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OVERVIEW
Institute Of Microengineering & Nanotechnology
The Department of Electrical, Electronics and Systems Engineering of UKM started microelectronics research activities in 1988. The activities were on small-scale and focused on IC design, simple device (such as Schottky diode) fabrication and theory modeling. Prof. Syono from Sophia University, Tokyo played a major role in the construction and development of the first microelectronics laboratory/cleanroom. He gave many ideas for the layout of cleanroom and even donated a few equipment to jumpstart UKM’s initial research in microelectronics. The first oxide layer was successfully grown in this cleanroom in 1992 using the small furnace contributed by Prof. Syono. Research on organic electronics first started at the UKM Physics Department in 1987.

In 1993, Telekom Malaysia R&D Sdn. Bhd. (TMR&D) recognized the cleanroom and presented UKM a RM 1 million grant to upgrade the cleanroom into microelectronics research centre called UKM-TM Microfabrication Laboratory. All activities were centered on fabrication using silicon technology. The lab also contributed to TMR&D research outputs. UKM-TM Microfabrication Laboratory was expanded in December 1997 to accommodate a 1000 class cleanroom for III-V compound and microwave monolithic integrated circuits devices research. The upgraded lab with additional grant given was named UKM-TM Microelectronics Research Centre (MERC) under the UKM Faculty of Engineering and TMR&D Sdn. Bhd. At the time, MERC was the only research centre in Malaysia that accommodated semiconductor fabrication facilities for research studies.
The proposal to build a centre of excellence for strategic research on MEMS was first introduced in 2002 by the IRPA fund panel of Ministry of Science, Technology and Innovation (MOSTI) when MERC was given IRPA fund worth RM 38 million to conduct research on developing MEMS technology for automotive applications. The centre of excellence for MEMS research would serve as the nation’s resource of MEMS research in Malaysia and aims at putting Malaysia on the map in the research area. The director of MERC, Prof. Dr. Burhanuddin Yeop Majlis proposed to combine MEMS research team with MERC, Organic Electronics, VLSI technology, and Photonics Technology groups to solidify the multi-disciplinary centre of excellence.

The Ministry of Education Malaysia gave the approval to build Institute of Microengineering and Nanoelectronics (IMEN) in November 2002 as an institute of Universiti Kebangsaan Malaysia. IMEN would conduct research on MEMS technology primarily the IRPA project given, together with five other research themes which are organic electronics, micro and nanoelectronic systems, MBE technology for high frequency devices (collaboration with TMR&D) and photonics technology. The microelectronics devices packaging research group joined IMEN in 2007.
MEMS and Nanoelectronics
Organic and Printed Electronics
Photonics Technology and Nanophotonics
Microelectronics Packaging and Materials
MBE Technology and III-V Compound Semiconductor
Micro and Nanoelectronic Systems
Vision of IMEN

“To be a WORLD CLASS research institute in microengineering and nanoelectronics.”
**Mission of IMEN**

To develop and excel in research in advanced micro and nanoelectronics, MEMS and microsensor technology, organic electronics, photonics and VLSI technology so as to contribute to technological advancement of Malaysia. IMEN is the country’s leading centre of excellence for postgraduate studies and research on microengineering and nanoelectronics specifically in the following research themes:

- MEMS/NEMS and Nanoelectronics
- Photonics and Nanophotonics
- Organic and Printed Electronics
- Microelectronics Packaging
- Micro and Nanoelectronic Systems

Each theme comes with a set of scientific and technological challenges such as modeling and design, materials science, device engineering, characterization and packaging, and may be multidisciplinary.

The mission is realized through Masters of Science and PhD programs, well-equipped facilities and a continuous quest to innovate designs, devices, processes, circuits and systems which could involve multiple disciplines. IMEN aims to foster microengineering and nanoelectronics technologies advancement in Malaysia through providing intellectual resource and human capital equipped with relevant knowledge in this field.

**Objectives of IMEN**

01. To strengthen and enrich knowledge in micro and nanoelectronics, micro-electromechanical systems / nano-electromechanical systems (MEMS & NEMS), advanced devices, MEMS & nanotechnology systems, organic & printed electronics, advanced packaging technology, and photonics & nanophotonics through research and development activities.

02. To develop capacity building in micro and nanoelectronics, micro-electromechanical systems / nano-electromechanical systems (MEMS/NEMS), advanced devices, MEMS & nanotechnology systems, organic & printed electronics, advanced packaging technology, and photonics & nanophotonics.

03. To create local human resource in micro and nanoelectronics, micro-electromechanical systems / nano-electromechanical systems (MEMS/NEMS), advanced devices, MEMS & nanotechnology systems, organic & printed electronics, advanced packaging technology, and photonics & nanophotonics.

04. To promote public awareness of the contributions of microelectronics in developing the nation by organizing public lectures, seminars and outreach programs, and publications.

05. To strengthen national and international networks thus putting Malaysia in global perspective.
This Annual Report describes the research activities of the Institute of Microengineering and Nanoelectronics as well as its collaborations with academic institutions and industry during 2012.

2012 was a special year for the Institute in two respects. For one, it was the tenth anniversary of institute’s establishment back in November 2002. It was also a busy year as the institute had to organize three important events namely the annual workshops between IMEN-LIPI and IMEN-Inter-University Semiconductor Research Centre Korea respectively and an international conference jointly organized with Electron Devices Chapter, IEEE Malaysia Section. IMEN also moved into a new ‘house’ this year.

In July 2012, staff began the move into IMEN’s new office on the 4th floor at the new UKM Research Complex, with new purpose built laboratories. The new research complex building is built from the RM 10 million grant IMEN received from the Ministry of Higher Education as an incentive to enhance our research capabilities and strength in areas such as MEMS, lab-on-chip, biomimetics, nanoelectronics, microelectronics packaging and materials, and organic electronics since each group will have new bigger labs. The complex will be shared with several other UKM research institutes. However the MEMS microfabrication lab, MBE technology lab and photonics technology lab would remain at their original locations in the Faculty of Engineering and Built Environment since most equipment have been permanently placed.
students were privileged this year to be able to attend four technical lectures from three distinguished researchers. Prof. Dr. Akhlesh Lakhtakia, the Charles Godfrey Binder (Endowed) Professor of Engineering Science and Mechanics at the Pennsylvania State University, USA came to IMEN in January to deliver two very interesting lectures. The first one was on sculptured thin films and the second lecture was about surface multiplasmonics. We then invited him to be IMEN’s visiting professor at the institute later in September 2012. Prof Yoon Soon Fatt from Nanyang Technical University Singapore gave a lecture in February 2012 on the advanced technology of dilute nitride-antimonide semiconductor alloys for high speed micro and nanosystems. Then in May 2012, Prof. Jakub Kedzierski of Massachusetts Institute of Technology presented a lecture that took the audience on a memory trip of the journey from the classical bulk CMOS to metal-gate FinFETs. The lectures were very much enjoyed by the audience and many left with deeper appreciation of the knowledge imparted. We wish to bring more distinguished scientists to UKM to share their knowledge with us.

Seven persons graduated from the Institute with PhD in Microengineering and Nanoelectronincs and seven graduate students received their MSc degree. Their theses are huge contribution to the university’s research output and significant to the institute’s development as a NanoMalaysia centre of excellence. Currently IMEN has 55 PhD students and 16 Masters students. To date IMEN has produced 32 Masters students and 25 PhD students.

September was a very hectic month because three events were organized concurrently. The 12th IEEE International Conference on Semiconductor Electronics (IEEE-ICSE2012) was held from 19-21 September at the Grand Millennium Hotel Kuala Lumpur. The Malaysia-Korea Workshop on Nanotechnology took place on 20 September followed by the IMEN-LIPI Joint Seminar on the next day. The ICSE2012 conference was jointly organized with Electron Devices Chapter, IEEE Malaysia Section and Malaysia Nanotechnology Association. I am happy to note that all events went well. The workshops with our counterparts from SNU and KNU Korea and also from LIPI were successful in bringing us closer and valuable knowledge has been shared throughout our friendships since 2007.

I would like to thank all institute members, staff and students for their dedication and enthusiasm in their own work and all other activities of IMEN. May IMEN grow to become into what I have been envisioned for it at its conception in 2002: be a world class research institute in microengineering and nanoelectronics that contributes prominently to the university and nation in terms of knowledge, technological advancement and human capital.

PROF. DATO’ DR. BURHANUDDIN YEOP MAJLIS
Director
IMEN UKM
IMEN PRINCIPAL AND RESEARCH FELLOWS
1. **Prof. Dato’ Dr. Burhanuddin Yeop Majlis,**
Director & Theme Leader MEMS & NEMS Technology

2. **Assoc. Prof Dr. Azman Jalal@Jalil,**
Deputy Director & Theme Leader Microelectronic Packaging & Materials

3. **Prof. Dr. Muhamad Mat Salleh,**
Theme Leader Organic & Printed Electronics

4. **Prof. Dr. Shahbudin Shaari,**
Theme Leader Photonics & Nanophotonics

5. **Prof. Dr. Masuri Othman,**
Theme Leader Micro & Nanoelectronics System Design

6. **Prof. Emeritus Dato’ Dr. Muhammad Yahaya,**
Principal Fellow

7. **Prof. Dr. Pankaj K. Choudhury,**
Principal Fellow

8. **Prof. Dr. Ilse C. Gebeshuber,**
Principal Fellow

9. **Dr. Dee Chang Fu,**
Research Fellow

10. **Dr. Azrul Azlan Hamzah,**
Research Fellow

11. **Dr. Md. Shabiul Islam,**
Research Fellow

12. **Dr. Akrajas Ali Umar,**
Research Fellow

13. **Dr. Jumril Yunas,**
Research Fellow

14. **Dr. Badariah Bais,**
Research Fellow

15. **Dr. P. Susitha Menon,**
Research Fellow

16. **Abang Annuar Ehsan,**
Junior Fellow

17. **Abdul Rahman Mohmad,**
Junior Fellow

18. **Chin Shin Liang,**
Junior Fellow

19. **Dilla Duryha Berhanuddin,**
Junior Fellow
IMEN ADMIN/TECHNICAL & SUPPORT STAFF
Research Staffs

1. Mohamed Razman bin Yahya,
   (BSc., MSc.) – Research Officer TM R&D

2. Asban Dollah,
   BSc. (UM) – Research Officer TM R&D

3. Nurul Afzan Omar,
   Research Officer TM R&D

4. Samsiah Ahmad,
   BSc. (UKM) – Research Officer TM R&D

5. Idris Sabtu,
   BSc. MSc. (UKM) – Research Officer TM R&D

6. Mimiwaty Mohd Noor,
   BSc. MSc. (UKM) – Research Officer

7. Mohd Faizal Aziz,
   BSc. (UKM) – Science Officer

8. Hayati Husin,
   BSc. MSc. (UKM) – Science Officer

9. Khairul Nisha bt. Dato’ Mohd Kharuddin,
   BSc. MSc. (UKM) – Science Officer

10. Tengku Hasnan bin Tengku Abdul Aziz,
    BSc. MSc. (UKM) – Science Officer

11. Shafii bin Abd.Wahab, BSc
    (UPM) – Science Officer

12. Mohd. Hannas Hosnon,
    BEngg (Totori) – Engineer

13. Aisyah bin Fauthan,
    BEngg (Uniten) – Technician

14. Mohd. Azrin bin Omar,
    Technician

15. Mohd. Fazriq Md.Yunus,
    Technician

Admin Staffs

16. Muhammad Aizuddin Saharudin,
    BBA (Uniten) – Assistant Registrar

17. Jumaah binti Abdul Aziz,
    Secretary

18. Mohd. Fahmi bin Mohamad Mustafa,
    Admin. Assistant

19. Faeizah Buang, Admin,
    Assistant

20. Hazde Akmar bin Mohd Salleh,
    General Office Assistant
# 2012 Graduates

The following students successfully completed their studies in the past year:

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<thead>
<tr>
<th>Name of Graduate</th>
<th>Title of Thesis</th>
<th>Supervisor</th>
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<tbody>
<tr>
<td>Dr. Rosminazuin Ab. Rahim</td>
<td>Process Development for Piezoresistive Microcantilever Biosensor</td>
<td>Prof. Dato' Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Dr. Alireza Bahadorimehr</td>
<td>Magnetic Microparticle Separation in Lab on a Chip System for Biomolecule Detection Applications</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Dr. Husam Ahmed M. Elgomati</td>
<td>Optimization of Process Parameters for 32nm CMOS Device</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Dr. Hesham Abdullah A. Bakarman</td>
<td>Security Performance and Enhancement for Spectral Amplitude Coding Optical Code Division Multiple Access Networks</td>
<td>Prof. Dr. Sahbudin Shaari</td>
</tr>
<tr>
<td>Dr. Mohd Fared Abdul Khir</td>
<td>Sistem Perkongsian Kekunci Kuantum Berasaskan Protokol Dua Hala dan Kaedah Umpanan / Quantum Key Distribution System based on Two-Way Protocol and Decoy State</td>
<td>Prof. Dr. Sahbudin Shaari</td>
</tr>
<tr>
<td>Dr. Abang Annuar Ehsan</td>
<td>Rekabentuk dan Fabrikasi Pengganding Gentian Optik Plastik Jenis Cabang-Y dengan Nisbah Gandingan Boleh Ubah / Design and Fabrication of Y-branch Type Plastic Optical Fiber with Variable Coupling Ratio</td>
<td>Prof. Dr. Sahbudin Shaari</td>
</tr>
<tr>
<td>Dr. Zainudin Kornain</td>
<td>Process Development for Piezoresistive Microcantilever Biosensor</td>
<td>Assoc. Prof. Dr. Azman Jalar</td>
</tr>
<tr>
<td>Name of Graduate</td>
<td>Title of Thesis</td>
<td>Supervisor</td>
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<tr>
<td>Tina Rezaie Matin</td>
<td>Biomemetics of Nanostructures Concerning Structural Colours</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Mohd Nizam Abdullah</td>
<td>Kesan Kehadiran Gentian Kristal Fotonik ke atas Penjanaan Campuran Empat Gelombang / Effects of Photonics Crystal Fibers on Four Wave Mixing Constructions</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Sri Nengsih</td>
<td>Penderiaan Formalin menggunakan Filem Nipis Emas Nanopartikel / Formaline Sensing using Gold Nanoparticles Thin Film</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Aidhia Rahmi</td>
<td>Fabrikasi Sel Suria Menggunakan Hibrida Bahan Bintik Kuantum dan Organikr</td>
<td>Prof. Dr. Sahbudin Shaari</td>
</tr>
<tr>
<td>Liszulfah Roza</td>
<td>Effect of TiO2 Nanostructure Morphology on the Performance of Photoelectrochemical Cell</td>
<td>Prof. Dr. Sahbudin Shaari</td>
</tr>
<tr>
<td>Noor Elisurianie Salehudin</td>
<td>Kuantitatif Stereologi Terhadap Morfologi Kerapuhan dan Kemuluran bagi Aloi Aluminium</td>
<td>Prof. Dr. Sahbudin Shaari</td>
</tr>
<tr>
<td>Muhammad Faizol Ahmad Ibrahim</td>
<td>Mekanisma Pembentukan Keliangan Kimpalan Aluminium AA6063</td>
<td>Assoc. Prof. Dr. Azman Jalar</td>
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## IMEN Postgraduate Students

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<tr>
<th>Student Name</th>
<th>Title of Thesis</th>
<th>Supervisor</th>
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<tbody>
<tr>
<td>Juliana Johari</td>
<td>Micropump for bioMEMS application</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Mohd HS Al Rashdan</td>
<td>MEMS microgenerator</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Nadzril Sulaiman</td>
<td>MEMS micromagnetometer</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Gandi Sugandi</td>
<td>MEMS microfluidic mixer</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Jafar Alvankarian</td>
<td>MEMS shear stress sensor</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Norihan Abd Hamid</td>
<td>MEMS thermal octualas for pump</td>
<td>Prof. Madya Dr. Jumril Yusnas</td>
</tr>
<tr>
<td>Abrar Ismardi</td>
<td>Synthesis and characterization of Indium doped ZnO nanowires for gas sensing application</td>
<td>Prof. Madya Dr.Deep Chang Fu</td>
</tr>
<tr>
<td>Benyamin Davaji</td>
<td>BioMEMS for stem cell isolation</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Ummikalsom Binti Abidi</td>
<td>High gradient magnetic field device for bioparticles separator</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Mohammad Mahdi Vakilian</td>
<td>BioMEMS drug delivery system</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Student Name</td>
<td>Title of Thesis</td>
<td>Supervisor</td>
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</tr>
<tr>
<td>Tiong Teck Yaw</td>
<td>Development of nanowires based field-effect transistor for chemical &amp; biosensor application</td>
<td>Prof. Madya Dr. Dee Chang Fu</td>
</tr>
<tr>
<td>Norazreen binti Abd Aziz</td>
<td>Bioparticles separation in microfluidic using surface acoustic waves</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Marianah Binti Masrie</td>
<td>MEMS bioparticles detection with optical transducer for LOC applications</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Noraini Marsi</td>
<td>Silicon carbide</td>
<td>Prof. Madya Dr. Azrul Azlan Hamzah</td>
</tr>
<tr>
<td>Muhamad Ramdzan Bin Buyong</td>
<td>Dielectrophoretic biochip for biological particles characterization tool</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Mohammad Zayed Ahmed Abo al Keshek</td>
<td>MEMS</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Norani binti Atan</td>
<td>Optimization of CMOS 22nm</td>
<td>Prof. Dato’ Dr. Burhanuddin Yeop Majlis</td>
</tr>
<tr>
<td>Siti Zaleha binti Mat Diah</td>
<td>Applied biomimetic development of a new generation of MEMS for enhancing human sensory perception</td>
<td>Prof. Dr. Ille C. Gebeshuber</td>
</tr>
<tr>
<td>Salmah binti Karman</td>
<td>Biomimetic development of a new generation of MEMS in enhancing the human sensory system</td>
<td>Prof. Dr. Ille C. Gebeshuber</td>
</tr>
<tr>
<td>Muchlis Abdul Muthalib</td>
<td>Next generation optical network performance</td>
<td>Prof. Dr. Sahbudin Shaari</td>
</tr>
<tr>
<td>Student Name</td>
<td>Title of Thesis</td>
<td>Supervisor</td>
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<tr>
<td>Hazura Binti Haroon</td>
<td>Passive ring resonator as optical storage</td>
<td>Prof. Dr. Sahbudin Shaari</td>
</tr>
<tr>
<td>Mardiana Binti Bidin</td>
<td>Study on the effect of voltage and current on active microring</td>
<td>Prof. Dr. Sahbudin Shaari</td>
</tr>
<tr>
<td>Hanim Binti Abdul Razak</td>
<td>Current injection in optical Mach Zehnder optical modulator</td>
<td>Prof. Dr. Sahbudin Shaari</td>
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<tr>
<td>Isaac A. M. Ashour</td>
<td>Development of WDM and OCDMA hybrid optical network</td>
<td>Prof. Dr. Sahbudin Shaari</td>
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<tr>
<td>Ali Z. Ghazi Zahid</td>
<td>New algorithm for the security enhancements of biometric authentication recognition systems</td>
<td>Dr. Mandeep Singh</td>
</tr>
<tr>
<td>Affa Rozana Binti Abdul Rashid</td>
<td>Photoconductivity studies on ZnO/TiO2 nanocrystals</td>
<td>Prof. Dr. Sahbudin Shaari</td>
</tr>
<tr>
<td>Wan Maisarah Binti Mukhtar</td>
<td>Fabrication of low loss silica nanofiber using tapering technique</td>
<td>Prof. Dr. Sahbudin Shaari</td>
</tr>
<tr>
<td>Afifah Maheran binti Abdul Hamid</td>
<td>Study and modelling of High-k Material for gate of 22nm CMOS device</td>
<td>Dr. P. Susthitha Menon</td>
</tr>
<tr>
<td>Khadijah Binti Ismail</td>
<td>Performance analysis of full spectrum CWDM system amplification</td>
<td>Dr. P. Susthitha Menon</td>
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<tr>
<td>Mohd Nizam Bin Abdulla</td>
<td></td>
<td>Prof. Dr. Sahbudin Shaari</td>
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<tr>
<td>Student Name</td>
<td>Title of Thesis</td>
<td>Supervisor</td>
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<tr>
<td>Nurjuliana Juhari</td>
<td>Electromagnetic behaviour of complex optical structures</td>
<td>Prof. Dr. Sahbudin Shaari</td>
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<td>Muhammad Abuzar Baqir</td>
<td></td>
<td>Prof. Dr. Pankaj K. Choudhury</td>
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<tr>
<td>Masih Ghasemi Goorbandi</td>
<td>Investigation of the propagation of electromagnetic waves in complex optical micro/nano structures</td>
<td>Prof. Dr. Pankaj K. Choudhury</td>
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<tr>
<td>Marlia Morsin</td>
<td>Transistor organik</td>
<td>Prof. Dr. Muhamad Mat Salleh &amp; Prof. Madya Dr. Akrajas Ali Umar</td>
</tr>
<tr>
<td>Vivi Fauzia</td>
<td>Fabrikasi sel surya organik berasaskan bahan P3HT/PCBM</td>
<td>Prof. Dr. Muhamad Mat Salleh &amp; Prof. Madya Dr. Akrajas Ali Umar</td>
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<tr>
<td>Siti Salwa Zainal Abidin</td>
<td>Fabrikasi sel suria organik berasaskan bahan bio-organik</td>
<td>Prof. Dr. Muhamad Mat Salleh &amp; Prof. Madya Dr. Akrajas Ali Umar</td>
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<tr>
<td>Athar Ali Shah</td>
<td>Plasmonic organic solar cell</td>
<td>Prof. Dr. Muhamad Mat Salleh &amp; Prof. Madya Dr. Akrajas Ali Umar</td>
</tr>
<tr>
<td>Airul Azha Abdul Rahman</td>
<td>Nanostructures organic/composite materials for thermoelectric</td>
<td>Prof. Madya Dr. Akrajas Ali Umar &amp; Prof. Dr. Muhamad Mat Salleh</td>
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<td>Tengku Hasnan Tengku Abdul Aziz</td>
<td>BioLED</td>
<td>Prof. Dr. Muhamad Mat Salleh &amp; Dr. Akrajas Ali Umar</td>
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<tr>
<td>Norhayati Abu Bakar</td>
<td>Penderiaan infra merah gas organik menggunakan hibrida nanopartikel perak dan bahan biologi</td>
<td>Prof. Dr. Muhamad Mat Salleh &amp; Prof. Madya Dr. Akrajas Ali Umar</td>
</tr>
<tr>
<td>Student Name</td>
<td>Title of Thesis</td>
<td>Supervisor</td>
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<tr>
<td>Fuaida Harun</td>
<td>Experimental study towards establishing suitable gold wire wedge pull (2nd bond) failure modes for leadframe packages</td>
<td>Prof. Madya Dr. Azman Jalar</td>
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<td>Yazan Samir Kasim</td>
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<td>Assoc. Prof. Dr. Shabiul Islam</td>
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<td>Assoc. Prof. Dr. Shabiul Islam</td>
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<td>Hafzaliza Emry Binti Zainal Abidin</td>
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<td>Fakhrozi Che Ani</td>
<td>Kajian Ke Atas Sifat Bahan Dan Bendalir / Struktur Interaksi Campuran Metalurgi &amp; Pemasangan Tanpa Plumbum Dalam Proses Aliran Semula Ketuhar</td>
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Profile Of

PRINCIPLE FELLOWS
Institute Of Microengineering & Nanotechnology
Profile Of Principles Fellows

1. Prof. Dato’ Dr. Burhanuddin Yeop Majlis, D.P.M.P BSc. (UKM), MSc. (Wales), PhD. (Durham), J.M.N., SMIEEE, FMASS
   - MEMS/ NEMS technology
   - Microelectronics and microfabrication
   - MEMS microstructure and sensing devices,
   - RF MEMS and BIOMEMS
   - Lab-on Chip
   - MBE technology

2. Prof. Dr. Muhamad Mat Salleh BSc. (ITB), Drs (ITB), PhD. (London), MIEEE, FMISSS
   - Preparation and characterization of thin films for electronics devices, odor and gas sensors
   - Organic light emitting diodes (OLED)
   - Electrochromic windows
   - Solar cells
   - Langmuir-Blodgett films

3. Prof. Dr. Sahbudin Hj. Shaari
   - Nano photonics
   - Quantum electronics and lasers
   - Fibre optics and waveguides
   - Optical communications
   - Optical systems
   - Microelectronic devices
   - Optoelectronic devices

4. Prof. Dr. Masuri Ohman BSc. (UKM), MSc. (Essex), PhD. (Southampton), MIEEE
   - Design and implementation of integrated circuits for telecommunications
   - On-chip implementation of DSP algorithms
   - Development of smart microchips for MEMS interfacing
   - Application of VLSI in automotive

5. Prof. Emeritus Dato’ Dr. Muhammad Yahaya, BSc. (ITB), Drs (ITB), PhD. (Monash), MIEEE, FMISSS
   - Solid state physics energy, thin films and sensor technology
   - Nanomaterials
   - Solar cells
   - Energy

6. Assoc. Prof. Dr. Azman Jalar, BSc. (UKM), PhD. (Birmingham), MIEEE
   - Microstructure-properties-performance-relationship of materials
   - Nanomaterials
Dr. Ilse C. Gebeshube Privatdozentin,  
(Dr. habil.) PhD Dipl.-Ing.,  
Vienna University of Technology,  
Institut fuer Allgemeine Physik, Austria

- Biomimetics  
- Ion-surface-interaction: Sputtering, nanostructure formation, capillary guiding, etc  
- Fusion plasmas: fusion plasma diagnostics, plasmawall- interaction, ECR ion source development  
- Ultrafast lasers in physics: laser-matter-interaction, laser ablation, medical applications, two-photon-modification  
- Applications of ultra-short lasers in material science nanotechnology and nanotribology  
- Biophysics AFM-imaging of bacteria, blood and cancer cells  
- Scanning probe microscopy

Prof. Dr. Pankaj K. Choudhury,  
BSc. (India); M.Sc. (India); Ph.D. (India); SMIEEE, MOSA

- Optical waveguides of different cross-sectional geometries and/or materials  
- Complex mediums  
- Thin film optical waveguides fabrication and characterization  
- Optical sensors  
- Photonic crystals  
- Vertical cavity surface emitting lasers

Dr. Dee Chang Fu,  
BSc. (Malaya), MSc. (Malaya), PhD. (UKM)

- Nanowires and CNT  
- GaAs technology

Dr. Akrajas Ali Umar, (UKM)  
BSc. (UNRI), PhD. (UKM)

- Semiconductor nanocrystals  
- Metallic nanoparticles  
- Nanocrystal-organic hybrid synthesis for optoelectronic devices layout

Dr. Jumril Yunas
Dipl.-Ing (Univ. of Technology Aachen, Germany), PhD. (UKM)

- Micro and Nano Electro Mechanical Systems (MEMS/ NEMS) devices and technology  
- Micro-sensors, lab-on chip  
- RF (radio frequency) devices and power electronics devices  
- Optoelectronics devices

Dr. Md. Shabiul Islam
B.Sc. (RU), M.Sc. (RU), M.Sc. (UKM), PhD. (MMU)

- VLSI design  
- Microelectronics  
- DSP hardware Implementation on FPGA using VHDL/ DFL  
- FPGA realization based on Fuzzy Logic (FL) algorithm  
- Embedded system design and interfacing using Micro controller  
- Microprocessor/ micro controller system and interfacing

Dr. Badariah Bais
BSc., MSc. (Worcester Poly. Inst.), PhD (UKM), MIEEE, MSPIE

- Microelectronics  
- MEMS/ NEMS  
- Device fabrication  
- Process simulation

Dr. Azrul Azlan Hamzah
BSc. (California), PhD. (UKM)

- MEMS/NEMS and packaging  
- Microfabrication

Dr. P Susthitha Menon
BEngg., MSc., PhD. (UKM), MIEEE, MOSA, MSPIE

- Nanophotonics  
- Optoelectronics  
- III-V materials  
- Optical communications
RESEARCH THEMES
Institute Of Microengineering & Nanotechnology
BURHANUDDIN Yeop Majlis is a professor of microelectronics at the faculty of Engineering. He received his Ph.D. in microelectronics from University of Durham, United Kingdom in 1988, MSc in microelectronics from University of Wales, UK in 1980 and BSc(Hons.) in Physics from UKM in 1979. He was a Deputy Dean of Engineering faculty from 1995 until 1997. He is also a Research Fellow of Telekom Malaysia Research and Development division, and he was the director of UKM-TM Microelectronics Research Centre at the Faculty of Engineering, UKM. He was responsible in developing and planning the setting up of the clean room for research at UKM. He had attended intensive industrial training in GaAs MMIC design and manufacture at GECMarconi Material Technology Ltd. United Kingdom. He is a senior member of the Institution of Electrical and Electronics Engineer (IEEE) and the Chairman of IEEE Electron Devices Malaysia Chapter from 1994 to 2006. He is also fellow of Malaysian Solid State Science and Technology (FMSSS). He is the founder chairman of Malaysia Nanotechnology Association which is established in 2007. He initiated research in microfabrication and microsensors at UKM in 1995 and has also initiated research in GaAs technology with Telekom Malaysia. In 2001 he stared research in MEMS with substantial research funding of US$10 million from Ministry of Science, Technology and Innovation. His current interests are design and fabrication of MEMS sensor, RF MEMS, BiOMEMS and microenergy. He has published four text books in electronics and one book on integrated Circuits Fabrication Technology for undergraduate courses and more than 400 academic research papers. Currently he is the founder director of Institute of Microengineering and Nanoelectronics (IMEN).

Qualifications:
- BSc.(Hons) in Physics from Universiti Kebangsaan Malaysia (1979)
- MSc. in Microelectronics from University of Wales, UK (1980)
- PhD in Microelectronics from University of Durham, UK (1988)

Research Interests:
- MEMS sensors and actuators
- BioMEMS/ RF MEMS
- Energy harvesting micro/ nanodevices
- MBE technology and III-V compound device fabrication and development
MEMS is a system that integrates mechanical, sensor, actuator and electronic elements on one silicon chip through microfabrication technologies. The field of MEMS encompasses devices created with micromachining technologies originally developed to produce integrated circuits, as well as non-silicon based devices created by the same micromachining or other techniques. They can be classified as sensors, actuators and passive structures. Sensors and actuators are transducers that convert one physical quantity to another, such as electromagnetic, mechanical, chemical, biological, optical or thermal phenomena. MEMS sensors commonly measure pressure, force, linear acceleration, rate of angular motion, torque, and flow. The sensing or actuation conversion can use a variety of methods. MEMS actuators provide the ability to manipulate physical parameters at the microscale, and can employ electrostatic, thermal, magnetic, piezoelectric, piezoresistive, and shape memory transformation methods. Passive MEMS structures such as micronozzles are used in atomizers, medical inhalers, fluid spray systems, fuel injection, and ink jet printers. MEMS group at IMEN develops miniature sensor and actuator systems using Micro fabrication. IMEN also conducts research in MEMS wafer level packaging, RF MEMS, BioMEMS and biometrics extraction. Research in these areas is motivated by the potential to produce high performance, low-cost, miniature sensors and actuators for automotive, telecommunications and biomedical applications. The output of this project will be commercialized products, knowledge for academia and skilled labors in this area.

Research Projects

- RF MEMS and RFIC
- MEMS Micro-pumps, Micro-valves and Micro-needles
- MEMS Loudspeakers and capacitive microphones
- MEMS Glucose Sensor
- MEMS Microfluidics Mixers
- Biocell Filter, Separator and Detector
- MEMS Microgenerator
- MEMS Micro-inductors, Micro-transformer and Magnetometers (Magnetic Sensor)
- Nano Lab-on-Chip
- Nanotube and Nanowires
Members of MEMS and Nanoelectronics research group:

Prof. Dato’ Dr. Burhanuddin Yeop Majlis  
BSc. (UKM), MSc. (Wales), PhD. (Durham),  
J.M.N., SMIEEE, FMASS  
Research interests:  
• MEMS/NEMS devices  
• Lab on Chip  
Contact: burhan@eng.ukm.my  

Assoc. Prof. Dr. Dee Chang Fu  
BSc. (UM), MSc. (UM), PhD. (UKM)  
Research interests:  
• Nanostructures growth Si, ZnO, CuO and SnO2  
• Molecular Beam Epitaxy, Compound semiconductor,  
• GaAs, PHEMT, HEMT  
• Crystal growth simulation  
• Monte Carlo simulation of crystal growth  
Contact: cfdee@ukm.my, deechangfu@gmail.com  

Assoc. Prof. Dr. Jumril Yunas  
Dipl.-Ing (RWTH Aachen University, Germany),  
PhD. (UKM)  
Research interests:  
• III-V compound semiconductor technology  
• MEMS/NEMS devices and technology  
• Micro-sensors, RF devices, power electronics devices  
• Optoelectronic devices  
Contact: jumrilyunas@ukm.my  

Prof. Dr. Ille Christine Gebeshuber  
Privatdozentin (Dr. habil.) PhD Dipl.-Ing.,  
Vienna University of Technology, Institut fuer  
Allgemeine Physik, Austria  
Research interests:  
• Biomimetics  
• Scanning Probe Microscopy  
• Nanomedicine  
• Tribology  
Contact: ille.gebeshuber@ukm.my
HE received his PhD in Solid state Physics from University of London (1970), Drs. (1973) and B.Sc. (1972) in Physics from Institut Teknologi Bandung. He was the Head of Physics Department from 1986-1991. He has been a Visiting Professor at Tokyo Agriculture and Technology University in 1991. Visiting Researcher at Takasaki Radiation Chemistry Research Establishment from 1991-1992 and Visiting Researcher at Coventry University, UK in 1995. Current research interests include preparation and characterization of thin films for electronic devices, odor and gas sensor, organic light, Emitting diodes (OLEDs), electrochromic windows, solar cells, and Langmuir-Blodgett films. He has won several gold medals and other special awards for invention of sensor devices and OLEDs.

Qualifications:
• Drs in Physics from Institut Teknologi Bandung (1973)
• Ph.D in Solid State from University of London UK (1979)

Research Interests:
• Preparation and characterization of thin films for electronics devices, odor and gas sensors
• Organic light emitting diodes (OLED)
• Electrochromic windows
• Solar cells
• Langmuir-Blodgett films
Organic electronics is a field related to the study the properties of organic or polymeric materials utilized in active parts of electronic and opto-electronic devices. The subject also includes plastic electronics, bioelectronics, conducting polymer, organic semiconductors and nonlinear optical materials. Among the devices that can be fabricated using science and technology organic electronics are bio(chemical) sensors, pyroelectric sensors, solar cells, transistors and organic light emitting diodes (OLED). Research in this field at the Universiti Kebangsaan Malaysia (UKM) has begun since 1987. Until now, IMEN group has successfully fabricated a few devices prototype as such carbon monoxide gas sensor, optical electronic nose and OLED. Several sensor systems are being developed to test the potential of materials as sensor element. Because of the extremely wide scope of field of sensors, sensor manufacturing here will mainly focus on the use of sensors in automotive systems. Sensors related to safety and environmental control is also targeted.

The group focuses their research onto applications of organic thin films in electronic devices majoring in four areas namely OLED fabrication, sensor fabrication, quantum dot devices and the latest which is printed electronics. The group has collaborations with several universities in Indonesia such as Lembaga Ilmu Pengetahuan Indonesia (LIPI) and Gadjah Mada University. Indonesia in developing organic thin film devices.

Members of MEMS and Nanoelectronics research group:

Prof. Dr. Muhamad Mat Salleh
BSc. (ITB), Drs (ITB), PhD. (London), MIEEE, FMSSS
Research interests:
• Preparation and characterization of thin films for organic electronic devices, odor and gas sensors.
• Organic light emitting diodes (OLED)
• Electrochromic windows
• Solar cells
• Langmuir-Blodgett films
Contact: mms@ukm.my

Prof. Dr. Akrajjas Ali Umar
BSc. (UNRI, Indonesia), PhD. (UKM)
Research interests:
• Controlled-growth morphology, size and surface structures of metals, such as Au, Ag, Pt, Pd, Cu, Ni, Co, in order to obtain a desired physical and chemical properties, such as electrical, optical, optoelectronics and catalysis properties
• Growth of semiconductors quantum dots with designed physical and chemical properties for optoelectronics and sensors applications
• Quantum dots-organic hybrid for optoelectronics device
Contact: mms@ukm.my
Sahbudin Shaari is a Professor of Microelectronics in the Department of Electrical, Electronics and System Engineering at the Faculty of Engineering & Built Environment in Universiti Kebangsaan Malaysia (UKM) since 2002. He is also a Principal Research Fellow at the Institute of Microengineering and Nanoelectronics (IMEN), UKM and leader of the Photonics & Nanophotonics Research Group in UKM. He is also a Research Fellow at Telekom Malaysia Research and Development Division since 2007. Prof. Dr. Sahbudin graduated with a PhD degree in Microelectronics from the University of Wales in 1989. He obtained his MSc degree in the field of Quantum/ Optoelectronics from the University of Essex and his BSc degree in Physics/Electronics from UKM in 1980 and 1978 respectively. He is a member of the Institution of Electrical and Electronics Engineers (IEEE), Laser and Electrooptic Society (LEOS), Electron Devices Society (EDS), the International Society for Optical Engineering (SPIE), Optical Society of America (OSA) and Malaysia Solid State Science Society (MSSS). Prof Dr Sahbudin is the founder of the Photonics Technology Laboratory (PTL) in UKM and co-founder of the UKM-Telekom Micro-fabrication Laboratory. In 1997, his research group was selected to represent UKM as one of the five research group in Malaysia to be involved in the first national top-down photonics research project to undertake the project entitled “Development of an All-Optical Network System Based on WDM-FTTH Technology” to develop passive components for the proposed system. He has publications in 30 international journals and more than 100 international/national conference proceedings; all in the field of photonics. His current research interests are in nanophotonics, photonics technology and photonics communications.

Qualifications:
• BSc. in Physics from Universiti Kebangsaan Malaysia (1979)
• MSc. in Quantum Electronics from University of Essex, UK (1980)
• PhD in Microelectronics from University of Wales, UK (1989)

Research Interests:
• Nano photonics
• Quantum electronics and lasers
• Optical communications
• Microelectronic devices
• Optoelectronic devices
The laboratory is a research entity under the main umbrella of Microelectronics with support and cooperation from MOSTI and industries. The laboratory was selected as one of the National Photonics Research Laboratory involved in the first national top-down photonics research project called “Development of an All-Optical Network System based on WDM-FTTH Technology”. This lab’s role is to develop passive components for the proposed system with an allocation of a few RM million for the period from 2000-2003. Cooperation and linkages with the industries have further boosted our research activities to the frontiers of the subject. The research activities can be divided into a few major streams:

- Fiber optics fusion coupling technology to produce fiber-based components
- Waveguide components design technology
- Integrated components design technology
- Integrated optical receivers
- Optics; polymer technology

Members of Photonics Technology and Nanophotonics research group:

Prof. Dr. Sahbudin Shaari
BSc. (UKM), MSc. (Essex), PhD. (Wales), MIEEE, MMSSS

Research interests:
- Communication and optical systems
- Nanotechnology and nanophotonics
- Acoustics and optical optical physics, quantum electronics and lasers
- Fibre optics and wave guides
- Electro-optics and light modulations

Contact: sahbudin@eng.ukm.my

Prof. Dr. Pankaj K. Choudhury
BSc. (India); M.Sc. (India); Ph.D. in Physics (India)

Research interests:
- Optical waveguides of different cross-sectional geometries and/or materials
- Complex mediums
- Thin film optical waveguides fabrication and characterization
- Optical sensors
- Photonic crystals
- Vertical cavity surface emitting lasers

Contact: pankaj@ukm.my
Dr. Azman Jalar is an associate professor of metallurgy and materials from the Faculty of Science and Technology, Universiti Kebangsaan Malaysia. He received SmSn (BSc) in Materials Science from UKM and Ph.D degree in Metallurgyand Materials from the University of Birmingham, United Kingdom. He started his academic career as Tutor at UKM in 1995, then as Lecturer in 2001. He is the Head of Microelectronics Packaging and Materials (MIPAC) Research Group and the current Deputy Director of the Institute of Microengineering and Nanoelectronics (IMEN), UKM. His interest in microstructure-properties-performance motivates him to conduct research in electronic packaging. He also interested in electronic materials, nanomaterials, materialography and stereometry. He has significantly contributed to solving many industrial-related semiconductor packaging problems through industry-driven research activities. He has produced more than 200 publications in various referred journals and proceeding. He is a member of the Institution of Electrical and Electronics Engineer (IEEE), Malaysian Association of Solid State Science and Technology (MASS), Electro Microscopy Society of Malaysia (EMSM) and Akademi Sains Islam Malaysia (ASASI).

**Qualifications:**
- BSc. (Hons) in Materials Science from Universiti Kebangsaan Malaysia (1995)
- Ph.D in Metallurgy and Materials from University of Birmingham, UK (2001)

**Research Interests:**
- Microstructure-properties-performance-Relationship of materials
- Electornics Materials
- Materialography and stereometry
- Nanomaterials
The history for advanced semiconductor packaging research group started since year 2003 and was led by Assoc. Prof. Ibrahim Ahmad. The first project was Under Bump Metallurgy (UBM) which was the first collaboration between UKM and On Semiconductor Sdn. Bhd. It was funded by MOSTI with a grant value of more than RM 200,000. In 2004, research groups for semiconductor packaging in Malaysia have received an enormous research grant under RM-8 which is more than RM 26 million. There are several government institutions that involved in this research group which are Universiti Malaya, SIRIM Berhad and Universiti Kebangsaan Malaysia as the lead institution in bringing up all the activities under this research and development programme. RM 13 million out from the grand total research grant are being put under UKM. This includes with advanced equipment purchasing and salary for contract staff and graduate researcher and also consultation fees for the industrial expert. For now, all the researcher from UKM are trying to centralized the research activities by build up a new building in purpose for extra laboratory space, programme monitoring and graduate research assistant logistics. More than RM 7 million has been spent in purchasing the equipment and simulation software. All the purchased equipment and simulation software already being centralized under the laboratory. In early of year 2007, this group was recognized as Advanced Semiconductor Packaging (ASPAC) Research Group by Faculty of Engineering in UKM. This group already received more than RM30K research grant under research university budget in order to continue the research and development programme for advanced semiconductor packaging in UKM.

Research Projects

- Materials Characterisation
- IC Packaging
- Substrate and Bonding Technology
- Failure Analysis
- Package Reliability

Members of MIPAC research group:

Assoc. Prof. Dr. Azman Jalar
BSc. (UKM), PhD. (Birmingham), MIEEE

Contact: azmn@ukm.my
Masuri Othman received his BSc from UKM (1978), MSc from University of Essex, UK (1980) and PhD from University of Southampton, UK (1986) in Microelectronics. He became the Head of Electrics, Electronics and System Engineering Department, Faculty of Engineering from 1991-1992 and the deputy dean of the Engineering Faculty from 1998-2003. He was appointed as a professor in Microelectronics System Design in 1996. Masuri Othman was also the chairman of the national committee in Microelectronics which is part of the ASEAN bigger Microelectronics network and has represented Malaysia at many meetings in South East Asia. He has spent sabbatical at Intel in Penang, and attachment at several universities such as the University of East Anglia in England. He has published 3 books in the area of microelectronics and more than 100 papers in international journals and conference proceedings. Masuri Othman currently is on secondment (since Nov 2006) to MIMOS Berhad as the Chief Research Director for MEMS/NEM, Microenergy and Green Technology group. His research group at MIMOS has produced the world first integrated N,P,K and Moisture sensors that can revolutionize the applications of wireless Sensor Network in areas such as Agriculture and environmental monitoring. The research has won many awards such as Frost and Sullivan Awards in Precision agriculture in 2007, ITEX 2010 Gold medal awards for work in Microenergy and also Special Innovative awards at ITEX 2009 in Wireless Sensor Network. In 2002 he was awarded with the Pingat Ahli Mahkota Kedah by the Sultan of Kedah.

Qualifications:
- BSc. in Physics from Universiti Kebangsaan Malaysia (1978)
- MSc. in Optoelectronics from University of Essex, UK (1980)
- Ph.D in Microelectronics from University of Southampton, UK (1986)

Research Interests:
- Design and implementation of integrated circuits for telecommunications
- On-chip implementation of DSP algorithms
- Development of smart microchips for MEMS interfacing
- Application of VLSI in automotive
Most of the system design at IMEN involves VLSI with CMOS technology. We are now preparing ourselves to get into the submicron and nanometer system design technology where more components will be packed into a more and more tiny space of area. IMEN focus the research in this field on circuits to assist MEMS devices. The strength of the group is academicians in and outside of the faculty and a team of more than a dozen of research postgraduate students (MSc/PhD).

**Research Projects**

- Architectural exploration of arithmetic units for DSP & Multimedia
- The development of a Digital Signal Controller – an Enhanced 8051 with DSP capability
- VLSI implementation of high speed FFT processor for UWB Multiband OFDM
- Pulse generation for UWB Sys. Circuit design MCML
- Pulse shaping filter design in UWB comm. sys. Using DA technique
- Design of built in self test diagnoses and repair for SRAMs
- On Chip Implementation of CIC Filter
- Low noise, single supply capacitive sensing amplifies to integrated MEMS sensor
- Comparison of adders for ACS block design of IEEE 802.15.3a UWB Viterbi decoder

**Members of Micro and Nanoelectronics Systems research group:**

**Prof. Dr. Sahbudin Shaari**  
BSc. (UKM), MSc. (Essex), PhD. (Wales), MIEEE, MMSSS  

**Research interests:**

- VLSI design
- Energy harvesting for ultra-low-power (ULP) electronics devices
- Microelectronics
- DSP Hardware Implementation on FPGA using VHDL/Verilog/DFL language
- FPGA realization based on Fuzzy Logic (FL) algorithm  
  Embedded system design and interfacing using microcontroller

**Contact:** shabiul@ukm.my
Gallium arsenide [GaAs] is a compound of two elements, gallium and arsenic. This semiconductor is used to make devices such as microwave frequency integrated circuits, infrared light emitting diodes, laser diodes and solar cells. GaAs has some electronics properties which are superior to silicon’s. It has a higher saturated velocity and higher electron mobility, allowing it to function at frequencies in excess of 250 GHz. Also, GaAs devices generate less noise than silicon devices when operated at high frequencies. They can also be operated at higher power levels than silicon device because they have higher breakdown voltages. These properties recommend GaAs circuitry in mobile phones, WLAN, satellite communications, microwave point-to-point links and some radar systems. It is used in the manufacture of Gunn diodes for generation of microwaves.

For this research theme, the group focuses on the development of growth technologies for compound semiconductor materials using molecular beam epitaxy (MBE) and fabrication technologies of high speed devices. Other important activities include investigation of properties and physics of new advanced materials. Collaboration with Telekom Research and Development (TMR&D) in III-V compound semiconductor research has been in progress since 1997. High speed devices such as high electron mobility transistor (HEMT), pseudomorphic HEMT (PHEMT), metamorphic HEMT (MHEMT) and VCSELs are studied especially about the structure of devices and characteristics of epitaxial layers. In advance, tailoring to future needs of green communication technology. Future research studies planned include development of high efficiency PV cells and high speed photodetectors heterostructure materials.

Research Projects

• Epitaxial growth of MHEMT layer using Molecular Beam Epitaxy
• Epitaxial growth of GINA structure for VCSEL

Contact :

Mr. Mohamed Razman Yahya,
Telekom R & D Sdn. Bhd
Email : razman@tmrnd.com.my

Mr. Nurul Afzan bin Omar,
Telekom R & D Sdn. Bhd
Email : afzan@tmrnd.com.my
# Research Grants 2012

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<td>Investigation of Localized Plasmonic Effect on The Light Energy Conversion Efficiency of Quantum Dots Organics Hybrid Photovoltage</td>
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<td>Green Organic Solar Cells based on Water Soluble Polystyrene and Nanocrystalline Zinc Oxide Prepared by Inkjet Printing Technique</td>
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<td>Surface-Enhanced Raman Scattering Effect of Triangular Gold Nanostructures as Ultra Sensitive Sensor to Detect Bisphenol A</td>
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<td>A new method to combine topology generation and circuit sizing for Analog Integrated Circuit Design</td>
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<td>A novel Algorithm to Combine Analytical Model with Genetic Algorithm Based Optimization for Analog Integrated Circuit Design</td>
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<td>A System on Chip (SoC) Design of High Performance Direct Digital Frequency Synthesizer</td>
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**INTERNAL FUNDING 2003-2012**

![Bar Chart of Internal Funding 2003-2012](chart.png)
Microfluidic systems have become increasingly well-known in different fields of studies. In recent years, research and development on lab-on-a-chip (LOC) and micro total analysis systems (μ-TAS) have been rapidly growing. Microfluidic devices are becoming one of the most dynamic parts of BioMEMS technology. The main applications of microfluidics are medical diagnostics, genetic sequencing, chemistry, drug delivery, and proteomics. Bioseparation techniques that are widely used in biotechnology become more difficult as the quantity of the materials to be purified are very small, especially, in biological cell separation from suspensions with high fragility and aggregation possibilities. The use of magnetic field for separation of small magnetic particles is a well-known technique in biology. The magnetic fields can manipulate biological cells tagged by magnetic particles that are suspended inside the microfluidic system. One of the most important strengths of this technique is that it provides probably the most convenient and rapid method in separating desired particles from diluted solutions because magnetic fields are transparent to the cells and leave them without any damage. In biology, separation of specific target protein from a biological sample is very important in order to detect small amounts of antigens and biomolecules. For this purpose magnetic micro-particles have been used to separate and manipulate biomolecules. In this method magnetic beads are attached to target cells using specific ligands.

This work describes a microfluidic device that can separate magnetic particles from suspended liquid by activating a planar microcoil in order to generate magnetic force on micro magnetic particles. Injection of magnetic beads and ferrofluids through the inlet channel transfers them to the main chamber in which magnetic field is applied.

The magnetic field generated by the planar spiral coil instead of using permanent magnet yields several advantages in design flexibility and compactness. The fabrication of the microelectromagnet coil is based on a microscale winding process combined with nickel electroplating as a magnetic core to enhance the forces on magnetic particles at separation chamber. Two thin layers of polydimethylsiloxane (PDMS) and SU-8 are used to decrease the distance between microcoil and microchannel. Electromagnetic and thermoelectric simulation is performed in order to calculate the magnetic field and temperature distribution in the system. The bead capturing behavior is demonstrated in the chamber using three types of magnetic particles with 200 nm, 750 nm and 2.8 μm diameters. The experimental results show optimum capturing efficiency with dc current of 1 A passing through the microcoil. At this current, maximum magnetic flux density of 0.022 Tesla is achieved in the fluid microchannel, and the magnetic microparticles in buffer solution moved toward the bottom of the fluidic chamber where the coil is located. The maximum magnetic flux density gradient of 110 (T/m) is obtained at the center of the microchamber. When the dc current is removed the particles release easily. The described microelectromagnetic part for the first time features the ability to separate from the microfluidic part in order to use in other fluidic designs.
The field of microfluidic devices with biomedical applications is growing up very fast. This type of systems offers advantages over macro-scale devices in terms of: low reagent and sample usage, short analysis time, high degree of automation/integration, and portability. There is a wide range of applications in biochemical, disease detection, and point-of-care analysis to name a few. The variety of physiochemical properties and low cost fabrication techniques has diverted the attentions of the researchers from silicon-based to polymeric substrates for microfluidic device fabrication. The isolation of white blood cells from other components of the human fresh blood is very important for assays such as genomic DNA extraction. The size-based mechanical filtration using regularly spaced micro-pores have high throughput separation capacity compared to others. A planar microfluidic device is designed for pillar-based separation of white cells from other components of the blood. Dimensions of the PUMA channels and the pillars are sized to withstand fluidic pressures. Numerical simulation of fluidic flows at different rates is performed for determining the pressure loss and efficient flow rates of separation. For rapid prototyping of the microfluidic device, a UV-curing elastomeric Polyurethane Methacrylate (PUMA) is introduced and characterized. Swelling and solubility of PUMA in different chemicals is determined. Time-dependent measurements of water contact angle shows that the native PUMA is hydrophilic without surface treatment. Current monitoring method is used for measurement of the electro-osmotic flow mobility in the microchannels made from PUMA. Optical, physical, thermal and mechanical properties of PUMA are evaluated. UV-lithography and molding process is used for making micropillars and deep channel microfluidic structures integrated to the supporting base layer. A device is fabricated and tested for examining strength of different bonding techniques such as conformal, corona treating and semi-curing of two PUMA layers in microfluidic application and the results show that the bonding strengths are comparable to PDMS. The 2-layer blood filtration device is fully made of elastomeric polyurethane methacrylate. Soft lithography is employed by casting PUMA using a PDMS mold replicated from deep reactive etched silicon master. The device was connected to the syringe pumps and fluorescent microspheres solution was injected at different flow rates. Images of introduced fluorescent microspheres are used for visualization of the separation phenomenon. The whole blood was introduced to the device and components of the blood that leave the filter were collected. Characterization of the device was performed for ruling out the efficiency and optimum separation throughput at various injection flow rates. Overall, the process time and efficiency of the employed techniques in separation show a substantial improvement compared to the traditional laboratory and other available microfluidic methods.

Abang Annuar Ehsan
Norhayati Abu Bakar
Shaharia Bhuyan
Nubli /Hafiz
IMEN TOTAL STUDENTS

TOTAL IMEN GRADUATE STUDENTS

Number Of Students

Years

0 1 2 3 4 5 6 7 8

2007 2008 2009 2010 2011

Colour Indicator

- Malaysia
- Indonesia
- Jordan
- Iran
- Libya
- Iraq
- UAE
- Bangladesh

Master
PhD
IMEN’s administration office, OPEL lab and Micro and Nanosystems lab officially moved into Level 4 of the newly completed UKM Research Complex in February 2012. However, the MEMS microfabrication, MBE technology, photonics technology and MIPAC labs remain at their original locations in the Faculty of Engineering and Built Environment. In future all IMEN labs shall be moved into the new research complex.
IMEN together with Electron Devices Society of IEEE Malaysia Section organized the 10th IEEE International Conference on Semiconductor Electronics (IEEE-ICSE2012), from September 21-23 at the Grand Millennium Hotel Kuala Lumpur. The biannual conference was chaired by the Director of IMEN. Over 150 papers on topics related to micro and nanoelectronics, advanced materials and technology were presented.

The plenary speakers were:

Prof. Dr. Yoon Soon Fatt from Nanyang Technological University, Singapore on Thermal effects in InAs/GaAs quantum dot vertical cavity surface emitting lasers

Prof. Dr. Nico de Rooij from Swiss Federal Institute of Technology, Lausanne (EPFL) on Product innovation enabled by MEMS

Prof. Dr. Edward Yi Chang from National Chiao Tung University, Taiwan on InAs HEMT for terahertz applications

Prof. Dr. Ooi Boon Siew from KAUST, Saudi Arabia on Broadband semiconductor lasers and their applications

Prof. Dr. Akhlesh Lakhtakia from Pennsylvania State University, USA on Nanotechnology and metamaterials: Conceptualization and intersection for new opportunities
2012 IEEE International Conference on Semiconductor Electronics (IEEE-ICSE2012)
The 6th Malaysia-Korea Joint Workshop on Nanotechnology and The 6th LIPI-IMEN Joint Seminar were held at the same venue with the conference. The 6th Malaysia-Korea Joint Workshop on Nanotechnology was held on 22 September 2013 while the 6th LIPI-IMEN Joint Seminar was held on the next day. Both workshops were dynamic with participants sharing their research activities and knowledge on their fields. The series of workshop shall be continued in 2013 at Korea and Indonesia respectively.
The 6th Malaysia-Korea Joint Workshop on Nanotechnology and The 6th LIPI-IMEN Joint Seminar
Syarahan Teknikal IMEN oleh Prof. Jakub Kedzierski of MIT, US
Majlis Sambutan Tahun Sains dan Gerakan Inovasi Nasional 2012 Peringkat UKM
Public Lecture by Prof. Dr. Yoon Soon Fatt
Kejohanan Fustal Empat Penjuru
Piala Dato’ Burhanuddin Yeop Majlis
1 Material Deposition
- LPCVD Oxidation Three stack Furnace (KoyoLab)
- Plasma Enhanced Chemical Vapour Deposition (PECVD)
- E-Beam Evaporation (Edwards Auto 306 Turbo)
- Metal evaporator (Med 0 I O Balzers)
- Sputter Coater (Baltec SCD-005)
- Oxidation Furnace
- DORF Sputtering System (NTI Nanofilm)

2 Etching
- ICP PlasmaLab System I 00 (Deep RIE)
- Electrochemical Etch System (MEMS Potentiostat SC)
- Plasma Enhanced Chemical Vapour Deposition (RIE)

3 Photolithography
- Karl-Suss MJB Mask Aligner (Karl Suss)
- Double Side Mask Aligner
- Ceramic Hotplate (Fischer Scientific)
- Coating Dispensing System-resist spinner (Spin Coater P6700)
- Resist Spin Coater (Mikasa SpinCoaster I H-D3)
- Thermolyne Hotplate (Thermolyne)
- Programmable Spin Coater
- DWL 66 Laser Write (Heidelberg DWL)

4 Simulation Softwares
- Intellisuite : MEMS simulation
- Coventor: MEMS simulation

5 Characterization
- Fourier Transform Infrared (FTIR) (FTS 3000MX)
- Philips XL30 Scanning Electron Microscope (Philips XL 30 Series)
- VEECO surface profiler (WYKO NT I I 00)
- Leica Material Workstation (Leica DMLA)
- S.Thickness Mapping System (Filmetrics FS0-2000)
- DACTRON shaker
- Probe station (Micromanipulator)
- PZTTesting
- Ellipsometer (Melles Griot 05-LHP-321)
- SECA Microscope
- Oscilloscope, Le Croy
- TENCOR surface profiler
- Impedence Analyzer Agilent -HP4284 A
- Microfluidic Fruige Pump
- Fluorescence Microscope

6 Other Machines/ Facilities
- Wire bonding system (Kulicke & soffa 4500 Digital series)
- Wire Bonder
- Ultrasonic Cleaner (Brinson 1200)
- Ozone cleaner (UVO cleaner 144AX-220)
- S.Wafer scriber (Karl Suss)
- General purpose oven
- DI water system
- Portable Liquid N2 tank
- Chemical freezer
- Wet station
- Eye wash station
- Fumehood I Wetbench
1. **Deposition**
   - E-GUN Evaporator
   - Electron Beam Evaporator
   - Dip Coater
   - Spin Coater
   - Langmuir-Blodgett

2. **Characterization Equipment**
   - Photo Luminescence Spectrometer
   - Fluorescent & Luminance Measurement
   - Current-Voltage Measurement
   - Color Measurement
   - Elipsometer
   - Scanning Probe Microscopy

3. **Other Machines/Facilities**
   - Acoustic Gas Sensor System
   - Array Gas Sensor System
   - Electrochromic Sensor System
   - Humidity Sensor System
   - Piezoelectric Pressure Sensor System
   - Pyroelectric Thermal Sensor System
   - Bolometer Sensor System
   - Electric Sensor System
   - Thermal Sensor System
   - Glove Box System
   - Helium HC70 Compressor Unit
   - Tape Bonding
1. **Optical Network**
   - FTTH testbed complete with ONUs and OLTs (24 users)
   - CATV video system overlay on FTTH
   - CWDM access network testbed
   - OCDMA transmission network testbed

2. **Film Deposition**
   - Oxidation/Diffusion Furnace
   - Digital spin coaters, programmable hotplates
   - UV curing and convection oven system

3. **Optical Fiber Station**
   - Optical time domain reflectometers (OTDRs)
   - Optical fused fiber coupler machine
   - Optical fiber splices, cleavers, stripper, etc
   - Fiber Optic testers

4. **Design and Simulation Software**
   - OptiBPM for PLC devices (Optiwave Inc)
   - OptiSystem for optical networks (Optiwave Inc)

5. **Characterization, Text and Measurement**
   - Prism Coupler Station
   - Fiber/Fiber array/Waveguide Alignment with viewing system
   - Angle/controlled waveguide polisher
   - Laser and broadband sources
   - Optical power and energy meters
   - Photodetectors
   - Tunable laser sources (TLS)
   - Optical Spectrum Analyzer (OSA) with channel selector
   - Current sources with temperature controller
   - Variable optical attenuator, polarizers and couplers
   - Lock-in amplifiers
   - High-speed oscilloscope
   - RF spectrum analyzer
   - Optical modulators
   - Laser diodes for optical pumps
LABORATORY MICROELECTRONICS PACKAGING & MATERIALS

1. Equipments
   - Universal Testing Machine 5564 (Instron)
   - Dynamic Microtesting Machine 5848 (Instron)
   - CT Scan X-Ray Imaging System Hmxct-160xi (Xtek)
   - Infinite Focus Profilometer (Aicona)
   - Nano Indenter (MicroMaterials)
   - Metallography Microsectioning (Buehler)
   - Thermal Cycle Chamber (Tps)

2. Software
   - Abaqus
   - Ansy

LABORATORY MICRO AND NANOELECTRONIC SYSTEMS

1. Characterization
   - Logic Analyzer
   - Oscilloscope
   - Data Generator
   - Function Generator

2. Board
   - Vertex-2 FG456 Proto Board
   - XC3s 400K
   - DSP Development Board
   - University Program UP2 Education board
   - Altera FPGA Board

3. Software
   - ISE 6.2 Xilinx Project Navigator
   - Modelsim Xilinx 6 edition II (MXE-1 I) VS.7g
   - Design Analyzer/ Design Compiler synthesis tool
   - SPW signal Processing worksystem
   - Assura Verification
   - Virtuoso layout editor
   - Spectre circuit simulation
Characterization

- Molecular Beam Epitaxy (MBE)
- Hall Effect System
- Surface Profiler
- ECV Profiler


Nguyen, H.-Q., Chang, E.Y., Yu, H.-W., Trinh, H.-D., Dee, C.-F., Wong, Y.-Y., Hsu, C.-H., Tran, B.-T. & Chung, C.-C. 2012. Threading dislocation blocking in metamorphic InGaAs/GaAs for growing high-quality In0.5Ga0.5As and In0.3Ga0.7As on GaAs substrate by using metal organic chemical vapor deposition. Applied Physics Express 5(5): art. no. 055503 (ISI, SCOPUS)


MEMS & Nanoelectronics

Articles in ISI WoS/SCOPUS INDEXED PROCEEDINGS


Articles in ISI WoS/SCOPUS Indexed Proceedings


P. K. Choudhury & W. K. Soon. 2012. Liquid crystal tapered optical fibers would be more efficient to obtain evanescent field. Proc. 2012 the 9th International Conference on Electrical Engineering/ Electronics, Computer, Telecommunications and Information Technology (ECTI-CON 2012), art. no. 6254139 (Scopus)


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Articles in ISI WoS/SCOPUS Indexed Journals


Articles in ISI WoS/SCOPUS Indexed Proceedings


Yap, C.C., Bakar, A.A., Yahaya, M. & Salleh, M.M. 2012. Growth of ZnO nanostructures at different reactant concentrations for inverted organic solar cell. Advanced Materials Research 545: 71-75 (Scopus)


Jumali, M.H.H., Mohamad, S.M., Awang, R., Yahaya, M., Said, M.R.M. & Salleh, M.M. 2012. Effect of annealing temperatures on formation of Na0.5Bi 0.5TiO3 and (Na0.5Bi0.5) 0.96Ba 0.04TiO3 ceramics prepared via sol gel method. Advanced Materials Research 501: 76-80 (Scopus)

ORGANIC AND PRINTED ELECTRONICS

Articles in ISI WoS/SCOPUS Indexed Proceedings


Ruziana Mohamed; Muhamad Mat Salleh & Muhammad Yahaya. 2012. Development of a piezoelectric chemical sensor using metalloporphyrins compounds as a coating material. Proceedings - 2012 IEEE 8th International Colloquium on Signal Processing and Its Applications (CSPA 2012), pp. 41-43 (Scopus)

MICROELECTRONICS SEMICONDUCTOR PACKAGING

Articles in ISI WoS/SCOPUS Indexed Journals


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STAY CONNECTED

+603-89118020  +603-89250439  imen@ukm.my

Institute of Microengineering and Nanoelectronics (IMEN)

Level 4, Research Complex
Universiti Kebangsaan Malaysia
43600 UKM-Bangi, Selangor, Malaysia