INTRODUCTION
The laboratory is a joint effort with the Department of Chemistry at the National University of Singapore (NUS). This synergy encourages enterprise from innovation, balances science exploration with technology development, and strengthens and widens the talent development infrastructure in A*STAR and NUS.

FOCUS
Molecular Catalysis
Research in this area covers the design, recycling and R&D of new energy-efficient sustainable catalysts for commercial chemicals, petroleum refining, bulk synthesis of polymers, drug synthesis, food processing, waste water treatment, and biomass reutilisation. Prof Tamio Hayashi (IMRE), a world leader in asymmetric catalytic chemistry heads the research in this area. He is joined by Dr Liu Xiaogang (IMRE/NUS), a rising star in functional nanomaterials research to develop heterogeneous chiral metal catalysts with high performance in asymmetric conjugate addition reactions. Other topics in molecular catalysis research includes magnetically equipped organocatalysts for generic drug synthesis led by A/Prof Lu Yixin of NUS.

Biocomposite Materials
This area focuses on the large-scale, low-cost production of bio-inspired functional materials for applications such as dry adhesives, surfaces with superhydrophobic or anti-reflective properties, tissue engineering and other clinical applications. Led by A/P Suresh Valiyaveettil (NUS) the team will explore insoluble cellulosic biomass and develop robust approaches to turn it into valuable biocomposite materials for industrial applications. The biocompatible and cost-effective features of the materials offer good market potential with relatively low investment.

Energy Materials
Research in this area is meant to develop new materials and device prototypes for energy harvesting (organic photovoltaic cells), energy storage (batteries, supercapacitors), and high energy efficiency (organic thin film transistor, organic light-emitting diodes, chromic materials for heat management). A good example is a newly developed electrochromic material that gives or blocks the passage of near-infrared light upon application of a small bias voltage. This material can be very useful for heat management in applications like car windows or windows of buildings in tropical areas. Other key efforts include developing new molecular systems that could self-assemble to form separated column nanostructures for high power conversion efficiency solar cells, and novel interfacing materials that enable efficient charge extraction and enhance interfacial stability in organic photovoltaics. Dr Xu Jianwei (IMRE) heads the research in this area, joined by Prof Loh Kian Ping (NUS), Assoc Prof Liu Bin (IMRE/NUS) and Dr Leong Wei Lin (IMRE).

Carbon Materials
This area involves the study of carbon-based nanostructured materials like graphene with emphasis on advanced fabrication for new functions in devices or large scale processing for in-pile production of high performance devices. The research will include processing of graphite to produce micron-sized functional graphene sheets that can be used as building blocks for the construction of superstructures via self-assembly fabrication. Jointly led by Prof Loh Kian Ping (NUS,) a leading scientist in graphene chemistry and Dr Low Hong Yee (IMRE), an expert in nanoimprint technology and with Dr Teng Jinghua (IMRE), Asst Prof Christian Albert Nijhuis (NUS), and Dr Cedric Troadec (IMRE), the team targets the production of graphene nanoplates of identical shape and size with in-plane dimension of a few micrometers for use in antibacterial application, or as building blocks for the construction of complex structures in advanced device fabrication. Studies on graphene-metal interface will also be conducted to create better performance devices.

Biocomposite Materials
Effective biocomposite membrane from cellulose for nano-hazard waste water treatment.

Energy Materials
Electric voltage induced redox reaction with clear and reversible color changes.

Carbon Materials
Highly reversible switching with significant change in the transmission to near-infrared light, i.e. the heat, making the material an excellent candidate for heat management related applications.

Flow sensing of single cell in full blood samples by graphene transistor in a microfluidic channel.
Selected Research Publications


Awards and Prizes
- Tamio Hayashi - 2012 Aldrich Lectureship at Scripps Research Institute, USA
- Liu Xiaogang - 2012 Chem Soc Rev Emerging Investigator Lectureship Award
- Loh Kian Ping - 2012 Outstanding Researcher Award
- Liu Bin - 2011 L’Oréal Singapore For Women in Science National Fellowships
- Low Hong Yee - 2010 L’Oréal Singapore For Women in Science National Fellowships

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