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IMRE signs MoU on OLED research with Eastgate Technology

By Mr Eugene Low, Corporate Communications Officer



Prof Chua Soo Jin (seated, left), IMRE's Deputy Director (Industry) signing the MoU with Mr Goh Hun Keng (seated, right), Chairman and CEO of Eastgate Technology. The Signing Ceremony was witnessed by Mr Tan Chek Ming (centre), Assistant Managing Director of Singapore Economic Development Board (EDB).

The day 26 of August 2003 marked another milestone for IMRE's research as a Memorandum of Understanding (MoU) was signed with Singapore Exchange-listed company, Eastgate Technology, to conduct research and development (R&D) support for the first local manufacturer of organic light emitting diode (OLED) displays. Eastgate, together with Cambridge Display Technology, UK and OTB Group of the Netherlands, had joined in partnership to create *Innoled Pte Ltd* - a new Eastgate subsidiary that will manufacture OLED displays here in Singapore.

On the new venture, Prof Chua Soo Jin, Deputy Director (Industry) for IMRE, who signed the MoU on behalf of the Institute said, "IMRE is pleased to be working closely with *Innoled* to support this commercial venture and provide the research and development backing that it needs to succeed."

The support that IMRE plans to provide is three-fold. Firstly, IMRE will work with *Innoled* on specific projects to create and develop the company's



Editorial

Dear Readers

As a research institute, IMRE has come a long way. Since 1996, we have been conducting significant materials research and development. All these efforts have started to bear fruit with more and more impressive research breakthroughs coming to light. The past two years have seen a sudden and welcome increase in the number of media highlights relating to IMRE’s work, in both foreign and local press. Joint collaborations have also been on the rise in some of IMRE’s areas of expertise like OLEDs, performance materials and micro- and nano- system technologies, not to mention the interest in our characterisation capabilities. Most recently (featured in this Perspectives issue), is the MoU agreement with Eastgate Technology to help in OLED research for their wholly-owned subsidiary *Innoled*, Singapore’s first OLED manufacturer. These are clear indications that IMRE is on its way to becoming a leading research institute for materials science and engineering dedicated to the advancement of Singapore.

The Editor

Organic Light Emitting Diode (OLED) displays

OLEDs represent the next evolution in lighting and display systems. These displays consume less power, have better viewing angles, thinner profiles and are brighter than present technology, the cathode ray tube (CRT) and the liquid crystal display (LCD).



new products, to give the products a technical edge over its competitors. Secondly, IMRE will train the talent pool for the company and future OLED display related businesses. Finally, IMRE will provide local technical knowledge and support in product design, development and testing of new processes and benchmarking of devices as they move from prototype through to production.

IMRE has been involved in OLED R&D in Singapore for over five years. This experience has enabled us to establish a formidable team of scientists and engineers who are supported by excellent equipment and facilities infrastructure in OLED technology.

Mr Tan Chek Ming, Assistant Managing Director of Singapore Economic Development Board was on hand to witness the signing of the agreements and the MoU. 🌐



The principal signatories (left to right): Mr Ron Kok, President of OTB Group B.V., Netherlands; Dr David Fyfe, Chief Executive Officer, Cambridge Display Technology Ltd, UK; Mr Goh Hun Keng, Chairman and CEO of Eastgate Technology; Prof Chua Soo Jin, Deputy Director (Industry), IMRE

IN BRIEF

- Demand for OLED screens worldwide is expected to rise to US\$3.1 billion a year by 2009 (Source: iSuppli/Stanford Resources)
- Eastgate Technology’s start-up investment in *Innoled* worth S\$25 million
- The OLED technology being employed in the manufacturing is the first in Singapore and most advanced in Asia


OLED research in IMRE makes headlines

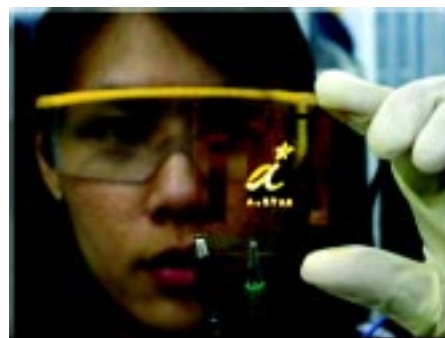
By Mr Eugene Low, Corporate Communications Officer

On 10 June 2003, IMRE's development in organic light emitting devices (OLEDs) was published in the Science and Technology section of The Straits Times.

The feature entitled, "Scientists clear up spotty high-tech display" highlighted IMRE's research advancements and progress in OLEDs, especially in alleviating the problem of "dark spots", or areas of non-emission, that reduce the longevity and brightness of the device. OLEDs are set to become the technology that replaces displays in mobile phones, digital cameras and other portable electronic products. They may also see eventual replacement in the more complex screens in laptops and desktop flat panel monitors.

IMRE has been researching and developing the materials and processes that relate to OLED devices for several years. We have the capability to fabricate both small molecule OLEDs (SMOLEDs) and polymer light emitting diode (PLED) devices, comprehensively test operating characteristics and undertake forensic analysis.

Our strengths lie in reducing growth of "dark spots", or non-emissive areas, improving the interfacial properties of the electrodes and optimising new device architectures such as flexible displays and top-emitting structures. 



IMRE's five years of experience with OLEDs has produced a capable team of scientists well-versed with the technology.


"Lab-on-a-Bead" research gains more media attention

By Mr Eugene Low, Corporate Communications Officer

After being featured in the Straits Times, IMRE's "Lab-on-a-Bead" research has again been highlighted in publications and magazines, both local and foreign.

An article entitled "Lab-on-a-Bead Deciphers Biomolecules", was published in *Innovation* magazine Vol. 3 No. 3, 2003, highlighting the research done by Dr Han Mingyong. In the May-June 2003 issue of the Dutch newsletter, *Tech Nieuws* – published by the Netherlands Office of Science and Technology – the research by Dr Han, a senior research scientist in IMRE, also featured an article entitled, "Development of 'Lab-on-a-bead': The Next Generation Diagnostic Kit at Singapore's Institute of Materials Research and Engineering". Both articles broadly introduced the quantum dot technology behind the research and the impact of its applications in diagnostics and the early detection of diseases.

The *Innovation* magazine article was subsequently picked by SurfIP as it's intellectual property focus of the

month. The SurfIP Portal, a special project of the Intellectual Property Office of Singapore (IPOS), was developed to serve the IP community as a first-stop, one-stop portal for intellectual property information. 



Short wavelength-emitting $Zn_{1-x}Cd_xSe$ alloy nanocrystals excited with a UV lamp. The lab-on-a-bead technology allows more flexibility in target selection, faster binding kinetics and cheaper production.

IMRE-SIMTech joint symposiums

IMRE and the Singapore Institute of Manufacturing Technology (SIMTech) came together and organised a series of symposiums designed to foster closer interaction between the scientists from both Research Institutes (RIs) as well as with industry. Based on three topics - optoelectronics, nanostructured materials and micro devices – each symposium was a half-day event that introduced the technological achievements of both RIs in various fields and promoted exchanges of ideas and research data.

Optoelectronics, Photonics and Displays

- 31 July 2003


By Dr Mark Auch,
Research Scientist



Researchers from IMRE and industry exchanging ideas during a break in the symposium

The first IMRE-SIMTech joint symposium, entitled “Optoelectronics, Photonics and Displays”, was held on 31 July 2003 at the SIMTech Auditorium. Research staff from the RIs and participants from industry attended the symposium.

Both IMRE and SIMTech speakers covered wide-ranging topics including *Laser Microprocessing and Optical Measurement Technology, GaN, GaAs and InP-based Laserdiodes and LEDs*, as well as topics on organic light emitting devices (OLEDs).

The presentations by IMRE’s scientists focused on the recent progress in GaAs, InP and GaN-based lasers and diodes, such as multiwavelength lasers using quantum well intermixing and the first red laser produced by MOCVD using TBP gas, as well as fabrication of blue and UV LEDs, which can potentially revolutionise lighting and signalling applications. Other topics covered included IMRE’s research on OLEDs, particularly work on degradation and dark spots, as well as efforts on barrier films for flexible OLEDs. 



Participants of the symposiums comprised members of the local research community and industry

held on 6 August 2003, which was well-attended by participants from academic and industrial research groups.

The topics covered included research on nanostructured polymers, nanocomposites,


Nanostructured Materials and Processing

- 6 August 2003

by Dr Low Hong Yee,
Research Scientist

The “Nanostructured Materials and Processing” joint symposium was

nanofabrication techniques and inorganic nanostructured materials.

The interesting physical and chemical properties of nanostructured materials have attracted a great deal of attention because of their potential applications in various technologies. For instance, the effects of *quantum confinement* are seen in polymeric materials, polymer nanocomposites and organic-inorganic hybrids. The materials are also endowed with unique and attractive properties such as improved thermal, mechanical and barrier properties. A number of participants have already shown interest in pursuing joint research on some of the work highlighted. 

Micro Devices Fabrication and Packaging

- 27 August 2003

By Dr Maria Isabel Rodriguez, Research Scientist

The symposium on Micro Devices Fabrication and Packaging was conducted on 27 August 2003.

Participants from industry and various academic institutions gathered for presentations on the latest research developments in microsystems




Participants arriving for the third IMRE-SIMTech symposium

fabrication and packaging carried out at both institutes.

The IMRE and SIMTech scientists covered various aspects of device fabrication, packaging and actuation, and presented a broad range of microsystems applications.

Some of the topics covered included miniaturised resonator sensors for biological detection using quartz crystals as biosensors; generic wafer level packaging processes for microsystems based on anodic bonding; and the development of several MEMS piezoelectric components including micro pumps or electrochemically driven micro needle arrays and micro vaporisers.

Presentations on a cost-effective process for the fabrication of polymer-based optical switches based on microimprinting; high-performance piezoelectric materials and miniaturised devices; and the design and fabrication processes for fabricating the world’s smallest gas turbine generator were also presented. 

Helping to chart the future direction of technology

By **Mr Eugene Low**, Corporate Communications Officer


Operations and Technology Roadmapping (OTR) is an exercise designed to help local enterprises in technology planning for the future.

OTR is part of the Growing Enterprises with Technology Upgrade (GET-Up) initiative currently being undertaken by the Research Institutes here in Singapore to help sharpen the competitive edge of local industry. One of the programme's primary goals is to provide coordinated interaction between the technical staff of Research Institutes and the senior management of local companies. This methodology has been adapted from a scheme developed by the University of Cambridge in the UK.

Dr Adrian Burden, the principal OTR facilitator for IMRE explains, "The Road Mapping process is designed to lead the company through its business aims, the market trends, the products and services that the company expects to offer in the future and finally the technology that will help it deliver. Typically, we spend five half days with the company, first to understand their current operating status and then to plan for the future. The outcome is generally very beneficial to the



The above shows an operational and technology roadmap coming together during a recent roadmapping exercise. This was led by IMRE's principal roadmap facilitator Dr Adrian Burden (standing) with the support of a number of IMRE staff, including Dr Krishnan P. Santhana Gopala, Dr Liu Ye, Ms Jennifer Lee, and Ms Kelly Khoo.

company, both in terms of the discussions that have occurred and the first-cut roadmap that is charted." Dr Burden is a Senior Research Engineer and Business Development Manager in IMRE whose research interest is in the area of optoelectronics, in particular organic light emitting devices (OLEDs). 

Training manpower for Singapore's displays industry

By **Dr Adrian Burden**, Senior Research Engineer and Business Development Manager

As part of IMRE's drive to support and promote commercialisation of organic light emitting diode (OLED) displays here in Singapore, we have recently won support from the Economic Development Board (EDB) to partake in the Research Training Programme (RTP) scheme. This initiative is designed to train manpower for targeted industries of the future in Singapore.

With the recent news about *Innoled* - a new company set-up by local CD manufacturer Eastgate Technology to manufacture OLEDs here sometime in 2004 - it is imperative that Singapore be equipped with the engineering skills required to support this high technology venture.

IMRE will be training five such RTP engineering trainees over the coming year, and the first, Mr Patrick Lau, started with us in late August. The candidates will experience all aspects of OLED device design, fabrication, testing and analysis by playing an active role in a specially set up "Demonstrator Team" who will be responsible for producing improved working prototypes of OLED displays. The hands-on training will be complemented with participation in relevant workshops and seminars in Singapore, and being very involved in the industrial projects that are being undertaken in tandem. After 12 months of intensive on-the-job learning, the trainees will go on to provide valuable technical support in the growing displays industry in Singapore. 



A brief profile on Shan Shan was featured in the January 2003 issue of Perspectives

Former IMRE staff clinches coveted Lee Kuan Yew scholarship

By Mr Eugene Low, Corporate Communications Executive

Ms Wu Shan Shan, a former full-time Research Officer with IMRE, is one of only three winners of this year's Lee Kuan Yew Scholarship. The prestigious Lee Kuan Yew Scholarships are awarded to outstanding Singaporeans to pursue postgraduate studies either overseas or locally so as to develop their potential as leaders in their fields and community.

Ms Wu, who obtained her Bachelor's and Master's degree in Chemical Engineering from Stanford University, USA was working on materials systems with applications in gene delivery in IMRE. She was subsequently transferred to the new Institute of Bioengineering and Nanotechnology (IBN) in April

2003, together with a group of IMRE research scientists and engineers, to form part of the core research team.

In a profile in the January 2003 issue of Perspectives featuring Ms Wu, the 24-year-old said to aspiring scientists that, "before jumping in with both feet, give it some real thought if you think research is for you". In this case, it is clear what she has already decided on.

The Lee Kuan Yew scholarships are given out annually to individuals who are academically brilliant, show leadership and are active in sports or community service. This year's scholarship award attracted some 120 applications.

The scholarship has enabled Ms Wu, who is currently in USA, to pursue a doctorate in biological engineering at the Massachusetts Institute of Technology (MIT).

Congratulations to you Shan Shan, from everyone at IMRE! 🌐

Visitors and Events



NJC students being introduced to IMRE

Visit by National Junior College (NJC) students 21 May 2003

The visit by some 20 students from NJC was part of the introductory and familiarisation tour prior to an informal attachment programme that the students will be attending in IMRE. Apart from learning about IMRE and some of our conducted research, the students also had the opportunity to get to know their immediate supervisors for the duration of the programme.

A*STAR National Science Scholarship (NSS) Students Visit 18 June 2003

Scholars under A*STAR's NSS programme visited IMRE as part of a familiarisation tour to the local Research Institutes (RIs). IMRE's Postgraduate Students' Committee briefed the scholars on IMRE's organisation and research areas. The programme ended with a laboratory visit during which the scholars were briefed on some of the research projects that were being carried out in IMRE.



NSS Scholars touring IMRE's research facilities

Visit by Postgraduate students from the Singapore-MIT Alliance, NUS 27 June 2003

Students from the Singapore-MIT Alliance (SMA) visited IMRE as part of the orientation programme for



New SMA students learning about IMRE's research

the SMA's new batch of students. The students were introduced to some of the research being conducted in IMRE by the respective research clusters and were also taken on a tour to some of the laboratories and facilities.

Scientific Advisory Board (SAB) meeting 3-4 July 2003

IMRE hosted its full board Scientific Advisory Board (SAB) meeting on 3 and 4 July 2003. The SAB members who attended the meeting were Professor Wolfgang Knoll, Professor Otto CC Lin, Professor Buddy Ratner, Professor William Tang, Dr Masami Tatsumi, Professor Edward Kramer and Professor G Julius Vancso. Also in attendance were A*STAR's Science and Engineering Research Council (SERC) Acting Executive Director, Prof Chong Tow Chong and Director, Dr Lim Khian Wee together with key staff of IMRE. The SAB meeting agenda consisted of updates on A*STAR SERC activities and overviews of IMRE's research work and some of the projects in the respective clusters. 🌐



IMRE staff, SAB and SERC in discussions

Patents and Publications

Patents Filed (JUNE – JULY 2003)

Polymers for the Delivery of Bioactive Agents and Methods of their Preparation

The invention involves a novel kind of poly(amino ester) containing at least one secondary amine and one tertiary amine in the backbone. This polymer could be used for the delivery of bioactive agents, especially for the formation of safe and efficient vectors for the delivery of DNA, which is important to the success of gene therapy.

Inventors: Y Liu, S Wang, CB He

Country filed: US

Sustained Release Formulation for Carbamates and a Method therefore

The invention involves the creation of a microparticulate system consisting of FDA-approved PLGA polymers and physostigmine, using a spray drying method. The method yielded a very high encapsulation efficiency of physostigmine without inducing toxic side effects.

Inventors: CS Chaw, YY Yang, S Moochhala, D Tan, B Zhao

Country filed: US

Micromachined Electromechanical Device

The invention is related to a method of producing piezoelectric-based micro-electromechanical system (MEMS) structures or devices, in which a piezoelectric film is deposited through a solution spin-coating process on a prior micro-machined structure using a specially designed spin chuck. The invention improves the production yield of piezoelectric MEMS structures, including piezoelectric membranes, by eliminating the labour- and time-consuming protection step during the micro-machining etch process.

Inventors: K Yao, XJ He, J Zhang, S Shannigrahi

Country filed: US

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, where the composite material consists of magnetic material embedded into pores of a non-magnetic (or weakly magnetic) material. The invention can be used to 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: PM Moran, AP Burden

Country filed: US

Publications - JUNE 2003

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Polymer Degradation and Stability, 81: 225-232, 2003
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- Surface modification studies of Kapton HN polyimide films**
XD Huang, SM Bhangale, PM Moran, NL Yakovlev, JS Pan
Polymer International, 52(7): 1064-1069, 2003
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- Melting behaviour of isotactic polystyrene revealed by differential scanning calorimetry and transmission electron microscopy**
TX Liu
European Polymer Journal, 39: 1311-1317, 2003
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- Probing the behaviour of ultra thin Co layers on clean and hydrogen terminated Si(001) and Si(111) surfaces**
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Surface Science, 532/535: 639-644, 2003
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Physical Review B 67: 165414, 2003 (online)
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- Computer simulations of the Stranski-Krastanov growth of heteroepitaxial films with elastic anisotropy**
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- High quality AlGaInP epilayers grown by MOCVD using TBP for red lasers**
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Journal of Crystal Growth, 253: 161-166, 2003
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Applied Physics Letters, 82(25): 4540-4542, 2003
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- Quartz crystal microbalance and surface plasma resonance devices for biological analysis**
 XD Su, G Stengel, W Knoll
International Symposium on Sensors Science, June, 2003 Paris, France
 For further information, contact: xd-su@imre.a-star.edu.sg
- Growth and characterisation of nano-scale wire from a series of conjugated oligomers**
 JM Xu, HY Lim, CZ Zhou, ZK Chen, TS Chung
Molecular Crystal Engineering - A EuroConference on Design and Preparation of Molecular Materials
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- Protein micropatterning on polymeric substrates and the influence on neuron growth**
 B Li, YX Ma, S Wang, PM Moran
European Research Conference on Biological Surfaces and Interfaces, Italy, 2003
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- Organic-acid-based chemical polishing solutions for Fe alloys**
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Materials Science Forum, 437-438: 333-336, 2003
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- Thin-film polymerisation and characterisation of Sumitomo's SumikasuperA-type liquid crystalline polymers**
 Y Wang, JM Xu, SX Cheng, KP Pramoda, TS Chung, SH Goh
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Journal of the American Chemical Society, 125(28): 8589-8594, 2003
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