

Patents Filed

Microelectromechanical device

The invention is related to a method to produce a piezoelectric micro electromechanical system (MEMS) structure or device which could be used for micro-actuators for precise positioning, electromechanical resonators, chemical and bio-chemical sensors.

Inventors: Yao Kui, Eric Tang Xiaosong, Gao Peng, He Xu Jiang, Zhang Jian, Shannigrahi Santiranjan

Date filed: 23-Apr-04

Countries filed: Filed under Patent Cooperation Treaty (PCT)

Method of transferring whole-layer polymer films from PDMS stamp

The present technique concerns a method to achieve whole-layer polymer film transfer to substrates with or without topography.

Inventors: Li Tan, Bao Lirong, Kong Yen Peng, Huang Xudong, L Jay Guo, Stella Pang, Albert Yee

Date filed: 20-May-04

Countries filed: Filed under Patent Cooperation Treaty (PCT)

Imprinting of supported and free-standing 3-D micro- or nano- structures

The invention presents a novel method to imprint free-standing 3-D structures with potential applications in MEMS and NEMS devices, sensors, IC devices and photonic bandgap structures.

Inventors: Kong Yen Peng, Low Hong Yee, Stella W Pang, Albert F Yee

Date filed: 24-May-04

Countries filed: US

Composite optical destructive electrode for high contrast electroluminescent devices

The invention relates to an optical destructive anode which can achieve a high contrast OLED/PLED for use in displays, such as those in handphones and palm-tops, outdoor instrument displays, etc.

Inventors: Zhu Furong, Ong Kian Soo, Hao Xiao Tao

Date filed: 25-May-04

Countries filed: Filed under Patent Cooperation Treaty (PCT)

Organic light emitting diode

This invention describes a novel OLED structure design and a suitable process technology for the effective control of non-emissive area of formation and its growth.

Inventors: Lin Ke, Ramadas Senthil Kumar, Chua Soo Jin

Date filed: 28-May-04

Countries filed (secondary filings): China, Japan, US

Polymers for the delivery of bioactive agents and methods of their preparation

The invention involves a novel kind of poly(amino ester) for the delivery of bioactive agents, e.g. DNA.

Inventors: Liu Ye, Wang Shu, He Chaobin

Date filed: 10-Jun-04, 11-Jun-04

Countries filed: Singapore, Europe

Micromachined electromechanical device

The invention is related to a method to produce piezoelectric-based micro-electromechanical system (MEMS) structures or devices. The invention improves the yield of producing piezoelectric MEMS structures, including piezoelectric membranes, by eliminating the labour- and time-consuming protection step during the micro-machining process by etching.

Inventors: Yao Kui, He Xujiang, Zhang Jian, Santiranjan Shannigrahi

Date filed: 28-Jun-04, 13-Jul-04

Countries filed: Singapore, China and Japan

Enhanced multimode interference coupler

The invention relates to a multimode interference (MMI) coupler with improved performance which can be used to realize many devices such as optical power splitters, optical switches, WDM etc.

Inventors: Yin Rui, Chua Soo Jin, Teng Jinghua

Date filed: 30-Jun-04

Countries filed: Singapore

Nanocomposites and process for their production

The invention describes a new approach for preparation of polymer/pristine clay nanocomposites with the clay particles uniformly dispersed and fully exfoliated.

Inventors: Wang Ke, Wu Jingshen, Chen Ling, He Chaobin

Date filed: 14-Jul-04

Countries filed: Filed under Patent Cooperation Treaty (PCT)

A method of identifying an object and a tag carrying identification information

The invention involves the use of composite materials for individually tagging an item. The invention can achieve cheap, forge-proof fingerprints which could be used for the identification of valuable items as well as prevention of forgery or counterfeiting of official documents, banknotes, credit cards, etc.

Inventors: Peter Moran, Adrian Burden

Date filed: 16-Jul-04

Countries filed: Filed under Patent Cooperation Treaty (PCT)

Variable focus microlens

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.

Inventors: Isabel Rodriguez, Peter Moran, Khaw Aik Hau, Saman Dharmatilleke

Date filed: 20-Jul-04

Countries filed: Filed under Patent Cooperation Treaty (PCT)

Reliable contacts

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.

Inventors: Chi Dongzhi, Lee Ka Yau, Rinus Lee, Liew Siao Li, Yao Hai Biao

Date filed: 27-Jul-04

Countries filed: Filed under Patent Cooperation Treaty (PCT)

Distributed feedback and distributed Bragg reflector semiconductor lasers

The invention relates to a distributed feedback (DFB) laser and a distributed Bragg reflector (DBR) laser, and a tunable 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.

Inventors: Teng Jinghua, Chua Soo Jin, Dong Jianrong

Date filed: 4-Aug-04

Countries filed: Singapore

Liquid delivering device

The invention relates to liquid delivering devices, powered by electrolysis, which are capable of releasing specific volumes of liquid at desired flow rates. It is suitable for administering liquids containing drugs to subjects.

Inventors: Zhang Xuan Xiong, Xu Yuan, Kong Yen Peng, Yao Kui, He Xu Jiang

Date filed: 7-Aug-02 (same as PCT filing date)

Countries filed: China

Publications (MAY 2004)

- **The effect of salt and pH on the phase-transition behaviors of temperature-sensitive copolymers based on N-Isopropylacrylamide**

XM Liu, LS Wang, L Wang, JC Huang, CB He
Biomaterials, 25(25), 5658-5665, 2004
Contact: xm-liu@imre.a-star.edu.sg

- **Calculation of the R_0A product in n^+ - n - p and p_+ - p - n GaInAsSb infrared detectors**

T Yuan, SJ Chua, YX Jin
Infrared Physics & Technology, 45(3):181-189, 2004
Contact: sj-chua@imre.a-star.edu.sg

- **Mechanical properties and fracture behavior of epoxy nanocomposites with highly exfoliated pristine clay**

K Wang, JS Wu, L Chen, ML Toh, CB He, AF Yee
ANTEC-SPE'04
Contact: k-wang@imre.a-star.edu.sg

- **Micro-deformation and fracture behavior of epoxy based nanocomposites with highly exfoliated pristine clay**

JS Wu, K Wang, L Chen, ML Toh, CB He, AF Yee
ANTEC-SPE'04
Contact: k-wang@imre.a-star.edu.sg

Publications (JUNE 2004)

- **Highly efficient luminescent organic clusters with quantum dot-like properties**

CB He, Y Xiao, JC Huang, TT Lin, KY Mya, XH Zhang
Journal of American Chemical Society, 126(25): 7792 - 7793, 2004
Contact: cb-he@imre.a-star.edu.sg

- **Formation and characterization of water-soluble platinum nanoparticles using a unique approach based on hydrosilylation reaction**

JC Huang, CB He, XM Liu, Y Xiao, KY Mya, JW Chai
Langmuir, 20, 5145-5148, 2004
Contact: jc-huang@imre.a-star.edu.sg

- **Carbon supported Pt and PtRu nanoparticles as catalysts for direct methanol fuel cell**

ZL Liu, XY Ling, XD Su, JY Lee
Journal of Physical Chemistry B, 108(24), 8234- 8240, 2004
Contact: zl-liu@imre.a-star.edu.sg

- **Molecular design of liquid crystalline poly(ester-amide)s with perfluoroalkyl spacers**

MM Teoh, TS Chung, SX Cheng, TT Lin, KP Pramoda
Liquid Crystals, 31(6), 871-881, 2004
Contact: tt-lin@imre.a-star.edu.sg

- **Preparation and thermomechanical properties of epoxy resins modified by octafunctional cubic silsesquioxane epoxides**

KY Mya, CB He, JC Huang, Y Xiao, J Dai, YP Siow
Journal of Polymer Science, Part A: Polymer Chemistry, 42, 3490-3503, 2004
Contact: ky-mya@imre.a-star.edu.sg

- **Alternating aromatic and transannular chromophores with and without Linker: Effect of transannular pi-pi interaction on the optical property of dithiaparacyclophane-based copolymers**

WL Wang, JW Xu, YH Lai, FK Wang
Macromolecules, 37, 3546-3553, 2004
Contact: jw-xu@imre.a-star.edu.sg

- **Deformation mechanisms of nanoclay-reinforced anhydride-modified polypropylene**

L Chen, SC Wong, TX Liu, XH Lu, CB He
Journal of Polymer Science, Part B: Polymer Physics, 42, 2759-2768, 2004
Contact: l-chen@imre.a-star.edu.sg

- **Photoluminescence of compressively strained AlGaInP/GaInP quantum well structures grown by metalorganic chemical vapour deposition**

JR Dong, XH Zhang, SJ Chua, YJ Wang, HR Yong
Journal of Crystal Growth, 266(4): 449 - 454, 2004
Contact: jr-dong@imre.a-star.edu.sg

- **Photoluminescent properties of copper-doped zinc oxide nanowires**

CX Xu, XW Sun, XH Zhang, L Ke, SJ Chua
Nanotechnology, 15(7): 856-861, 2004
Contact: xh-zhang@imre.a-star.edu.sg

- **Comparison of a surface plasmon resonance device and a quartz crystal microbalance biosensor for human IgE quantification**

XD Su, J Zhang
Sensors and Actuators B-Chemical, 100(3): 309-314, 2004
Contact: xd-su@imre.a-star.edu.sg

- **Discrete solvation layering in confined binary liquids**

RYH Lim, SJ O'Shea
Langmuir, 20(12): 4916-4919, 2004
Contact: s-oshea@imre.a-star.edu.sg

- **Evidence of nitric-oxide-induced surface band bending of indium tin oxide**

JQ Hu, JS Pan, FR Zhu, H Gong
Journal of Applied Physics, 95: 6273-6276, 2004
Contact: js-pan@imre.a-star.edu.sg

- **Co overlayers on low-index Si surfaces: Growth mode, surface morphology and interfacial interaction**

JS Pan, ES Tok, JW Chai, SW Poon, CHA Huan
16th International Vacuum Congress
Contact: js-pan@imre.a-star.edu.sg

- **Non-wetting behaviour of Co nanostructures deposited on graphite surfaces**

SW Poon, ES Tok, JS Pan
16th International Vacuum Congress
Contact: sw-poon@imre.a-star.edu.sg

- **Detection of mutations in DNA using QCM and MutS**

XD Su, YJ Wu, R Rudolf, W Knoll
The 2nd International Symposium on Sensor Sciences, China, Nanjing
Contact: xd-su@imre.a-star.edu.sg

- **Free-standing 3-D polymeric structures by duo-molding imprinting**

YP Kong, HY Low, SW Pang, AF Yee
The 48th International Conference on Electron, Ion and Photon Beam Technology and Nanofabrication
Contact: hy-low@imre.a-star.edu.sg

- **Stability of patterns in nanoimprinting of functional polymers**

RM Reano, YP Kong, HY Low, LTan, F Wang, SW Pang, AF Yee
The 48th International Conference on Electron, Ion and Photon Beam Technology and Nanofabrication
Contact: hy-low@imre.a-star.edu.sg

- **Towards novel flexible display - Design and fabrication of OLEDs on plastic substrates**

FR Zhu, XT Hao, KS Ong, YQ Li, LW Tan
The 5th International Conference on Thin Film Physics and Applications, May 31 - June 2, 2004, Shanghai, China (invited talk)
Contact: fr-zhu@imre.a-star.edu.sg

- **Atomic force microscopy in liquid environments**

S O'Shea, RYH Lim
8th Asia-Pacific conference on electron microscopy (8APEM), 7th-11th June 2004, Kanazawa (invited talk)
Contact: s-oshea@imre.a-star.edu.sg

- **Ballistic emission spectroscopy and imaging of a buried metal organic interface**

N Chandrasekhar, C Troadec, L Kunardi
5th International Conference on Thin Film Physics and Application, 31 May-2 June 2004, Shanghai
Contact: n-chandra@imre.a-star.edu.sg

Publications (JULY 2004)

• **Cracking and orientation of solution deposited rutile TiO₂ films**

GKL Goh, SK Donthu, PK Pallathadka
Chemistry of Materials, 16:2857-2861, 2004
Contact: g-goh@imre.a-star.edu.sg

• **Selective growth of GaAs quantum dots on the triangle nanocavities bounded by SiO₂ mask on Si substrate by MBE**

YB Zheng, SJ Chua, A Huan, ZL Miao
Journal of Crystal Growth, 268: 369-374, 2004
Contact: yb-zheng@imre.a-star.edu.sg

• **Synthesis, characterization, and curing kinetics of novel ladder-like polysilsesquioxanes containing side-chain maleimide groups**

PGS Krishnan, CB He, CSS Tay
Journal of Polymer Science -Part A Polymer Chemistry, 42:4036-4046, 2004
Contact: cb-he@imre.a-star.edu.sg

• **Crystallization and melting behavior of polyester/clay nanocomposites**

IY Phang, KP Pramoda, TX Liu, CB He
Polymer International, 53(9): 1282-1289, 2004
Contact: pramoda-kp@imre.a-star.edu.sg

• **Surface modification studies of edge-oriented molybdenum sulfide nanosheets**

H Zhang, KP Loh, CH Sow, HR Gu, XD Su, C Huang, ZK Chen
Langmuir, 20(16): 6914 - 6920, 2004
Contact: xd-su@imre.a-star.edu.sg

• **A water-soluble non-aggregating fluorescent octa-carboxylic acid derived from tetraphenylmethane: synthesis and optical properties**

XM Liu, CB He, JC Huang
Tetrahedron Letters 45(32), 6173-6177, 2004
Contact: xm-liu@imre.a-star.edu.sg

• **Hyper-branched blue light-emitting alternating copolymers of tetrabromoarylmethane/ silane and 9,9-Dihexylfluorene-2,7-diboronic acid**

XM Liu, CB He, XT Hao, LW Tan, YQ Li, KS Ong
Macromolecules, 37(16): 5965-5970, 2004
Contact: xm-liu@imre.a-star.edu.sg

• **Raman scattering probe of anharmonic effects in NiSi**

SK Donthu, DZ Chi, S Tripathy, AS Wong, SJ Chua
Journal of Raman Spectroscopy, 35(7): 536-540, 2004
Contact: dz-chi@imre.a-star.edu.sg

• **Enhanced photoluminescence of InAs self-assembled quantum dots grown by molecular-beam epitaxy using a 'nucleation-augmented' method**

CK Chia, SJ Chua, ZL Miao, YH Chye
Applied Physics Letters, 85(4): 567-569, 2004
Contact: ck-chia@imre.a-star.edu.sg

• **High-quality InAs grown on GaAs substrate with an in situ micro-structured buffer**

ZL Miao, SJ Chua, S Tripathy, CK Chia, YH Chye, P Chen
Journal of Crystal Growth, 268(1-3): 18-23, 2004
Contact: zl-miao@imre.a-star.edu.sg

• **Highly sensitive detection of processes occurring inside nanoporous anodic alumina templates: A waveguide optical study**

KHA Lau, LS Tan, K Tamada, MS Sander, W Knoll
The Journal of Physical Chemistry B, 108: 30, 10812-10818, 2004
Contact: aaron-khlau@imre.a-star.edu.sg

• **Preparation, characterization, and their photocatalytic activities of Ce-doped TiO₂ nanoparticles**

ZL Liu, B Guo, L Hong, HX Jiang
Thin Films 2004 & Nanotech 2004
Contact: zl-liu@imre.a-star.edu.sg

• **Moisture barrier properties of multilayered thin films deposited on polymer substrate**

YA Xu, HY Low, HL Huang, WW Loh
Thin Films 2004 & Nanotech 2004
Contact: ya-xu@imre.a-star.edu.sg

• **InGas self-organised quantum dots grown by molecular beam epitaxy using "nucleation-augmented method"**

CK Chia, SJ Chua, ZL Miao, YH Chye
1st Nano-Engineering & Nano-Science Congress 2004, 7 - 9 July 2004
Contact: ck-chia@imre.a-star.edu.sg

• **Quantum dots and group-III nitride optoelectronics**

SJ Chua
1st Nano-Engineering & Nano-Science Congress 2004, 7 - 9 July 2004
Contact: sj-chua@imre.a-star.edu.sg

• **Polymer micro and nano fluidic channels fabricated using proton-beam fabrication**

P Shao, JAV Kan, K Ansari, I Rodriguez, F Watt
1st International Workshop on Proton Beam Writing Singapore
Contact: i-rodriguez@imre.a-star.edu.sg

Upcoming Seminars / Workshops / Symposia (Sep - Nov 2004)

Date	Event	Location
3 - 5 Sep 04	Science 04 Exhibition - X-Periment	Suntec City
7 - 10 Sep 04	Globaltronics 2004	Suntec City
24 Sep 04	IMRE Industry Symposium	IMRE Seminar Room 1
6 Oct 04	IMRE - ICES Joint Symposium	IMRE Seminar Room 1
18 Nov 04	IMRE - NUS Chemistry Department Joint Symposium	IMRE Seminar Room 1

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