

MESSAGE FROM IMRE'S DEPUTY DIRECTOR (INDUSTRY)



Dear Readers,

Happy New Year and welcome to 2004!

The year 2003 has been eventful for us in IMRE with the significant signing of a Memorandum of Understanding with Eastgate Technology on OLED research in August, and the signing of a Research Collaboration Agreement with GasHub Power relating to our patented fuel cell membranes in November. These are just two of the many shining examples of the quality of our research work, which is guided by two important factors.

Firstly, our core values, which reflects the *Impact* that is the nature of results we aim to create; *Respect*, both for the views and ideas of individuals that are the sparks of creativity; *Excellence*, which describes the very hallmark of our research work; and the demands of *Integrity* and *Quality* in the fundamental execution of experiments and research.

Secondly, research, results, innovations, and successes are only as good as the people who see them through, from conception to experimentation to realisation. And essential to this is the high motivation factor and passion of our staff. Therefore, we are proud of our researchers' achievements over the last year and we are dedicated to meeting further challenges and forging ahead to greater heights of professionalism and expertise.

An interesting point to note is that motivation, in tandem with our core values (indicated by the initials I, Q, E, I and R), forms the anagram, "*IMRE & IQ*", which aptly describes the pillars of our successes, our people (IMRE) and our expertise (IQ)!

This new year, we are committed to bringing more of our research highlights to the forefront by introducing our inaugural eNewsletter – *IMRE-news*, which promises to deliver more timely updates and news to a wider audience.

On behalf of IMRE, I wish all our readers a successful year ahead!

Prof Chua Soo Jin
Deputy Director (Industry), IMRE

A Boost for Local Development of Fuel Cell Technology

IMRE and GasHub sign Research Collaboration Agreement

On 11 November 2003, IMRE and GasHub held a joint press conference to announce an agreement that provides for the joint development of prototype fuel cells using IMRE's novel research and proprietary technology in high quality fuel cell membranes.

IMRE's proton-exchange membranes (PEMs), which have better conductivity and greater efficiency than membranes in the current market, makes use of hydrocarbons instead of the conventional fluorine-based membranes. Hydrocarbon-based membranes are not only cheaper but also more environmental friendly.

"Fuel cell technology is an increasingly attractive alternate source of electricity. Our technology know-how to fabricate a high performance and efficient fuel cell from scratch holds potential for cleaner and more efficient sources of power," said Prof Chua Soo Jin, Deputy Director (Industry) of IMRE.



Prof Chua Soo Jin (RIGHT) with Mr Roger Khoo, Chief Executive Officer of GasHub Power, at the media conference announcing the research collaboration agreement between IMRE and GasHub.

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"This collaboration is a strong testimony of how the private sector can work with quality research institutes such as IMRE, to fulfill their technology milestones and hence bridge the gap to commercialisation. Working with IMRE is potentially one of the best models for GasHub in its quest to evolve promising technologies for green energy solutions," said Mr Roger Khoo, Chief Executive Officer, GasHub Power Pte Ltd.

The research collaboration will integrate IMRE's patented PEM and fuel cell stack know-how with GasHub's highly conductive graphite plate technology. The project involves the fabrication of three fuel cell prototypes; two with 330W output and one with a 3kW output.

At the same press conference, GasHub also signed a Licensing Agreement with Exploit Technologies Pte Ltd (ETPL), the commercialisation arm of Agency for Science, Technology and Research (A*STAR). The Licensing Agreement will enable GasHub to use IMRE's PEM technology to manufacture fuel cell as well as fuel cell systems and products in the region.

Fuel Cell powered skate scooter prototype



Fuel-cell powered scooter demonstrating the applicability of the IMRE and GasHub joint research.

Working hand-in-hand, IMRE's fuel cell team and GasHub's technical department had assembled a fuel cell powered skate scooter prototype. Powered by a 200W fuel cell stack, the skate scooter has a speed of between 20-40 km/h. The prototype is a

testament to the applicability and versatility of the technology, indicating that the technology can be customised to suit a wide variety of devices and applications. The prototype was successfully demonstrated and featured on Singapore's Channel NewsAsia and Channel U news reports on 12 December 2003.

News about our fuel cell research in various printed and online media.

联合早报
薄层燃料电池 功效高 成本少

THE BUSINESS TIMES
Made-in-S'pore fuel cell makes waves

The Straits Times
GasHub Power and IMRE to work on PEM fuel cells

THE BUSINESS TIMES
GasHub Power in fuel cell research

联合早报
新加坡材料研究院的首席科学家跟良策博士花了十多年时间，终于研制出一种结构特殊的薄层燃料电池。把薄层燃料电池用在燃料电池堆上，把燃料电池堆起来，形成一个燃料电池堆，使燃料电池的发电功率提高到1千瓦。这个发电功率已足以驱动电视机、电脑、冰箱等。

Powering up for a clean getaway

薄层燃料电池 可驱动迷你史古达

OLED Network of Singapore (ON-Singapore)

Putting the Spotlight on Organic Light Emitting Devices (OLEDs)

IMRE recently announced the launch of ON-Singapore at the *Intertech OLEDs 2003* Conference held in November 2003 in USA. ON-Singapore is an initiative that seeks to bring together industries and research organisations that are interested in participating, developing, supporting and nurturing the research, development and manufacturing of OLEDs in the region. The network also provides the link between the local and the international OLED community.

This initiative is being heralded by IMRE and supported by Singapore's Economic Development Board (EDB).

IMRE is well placed to host the network as it has been very active in OLED technology for over five years and already has well established relationships with many global companies in the field. In essence, we are able to provide a technological anchor from which the community can grow.

During the last year, the Institute has been in talks with many local and overseas companies about the status of OLED technology and the opportunities it offers. Many businesses expressed a keen interest to learn more about how they can participate in this growing industry, and ON-Singapore is the next logical step to sustain this momentum.

The Network encourages corporate membership from local and overseas small-and-medium-sized enterprises, government institutions, academic departments, venture capitalists, business angels, and multinational companies. It is being kept at a low cost and as an open network with an initial annual registration fee at SGD315 (inclusive of 5% GST) for 2004. A number of events are being planned to help members stay

abreast of developments and interact with other people active in the industry. Some of the confirmed events include:

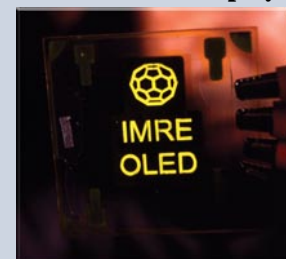
- **Inaugural ON-Singapore Reception**
Early March 2004 – Programme includes, light refreshments, short updates on the industry and a chance to network with other members.
- **OLED Symposium**
Mid May 2004 – Programme includes a series of technical presentations and industry updates.

For updated information on our events, please visit our website at www.imre.a-star.edu.sg.

For more information about ON-Singapore and a 2004 registration form, please visit www.imre.a-star.edu.sg/on-singapore.

For enquiries about ON-Singapore, please contact:
Dr Adrian Burden, Senior Research Engineer, IMRE
Email: on-singapore@imre.a-star.edu.sg
Fax: + (65) 6872 0785

The Future of Displays



OLEDs are next generation information displays and lighting. OLED displays can offer improved power efficiency, better viewing characteristics and a thinner more compact format than the currently ubiquitous liquid crystal display (LCD) devices.

IMRE Industry Symposium 2003

Bringing research and industry closer together

On 26 September 2003, IMRE held its second Industry Symposium, which was attended by a large number of local members from various industries. The objective was to bridge the gap between researcher and industry and foster potential collaborations where IMRE's expertise can be matched to a particular company's current and possible future research needs.

More than 100 participants from local small and medium-sized enterprises (SMEs) and multinational corporations (MNCs) attended the event, and these included Technical Managers, Research Engineers and Chemists from industries related to optoelectronics, avionics, nanomaterials, electronics manufacturing and chemicals.

The participants were briefed on IMRE's key research areas namely, Micro- and Nano- Systems, Molecular and Performance Materials, Opto- and Electronic Systems, and Materials Science and Characterisation.

The visitors were also given the opportunity to visit some of the laboratories where IMRE's advanced research is

conducted, such as our work on organic light emitting devices, sensor technology, optoelectronics and lasers, and our state-of-the-art characterisation facilities.

For information about IMRE Industry Symposium 2004 or upcoming events, seminars and workshops, please watch out for regular announcements on our website.



Some participants visiting the Materials Science and Characterisation Laboratory.



Prof Chua Soo Jin in discussion with a participant.

Taking a Peek into the World of Science at Science 03 *X-periment* Exhibition and the Junior College Open House

Previously known as Techmonth, Science 03 is a high profile national event, which reaches out to professionals, students and the general public to promote science, technology and biomedicine. It is a month-long series of events that encourages scientific discovery, technical innovation and biomedical awareness.

X-Periment Exhibition (5-7 September 2003)

This is the second year in which IMRE was involved in the annual X-periment Exhibition held from 5-7 September 2003 at Suntec City as part of the Science 03 event. The aim of the exhibition was to reach out to the public to create awareness for scientific research and advancements being conducted in Singapore.

Interactive exhibits and demonstrations on some of IMRE's research projects included work on red lasers, organic light emitting diodes (OLEDs), scanning tunnelling microscopy, fuel cells and micrographs from transmission electron microscopes.

Our booth attracted a lot of interest from visitors from all walks of life, both young and old. Even the guest-of-honour at the launch of the exhibition, Mr Chan Soo Sen, Minister-of-State for Education and Community Development and Sports dropped by for a look!

Junior College Open House (12 September 2003)

In conjunction with Science 03, "A Peep into the World of Science" was held on 12 September 2003 where students from various Junior Colleges and Polytechnics were taken on a tour of several A*STAR research institutes. Working with the Singapore Science Centre, IMRE hosted a delegation of 30 students.

The students, visiting IMRE for the first time, were given a brief presentation on the research laboratories and the type of research work conducted.

They were later brought on a laboratory tour that included hands-on demonstrations on some of the R&D carried out in IMRE.

The students and researchers were also given the opportunity to mingle and interact with one another at the end of the tour to allow the students to discover more about the experience of working in a research environment. A number of the students had also arranged to visit IMRE again to find out more about the research projects being done here.



Eager young budding scientist at IMRE booth.



Mr Chan Soo Sen (LEFT), Minister-of-State for Education and Community Development, listening intently to Ms Toh Mei Ling (RIGHT), an IMRE Research Officer, while she explains the workings of a fuel cell.



Junior College students getting a closer look at a Scanning Electron Microscope of IMRE's Materials Science and Characterisation Laboratory.



The public, both young and old, converged on the X-periment Exhibition.



JC students getting a feel of research work - in this case, an OLED device.

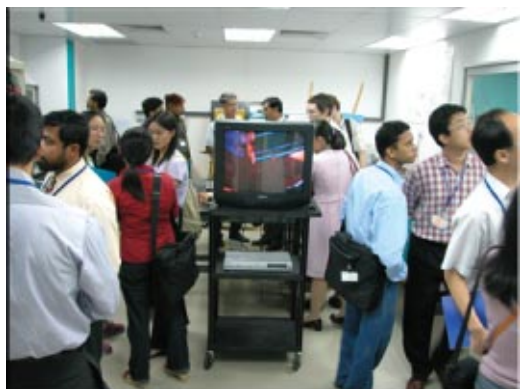


Ms Lena Lui, a postgraduate student attached to IMRE, demonstrating one of the equipments used in her research.



Inquiring young minds learning more about local research.


ICMAT delegates visit IMRE



ICMAT delegates visiting the fuel cell laboratory.

Delegates from the International Conference on Materials for Advanced Technologies (ICMAT) 2003, visited IMRE on 9 December 2003 as part of a laboratory tour jointly organised with The Materials Research Society (Singapore).

About 240 delegates took the opportunity to visit IMRE and our facilities in a programme that encompassed visits to other research institutes and the local universities including the National University of Singapore, Nanyang Technological University, Institute of Microelectronics (IME) and the Singapore Synchrotron Light Source (SSLS).

The IMRE laboratories that were open to the visitors included our characterisation facilities, integrated micro- and nano- systems, quantum dot research, organic light emitting devices, optoelectronics and lasers, fuel cells, sensor technology research and hydrogel drug delivery systems. 

Events and Visits

Singapore Chinese Chamber of Commerce and Industry (SCCCI) visit

7 October 2003

Some members of SCCCI visited IMRE as part of an event organised by IMRE and the Association. The event was designed to showcase IMRE's capabilities and facilities and to allow opportunities for interaction and possible collaboration. The visitors were briefed on IMRE's various research efforts and were taken on a tour of some of our laboratories. The event concluded with a poster and interaction session.

Swiss Delegates visit

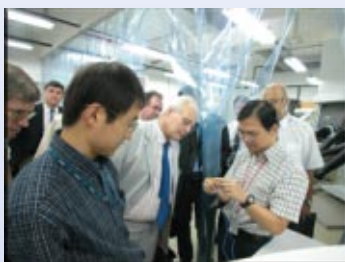
20 October 2003

A high level delegation comprising 24 organisations (30 participants) visited Singapore to assess the feasibility of establishing a Swiss House. The Swiss delegates from the Science & Engineering Group visited IMRE to find out more about the research being done here.

Visit by members of France-Singapore Optics/Photonics Cooperation

30 October 2003

IMRE's Opto- and Electronics System (OES) cluster played host to 20 delegates of the France-Singapore Optics / Photonics Cooperation programme, organised by EDB. The visitors were given an overview of the Institute and introduction to the research work done in the OES cluster. The visitors were then taken on a tour of some of IMRE's laboratories and facilities, including materials



Delegates from the France-Singapore Optics / Photonics programme visiting the OLED laboratory.



JC students being briefed by an IMRE researcher about atomic force microscopy.

Nobel Laureate visits IMRE

Prof Klaus von Klitzing, Nobel Laureate in Physics (1985) visited IMRE on 9 December 2003 to gain an insight on the materials science research and development that is being conducted in Singapore. He also had fruitful discussions with IMRE's researchers on a number of key projects. Prof von Klitzing is currently the Director of the Max Planck Institute for Solid State Research in Stuttgart, Germany.



characterisation, organic light emitting devices and optoelectronic and photonic research.


Junior College Students' visit

18 November 2003

15 students from four Junior Colleges around Singapore visited IMRE, which exposed the students to scientific research and kept them informed about the research opportunities available to them. Designed to enthuse the students, the programme included talks by young researchers on research life in IMRE and laboratory tours where students could witness research in action. The event culminated in a *Meet-the-Researchers* session where there was proactive interaction between the students and our researchers.

MBraun Organic Light Emitting Diode (OLED) Seminar

28 November 2003

MBraun, the German company producing glove boxes, conducted a seminar at IMRE. About 40 registered participants from both industry and research institutes attended the seminar. After the seminar on OLED processes presented by MBraun, participants were taken on a tour of IMRE's characterisation facilities and the OLED laboratory. 

Student Attachments, Open House and Lab Tours

Reaching out to the Young



Students from the STaR programme getting tips on how to use an imprinting machine from Ms Karen Darmono, an IMRE Research Officer.



Participants of the Student Attachment Programme:
BACK ROW (L-R):
Koh Chao Rui (HCJC), Ng Wei Yan (HCJC), Teng Yong Ping (VJC), Victor Loi (NJC), Michael Lau (ACJC).

FRONT ROW (L-R):
Leng Xiang Yu (TJC), May Sripatanaskul (NJC), Ang Hui Shan (TJC), Anna Choo (ACJC).

Investing and developing youth interest in science and engineering is one of IMRE's major objectives. Initially training and accepting student attachments from the related degree courses of the National University of Singapore, IMRE's youth outreach programme has gone beyond the limits of academic confines. We now

regularly conduct open houses, attachment programmes and laboratory tours for secondary school students to postgraduates.

IMRE's tie-up with National Junior College (NJC) in its **Science Training & Research (STaR) Programme** is an excellent example of the extent of our youth outreach. The pilot IMRE-NJC STaR programme began in May 2003 with 8 IMRE researchers supervising 14 students on a variety of projects.

The programme allows students an opportunity to be attached to IMRE for six to nine months during which the students will give regular oral presentations of their projects in their college. Upon completion of the project, they are required to prepare


written reports on the work they had completed. These are then presented in the NJC STaR

symposium for eventual selection to the Singapore Science Engineering Fair (SSEF) and the National Science Talent Search (NSTS).

Apart from STaR, IMRE is also involved in the Student Attachment Programme (SAP), a joint initiative by A*STAR and the Ministry of Education (MOE), held during the months of November to December. Two students are paired up and attached to an IMRE research supervisor for a period of four to five weeks. Under their supervisor, the students will have hands-on experience in small

projects designed to illustrate some aspects of the research scope of the Institute and gain concrete knowledge of what scientific research entails.

IMRE also regularly hosts students who are interested in learning more about science and laboratory-based research. For example, 15 students from four Singapore Junior Colleges visited IMRE on 18 November 2003. The objective of the visit is to reach out to the students and expose them to scientific research. This included talks by young researchers on research life as well as laboratory tours.

The programme also involves a *Meet-the-Researchers* session, where the students are given the opportunity to interact with researchers. 

"IMRE has inspired me to think that Science in Singapore has great future and prospects, it has shown that though small and lacking in resources, scientific discoveries are still within our reach"

- Mr Victor Loi
17-year-old, National Junior College (NJC) student attached to IMRE during the SAP



Patents and Publications

Patents Granted (SEPTEMBER – NOVEMBER 2003)

A Method of Fabricating Semiconductor Structures and A Semiconductor Structure Formed Thereby

The invention describes a method of fabricating a semiconductor body with a surface adjoined by regions of insulating materials.

Inventors: Syamal Lahiri, Dominique Mangelinck, Chi Dongzhi

Date granted: 28 November 2003

Country granted: Singapore

A Method of Fabricating a Semiconductor Structure having Quantum Wires and a Semiconductor Device including such Structure

This invention provides a method for fabricating a semiconductor structure having self-organised quantum wires to provide a semiconductor device incorporating such quantum wires.

Inventors: Wang Benzong, Chua Soo Jin

Date granted: 31 October 2003

Country granted: Singapore

A Buried Hetero-Structure InP-Based Opto-Electronic Device with Native Oxidized Current Blocking Layer

A buried hetero-structure InP-based opto-electronic device with native oxidized current blocking layer comprises a InP semiconductor substrate, a buffer layer, a ridge mesa containing lower confinement layer, active layer and upper grating confinement layer, a first InP cladding layer and a native oxidized Al-bearing layer as current blocking layers at both lateral edges, a second InP cladding layer, contact layer, contact metal, and the second ridge mesa covered with insulating layer. This method is to facilitate the processing of conventional buried hetero-structure InP-based opto-electronic devices.

Inventors: Wang Zhi Jie, Chua Soo Jin

Date granted: 30 September 2003

Country granted: Singapore

Patents Filed (SEPTEMBER – NOVEMBER 2003)

Microneedles and Microneedle Fabrication

The invention describes several methods for fabricating tapered (or straight) hollow microneedles. These methods can be used to make metallic needles with sufficient strength and ductility. The invention has the advantage that the fabrication cost is lower than those techniques reported in literature and has potential application for transdermal drug delivery.

Inventors: Xu Yuan, Chen Mei Ma, Li Zhongli, Lim Chee Yen, Tan Pei Ying

Date filed: 11 November 2003

Country filed: Filed under Patent Cooperation Treaty (PCT)

Liquid Housing Chamber And Liquid Delivering Device Containing Such Chamber

The invention describes several painless hypodermic injection devices that combine microneedles with syringes or automatic devices. Using electrochemical or pneumatic or electric/mechanical mechanism and the invented drug chamber, the injection process can be conducted automatically at controlled rates.

Inventors: Xu Yuan, Lim Chee Yen, Tan Yuan Ling, Tan Pei Ying

Date filed: 7 November 2003

Country filed: Filed under Patent Cooperation Treaty (PCT)

Method of Detection of Mutations and Polymorphisms in DNA

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.

Inventors: Su Xiaodi, Robelek Rudolf, Wolfgang Knoll, Sean O'Shea

Date filed: 22 September 2003

Country filed: US

Publications (SEPTEMBER 2003)

- **Temperature-dependent photoluminescence of GaInP/AlGaInP multiple quantum well laser structure grown by metalorganic chemical vapor deposition with tertiarybutylarsine and tertiarybutylphosphine**

CY Liu, S Yuan, JR Dong, SJ Chua, MCY Yuan, SZ Wang
Journal of Applied Physics, 94(5): 2962-2967, 2003
Contact: jr-dong@imre.a-star.edu.sg

- **Effects of indium surfactant on crystalline and optical properties of GaN during initial growth stage**

HR Yuan, SJ Chua, S Tripathy, P Chen
Journal of Vacuum Science and Technology A, 21(6): 1814-1819, 2003
Contact: hr-yuan@imre.a-star.edu.sg

- **Excimer-laser-induced oxidation of GaN epilayer**

XC Wang, GC Lim, HY Zheng, JL Tan, W Liu, SJ Chua
Japan Journal of Applied Physics, 42(9A): 5638-5641, 2003
Contact: w-liu@imre.a-star.edu.sg

- **Nanostructure formation by O₂⁺ ion sputtering of Si/SiGe heterostructures**

GS Lau, WWC Tjiu, R Liu, ES Tok, ATS Wee, J Zhang
Nanotechnology, 14(11): 1187-1191, 2003
Contact: gs-lau@imre.a-star.edu.sg

- **Direct observation of boron nitride nanocage growth by molecular beam nitridation and liquid-like motion of Fe-B nanoparticles**

M Yeadon, M Lin, CB Boothroyd, KP Loh, G Fu, Z Hu
Journal of Materials Chemistry, 13, 2573-2576, 2003
Contact: chris-b@imre.a-star.edu.sg

- **The phonon contribution to high-resolution electron microscope images**

CB Boothroyd, M Yeadon
Ultramicroscopy, 96(3-4): 361-365, 2003
Contact: chris-b@imre.a-star.edu.sg

- **Determination of hardness and elastic modulus of low-k thin films and barrier layer for microelectronic applications**

L Shen, KY Zeng, YH Wang, B Narayanan, R Kumar
Microelectronic Engineering, 70(1), 115-124, 2003
Contact: lu-shen@imre.a-star.edu.sg

• **Investigation of mechanical properties of transparent conducting oxide thin films**

KY Zeng, FR Zhu, JQ Hu, L Shen, KR Zhang, H Gong
Thin Solid Films, 443(1-2): 60-65, 2003
 Contact: ky-zeng@imre.a-star.edu.sg

• **Preparation of nanoporous polyimide films from poly(urethane-imide) by thermal treatment**

PSG Krishnan, ZC Chia, SC Yeo, JCC Wu
Macromolecular Materials & Engineering, 288: 730-736, 2003
 Contact: sg-krishnan@imre.a-star.edu.sg

• **Water-soluble luminescent polymeric materials comprised of tetrahedral chromophores and hydrophilic side chains**

XM Liu, CB He
 226th ACS National Meeting
 Contact: xm-liu@imre.a-star.edu.sg

• **Improvement of thermal-mechanical properties using polyhedral oligomeric silsesquioxanes (POSS)-modified epoxy resins**

KY Mya, JC Huang, Y Xiao, CB He, YP Siow, J Dai
 226th ACS National Meeting
 Contact: ky-mya@imre.a-star.edu.sg

• **Keynote Speech: Microcontact printing of catalytic nanoparticles for achieving metal microcircuits**

PM Moran, L Wu, SM Bhangale
 "Imaging, Marking, and Printing Applications of Particle Technology", Toronto, Canada
 Contact: p-moran@imre.a-star.edu.sg

Publications (SEPTEMBER 2003)

• **Influence of the polarization on interfacial properties in Al/SiO₂/GaN/Al_{0.4}Ga_{0.6}N/GaN heterojunction metal-insulator-semiconductor structures**

P Chen, SJ Chua, WD Wang, DZ Chi, ZL Miao
Journal of Applied Physics, 94(7): 4702-4704, 2003
 Contact: p-chen@imre.a-star.edu.sg

• **Crystallization and phase behaviors of multicomponent supramolecular complexes through hydrogen-bonding association**

XH Lu, CB He, AC Griffin
Macromolecules, 36(14): 5195-5220, 2003
 Contact: cb-he@imre.a-star.edu.sg

• **The nanocomposites of carbon nanotube with Sb and SnSb_{0.5} as Li-ion battery anodes**

WX Chen, JY Lee, ZL Liu
Carbon, 41(5): 959-966, 2003
 Contact: zl-liu@imre.a-star.edu.sg

• **Nanosized Pt and PtRu colloids as precursors for direct methanol fuel cell catalysts**

ZL Liu, XY Ling, JY Lee, XD, Su, LM Gan
Journal of Materials Chemistry, 13, 2003 (Advance Article)
 DOI: 10.1039/b309342e
 Contact: zl-liu@imre.a-star.edu.sg

• **Alloyed Zn_xCd_{1-x}S nanocrystals with highly narrow luminescence spectral width**

XH Zhong, YY Feng, W Knoll, MY Han
Journal of American Chemical Society, 125: 13559-13563, 2003
 Contact: my-han@imre.a-star.edu.sg

• **Water soluble luminescent polymeric materials comprised of tetrahedral chromophores and hydrophilic side chains**

XM Liu, CB He
Polymeric Materials Science and Engineering, 89: 221-222, 2003
 Contact: xm-liu@imre.a-star.edu.sg

• **Preparation and characterization of temperature-sensitive poly(N-isopropylacrylamide)-b-poly(D,L-lactide) microspheres for protein delivery**

SQ Liu, YY Yang, XM Liu, YW Tong
Biomacromolecules, 4(6): 1784-1793, 2003
 Contact: xm-liu@imre.a-star.edu.sg

• **Novel poly(amino ester)s obtained from Michael addition polymerizations of trifunctional amine monomers with diacrylates: Safe and efficient DNA carriers**

Y Liu, DC Wu, YX Ma, GP Tang, S Wang, CB He, TS Chung, SH Goh
Chemical Communications, (20): 2630-2631, 2003
 Contact: ye-liu@imre.a-star.edu.sg

Publications (SEPTEMBER 2003)

• **Characterization of metal adsorption kinetic properties in batch and fixed-bed reactors**

JP Chen, L Wang
Chemosphere, 54(3): 397-404, 2003
 Contact: l-wang@imre.a-star.edu.sg

• **Quartz crystal microbalance coated with sol-gel-derived thin films as gas sensor for NO detection**

J Zhang, JQ Hu, FR Zhu, H Gong, SJ O'Shea
Sensors, 3(10): 404-414, 2003
 Contact: fr-zhu@imre.a-star.edu.sg

• **InGaN self-organized quantum dots grown by metalorganic vapour deposition (MOCVD)**

LS Wang, SJ Chua, KY Zang, S Tripathy
Physica Status Solidi (c) (Germany), 0(7):2083-2086, 2003
 Contact: ls-wang@imre.a-star.edu.sg

• **Nanotechnology in Singapore**

PM Moran
 Netherlands' Ministry of Economic Affairs Symposium
 Contact: p-moran@imre.a-star.edu.sg

• **Developing the technological infrastructure towards manufacturing displays in Singapore**

AP Burden
 Invited presentation at OLEDs 2003, San Diego, USA
 Contact: adrian-pb@imre.a-star.edu.sg

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Contributors to this issue

Prof Chua Soo Jin, Dr Adrian Burden, Ms Lee Chun Theng, Ms Chua Sze Sze, Mr Eugene Low

Institute of Materials Research and Engineering

3 Research Link, Republic of Singapore 117602
 Tel: (65) 6874 8111 Fax: (65) 6872 0785
 Email: enquiry@imre.a-star.edu.sg Website: www.imre.a-star.edu.sg