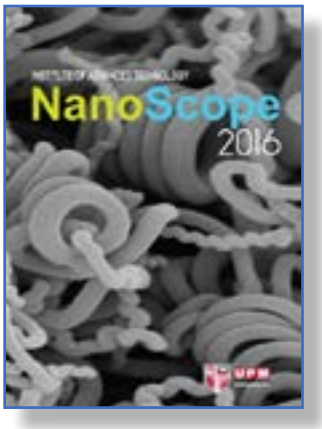
INSTITUTE OF ADVANCED TECHNOLOGY

NanoScope 2016

SAMPLE:
Spiral And Spring Pasta-Like Carbon Nanocoils (CNCs) by Fadzidah Bt Mohd Idris
(Institute of Advanced Technology).
1st Place Award
Mass Micrograph Award 2016

UPM
UNIVERSITI PUTRA MALAYSIA
BERILMU BERBAKTI



COVER:
Image obtained using Ultra High Resolution Scanning Electon Microscope (FESEM).

SAMPLE:
Spiral And Spring Pasta-Like Carbon Nanocoils (CNCs) by Fadzidah Bt Mohd Idris (Institute of Advanced Technology).

Publication Committee

Advisor
Assoc. Prof. Dr. Suraya Abdul Rashid

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News Unit
Intan Helina Hasan

Lab Report Unit
Rosnah Nawang

Photo Unit
Norliyana binti Mahat

Cameraman
Ab Haffiz Ab Jalil

CONTACT US

ITMA Publication Committee
Institute of Advanced Technology
Universiti Putra Malaysia
43400 UPM Serdang, Selangor

T : +603-8946 7834
E : itma@upm.edu.my
W: https://www.itma.upm.edu.my
Facebook : https://www.facebook.com/instituteofadvancedtechnology
Instagram : https://www.instagram.com/institutteknologimaju

EDITOR'S PREFACE

Alhamdulillah, all praises to Allah that with His blessings, Institute of Advanced Technology (ITMA) has successfully published Nanoscope 2016. On behalf of the Publication and Publicity Committee, I would like to extend my appreciation to all ITMA community for actively participating in contributions and providing feedbacks for Nanoscope 2016. Throughout the preparation of this magazine, many individuals from ITMA have taken time to help in various ways.

This magazine presents ITMA's achievements and activities throughout year 2016, as well as research highlights from ITMA researchers, with the objective to become a medium of promoting ITMA's research strengths in nanotechnology and advanced materials. ITMA will continue to commit in developing innovations in nanotechnology and advanced materials at every level and field of applications.

I hope that this magazine will serve its purpose of becoming a reference to experts who have studied or is working on nanotechnology and advanced materials, and also to those who wish to venture in new research related to these fields.

Nanotechnology research has many mysteries that can be explored and discovered, and with new findings we may help mankind to increase new knowledge in science. The more we understand science, the closer we get to understand more about life, evolution, and of course, our Creator.

"And if you would count Allah's favors, you will not be able to number them; most surely Allah is Forgiving, Merciful."
Al-Quran (Surah An-Nahl, 18).
(Surat an-Nahl, 18)

Warm Regards,

Marzieana Ab Rahman
Editor
marzieana@upm.edu.my

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DIRECTOR'S FOREWORD

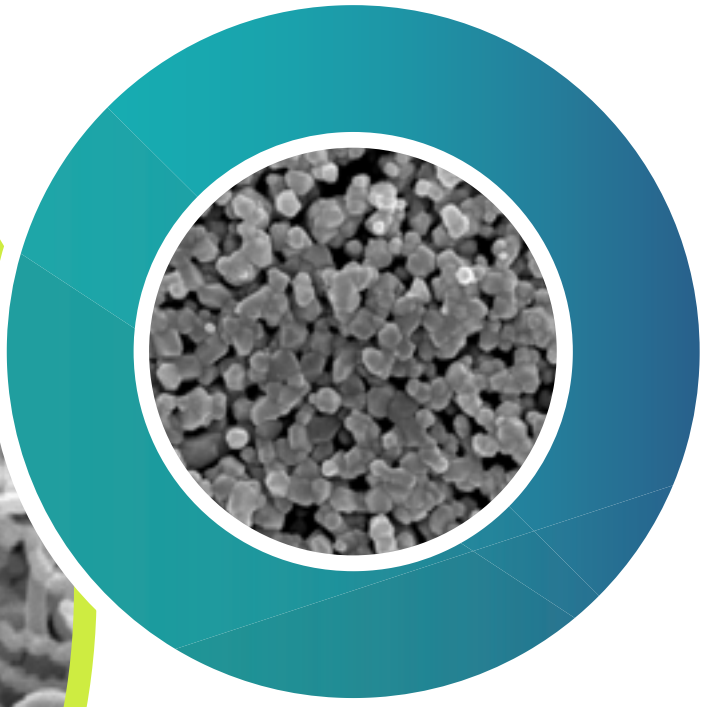
Prof. Dr. Nor Azah Yusof
Director
azahy@upm.edu.my

Alhamdulillah, all praises to Allah who eased the publication process of our institute's annual magazine, Nanoscope 2016. I would like to express my gratitude to the Publication and Publicity Committee for their contributions throughout the process of preparing this magazine. This magazine compiles all information on the activities and achievement of ITMA specifically in the field of nanotechnology and advanced materials.

The research activities in some niche areas currently conducted by the members of ITMA are hoped to lead to new discoveries of a great benefit to mankind in the near future. An example of such achievement is the success of a team of our researchers who have developed a new technique known as Nanotechnology for Encapsulation of Phase Change Material or NPCM. This technology could help in reducing temperature fluctuation in a building due to its property that can efficiently absorb, store and release thermal heat when the surrounding temperature is above or below melting temperature. Such properties are effective in reducing energy consumption - towards energy efficient green buildings.

I hope that ITMA community will continue their excellent work and dedication especially in developing innovations related to nanotechnology and advanced materials. I also would like to congratulate our researchers who have contributed substantially to the institute's output in terms of publications, post graduate students and patents.

I also hope that ITMA is always geared towards conducting research as well as providing the best service of high-tech facilities, not only for researchers and students, but also for industry and community involved in the related fields. Our aim is to give full cooperation to achieve our scientific goals in all aspects and fields of nanotechnology, and to be able to introduce them to our society in the future, Insyaa Allah.



ITMA

Institute of Advanced Technology

Institute of Advanced Technology (ITMA) is an interdisciplinary advanced research institute with an international reputation in the field of Advanced Materials and Nanotechnology. ITMA focuses on areas such as materials synthesis and characterization, materials processing and technology, and materials applications in sensors and functional devices. It supports over 50 researchers and fellows and over 100 post-graduate students.

In ITMA, we have four main laboratories including the Analytical Laboratory - all within close proximity to ITMA's distinguished technology facilities, giving our researchers direct access to our MS ISO/IEC 17025 accredited laboratory services while encouraging collaboration with industries. We make every effort to provide cutting-edge equipment to help our researchers to carry out research of the highest standard.

VISION

To become a research institute of international repute in the field of nanotechnology and advanced materials.

MISSION

To contribute significantly towards wealth creation, nation building and universal human development through high impact research in nanotechnology and advanced materials.

MISSION & STRATEGIES

1. Conduct interdisciplinary research and development in advanced materials and nanotechnology:
    - Establish world-class laboratories and acquire state-of-the art facilities.
    - Pool highly trained research personnel.
    - Create national and international linkages

2. Offer international postgraduate programs in niche areas:
    - Determine and develop niche areas
    - Facilitate entry of outstanding students through attractive scholarships
    - Establish good research culture

3. Disseminate knowledge and innovative technologies:
    - Publish in reputed journals
    - Maintain a global network
    - Involve in consultancy services

MAIN OBJECTIVES

1. To undertake, coordinate and lead interdisciplinary research and development in cutting-edge areas of advanced technology.

2. To offer postgraduate training programmes at the M.Sc. and Ph.D levels to local and international students.

3. To develop a center for dissemination of knowledge and innovative technology and network with universities, laboratories and industry globally.

TOP MANAGEMENT

Director

Prof. Dr. Nor Azah Yusof
azahy@upm.edu.my

Deputy Director

Assoc. Prof. Dr. Mohd Nizar Hamidon
mnh@upm.edu.my

Senior Assistant Registrar

Din bin Ayup
dinayup@upm.edu.my

Head of MSCL *(previous)*

Assoc. Prof. Dr. Khamirul Amin Matori
khamirul@upm.edu.my

Head of MSCL *(current)*

Assoc. Prof. Dr. Abdul Halim Abdullah
halim@upm.edu.my

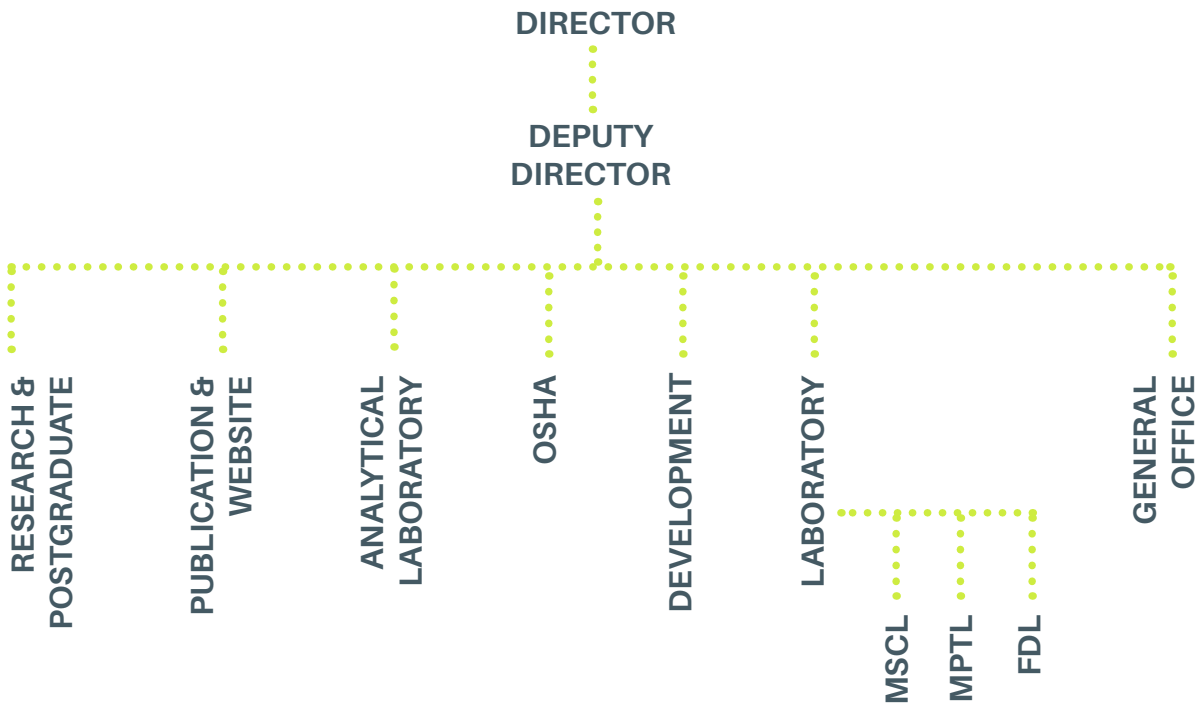
Head of MPTL

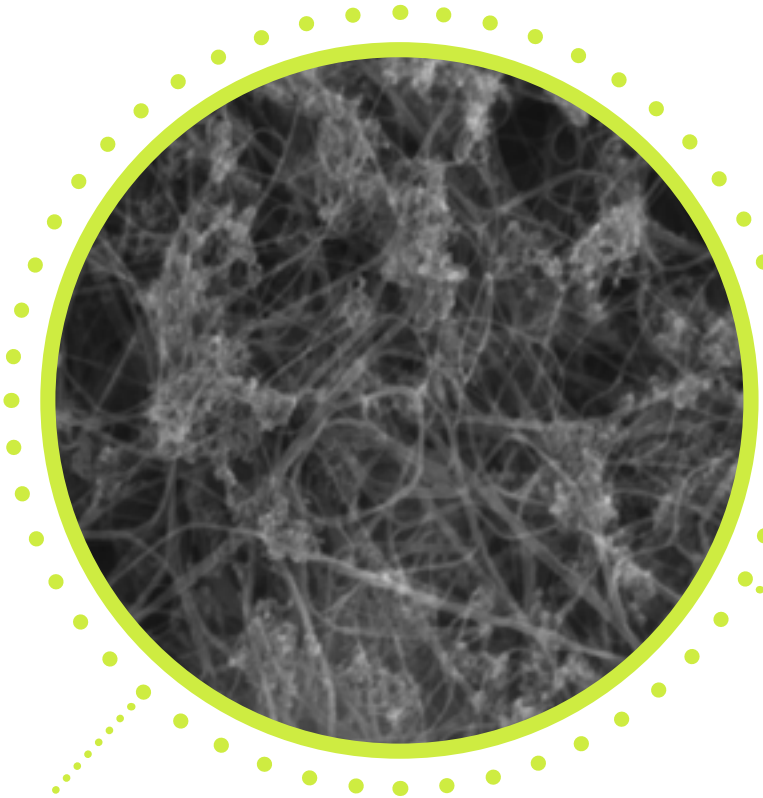
Assoc. Prof. Dr. Suraya Abdul Rashid
suraya_ar@upm.edu.my

Head of FDL

Assoc. Prof. Dr. Suhaidi bin Shafie
suhaidi@upm.edu.my

ORGANIZATIONAL STRUCTURE





RESEARCH GRANTS

The total revenue of ITMA's research funds in 2016 was MYR 1,952,786. Sources of funds were from Putra Grant (MYR266,200), FRGS (MYR620,000), PRGS (MYR127,000), Bank Rakyat (MYR743,361), Nano Malaysia Berhad(MYR200,000), Sharp Electronic Malaysia Sdn Bhd (MYR5000) as well as the international grants which were from Newton Fund amounting to RM MYR290,025. These funding sources were obtained to finance 16 projects led by ITMA.

NO.	GRANT	TYPE OF GRANT	AMOUNT (MYR)
1	GP-IPS	Public Grant	266,200
2	FRGS	Public Grant	620,000
3	PRGS	Public Grant	127,000
4	Nano Malaysia Berhad	Private Grant	200,000
5	Sharp Electronic Malaysia Sdn Bhd	Private Grant	5000.00
6	Newton Fund (Anglia Ruskin University Higher Education Corporation	International	(£14,000) RM71,987
7	Newton Fund (The University Of Manchester)	International	(£42,404) RM218,038
TOTAL AMOUNT			**1,209,425**

PUBLIC GRANTS MYR 714,400

PRIVATE GRANTS MYR205,000

INTERNATIONAL GRANTS MYR 290,025

Amount of Grants obtained in 2016.

PUBLICATIONS 2016

ITMA had exceeded our KPI of 63 journal publications, whereby 53 out of 105 journal papers were from Q1 journals.

Key Performance Indicator (KPI)	2016 Target	2016 Achievement
Citation	336	2100
Journals	63	63
Conference Proceedings	0	15
No. Publications in Q1 & Q2	37	53
Percentage of Publications in Q1 & Q2	60%	(53/63) x 100 = 84%
Publications in Other Journals	7	4

Key Performance Indicator (KPI) of Publications in 2016

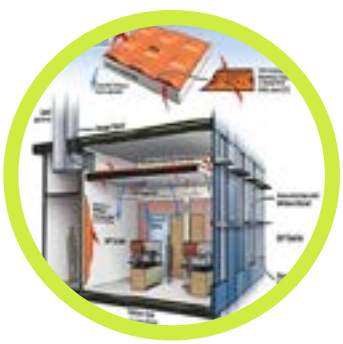
PATENTS 2016

Throughout 2016, five National patent applications were filed for the outstanding research carried out by ITMA researchers.

NO.	APPLICATION NO.	INVENTOR	PATENT NAME	COUNTRY
1	PI2016700749	Dr. Ismayadi Ismail	Method for Producing Carbon Nanotube Cotton	Malaysia
2	PI2016000958	Dr. Jaafar Abdullah	A Method for Preparing a Biosensor Probe for Uric Acid Detection and a Biosensor Probe the Same	Malaysia
3	PI2016703467	Assoc. Prof. Dr. Suraya Abdul Rashid	Preparation of Carbon Quantum Dots	Malaysia
4	PI 2016703916	Assoc. Prof. Dr. Mohd Nizar Hamidon	A Device And A Method For Detecting A Metallic Object In A Dielectric Material In Non-Destructive Test	Malaysia
5	PI2016702886	Dr. Ismayadi Ismail	Synthesis of Graphenated Carbon Nanotube and Graphenated Carbon nanotube Thereof	Malaysia

List of Patents filed throughout 2016.

Achievements



UPM researchers invent a new material based on nano technology to cool down building temperature

SERDANG, July 20, 2016 – A team of researchers from Institut Teknologi Maju (ITMA), Universiti Putra Malaysia (UPM) has succeeded in inventing a new material, based on nanotechnology for encapsulation of phase change material for the function of nanocapsule phase change material (NPCM) that can bring down room temperature in buildings, thus minimising the use of air-conditioning or heating systems, and saving electricity bill.

Head of research team, Prof. Dr. Mohd Zobir Hussein said the nano encapsulation technology could change material at nano-sized regime which is good for use as thermal energy storage media.

"This NPCM method is the first of its kind in Malaysia that can absorb, store and release thermal heat when the surrounding temperature where the material is located is above or below melting temperature".

"These properties allow the phase change material to store the thermal energy when it melts and releases the energy when it solidifies," he said.

"If it is used as passive or active building component, it can help in controlling the internal building temperature fluctuations which will result in thermal-comfort buildings".

"This will reduce the dependency of building occupants to air conditioning or heating systems and electricity consumption, which indirectly reducing carbon dioxide emission".

"NPCM" can be incorporated into cement or paint as active insulation materials and apply to the ceilings or walls of the buildings," he told a Press Conference during 2016 ITMA Innovation Day.

He also said "if it is incorporated into building components, it will not give any adverse effect to the structural integrity of the buildings".

Elaborating further, "he said a study showed that the surrounding temperature in Malaysia is getting increasingly hot, torrid and humid with heavy usage of air-conditioning system and this, indirectly had contributed to the increase in electricity consumption.

"In addition, most modern buildings are developed using light weight building material technology with low thermal inertia or low thermal mass".

"This causes the internal building to face large temperature fluctuations due to external heating or cooling load".

"The increasing demand for air-conditioning units will lead to further increase not only in electricity consumption but also cost of living," he said.

NPCM research which took about two years to be completed was carried out by four researchers, led by Prof. Dr Mohd Zobir. The other three researchers are Dr Tumirah Khadiran, Prof. Dr. Zulkarnain Zainal and Dr Rafeadah Rusli. The encapsulation technology is ready to be commercialized. – UPM.

PRPI2016 Award Winner

SERDANG, November 15, 2016 - A total of 9 participants from Institute of Advanced Technology (ITMA) were selected to participate in Pameran Penyelidikan & Inovasi (PRPI2016),
Universiti Putra Malaysia. The program was held in Dewan Besar PKKSSAAS, UPM.

ITMA won 4 gold, 4 silver and 1 bronze medals and also won two other categories, namely the Centre of Responsibility:
Excellence in Research and Best Journal 2015. Each award was handed over by the Honorable Prof Datin Paduka Dr. Aini Ideris, Deputy Vice-Chancellor of Universiti Putra Malaysia- UPM.

NO.	RESEARCHER	TITLE	MEDAL
1	Prof. Dr. Mohd Zobir Hussein	Smart gypsum composite boards with nano-encapsulated phase change material for thermal comfort building application	Gold
2	Prof. Dr. Mohd Zobir Hussein	Novel nanodelivery system of an anti-tuberculosis drug based on isoniazid	Gold
3	Dr. Ismayadi Ismail	Bio-based Carbon Nanotubes (CNTs) Cotton for Nanotechnological Applications	Gold
4	Prof. Madya Dr. Suraya Abdul Rashid	Photoluminescent Graphene Quantum Dots Derived from Biochar Via a Green Subcritical Hydrothermal Method	Gold
5	Dr. Reza Hajian	Portable Amoxicillin Sensor for Milk Sample Monitoring	Silver
6	Dr. Umer Rashid	Efficient Mesoporous Catalyst for Biodiesel Synthesis	Silver
7	Prof. Dr. Mohd Zobir Hussein	Novel nanodelivery system of an anti-cancer drug based on chlorogenic acid	Silver
8	Dr. Raba'ah Syahidah Azis	nm-to-μm Grain-size Microstructure-Magnetic Properties EVOLUTION: A New Gulf of Experimental Data From Polycrystalline Magnetic Materials?	Silver
9	Dr. Yusran Sulaiman	A sensor platform based on poly(vinyl alcohol)-graphene oxide/poly(3,4-ethylenedioxythiophene) (PEDOT) nanofiber	Bronze

MAJLIS GEMILANG ANUGERAH PUTRA (MGAP) 2015

On 5th May 2015, Majlis Gemilang Anugerah Putra (MGAP) was held at UPM to recognize the potential and contributions of 18 outstanding academic experts who displayed excellent performances in their respective fields. The award was conferred to all recipients by Sultan of Selangor, Sultan Sharafuddin Idris Shah who is also the Chancellor of UPM.

Two of ITMA research associates, Prof. Dr. Robiah Yunus and Dr. Abdul Azis Ariffin were among the award receivers on that day. Both researchers received Vice Chancellor Fellowship Award in Research and Innovation cluster. Prof. Dr. Robiah was recognized as one of the Outstanding Researcher in that cluster.

MGAP is a form of appreciation and recognition awarded by the university to its staff who display outstanding research efforts, knowledge development as well as educational services that could enhance the acculturation of excellence in knowledge. UPM's Vice Chancellor, Prof. Datin Paduka Dr. Aini Ideris in her appreciation talk congratulated all recipients and hoped their achievements could inspire more UPM's staff to strive for excellence and quality in their service.

Newspapaper clipping - SINAR HARIAN 6 JANUARY 2016

DR. TUMIRAH BINTI KHADIRAN EXCELS IN NANOSCIENCE RESEARCH

Tumirah ungguli kajian nanosains

FOUZIAH AMIR
6 JANUARI 2016

Tumirah (tiga, kiri) bersama rakan setugas di Makmal Analisis Asetat Kayu, Frim

Certificate of accreditation by International Standard ISO/IEC 17025 : 2005

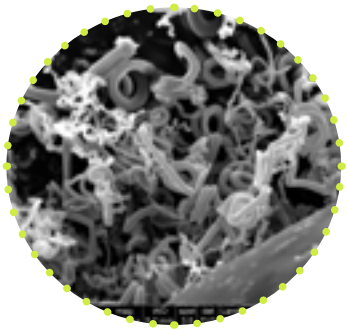
Certificate of Accreditation

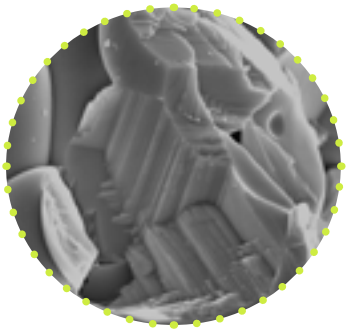
This is to certify that

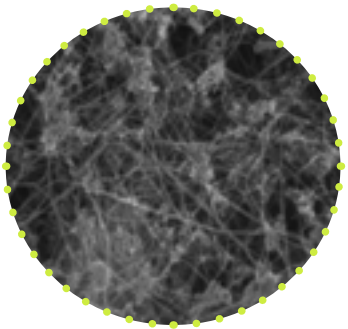
INSTITUTE OF ADVANCE TECHNOLOGY (ITMA)
UNIVERSITI PUTRA MALAYSIA
SERDANG
SELANGOR
MALAYSIA

March 25, 2016- Institute of Advanced Technology was awarded with the International Standard of ISO/IEC 17025: 2005 for Chemical & Mechanical/Physical Testing. The main purpose of the accreditation is to set a benchmark for performance, to enhance marketing advantages by promoting certified laboratory services to the potential customers, and to gain international recognition with the technical competencies.

ITMA is committed to provide testing services of the highest quality using a variety of equipment to meet the needs of research, especially in the areas of advanced materials and nanotechnology.







Mass Micrograph Award 2016

August 8, 2016 - A total of 5 students from ITMA participated in the Mass Micrograph Award 2016 contest. Mass Micrograph Award 2016 is jointly organized by Advanced Optical Material Research Group (AOMRG) Universiti Teknologi Malaysia, Malaysia Solid State Science and Technology Society (MASS) and Hi-Tech Instruments, Malaysia.

This contest is an excellent opportunity for the students to develop their understanding on the micro and sub micro-morphology of the material.

NO.	NAME	NAME OF SAMPLE/SAMPLE COMPOSITION	SUPERVISOR	AWARD
1	Fadzidah Bt Mohd Idris	Spiral And Spring Pasta-Like Carbon Nanocoils (CNCs)	Assoc. Prof. Dr. Khamirul Amin Matori	First Prize
2	Idza Riati Ibrahim	$SrTiO_3$	Assoc. Prof. Dr. Khamirul Amin Matori	Consolation
3	Low Zhi Huang	BaFe12O19	Dr. Chen Soo Kien	Consolation
4	Nur Izzaiti binti Ibrahim	(Ethanol: 96.4 wt%, Ferrocene: 1.2 wt%, Thiophene: 2.4 wt%)	Dr. Ismayadi Ismail	Consolation
5	Rodziah binti Nazlan	CNT-Ni0.6Zn0.4Fe2O4+ Carbonyl Iron	Dr. Raba' ah Syahidah Azis	Consolation

Outstanding Administrator (Research) Award

Credit :
Azman Zakaria (UPM)

Sept 15, 2015 - Two administrative staff of Universiti Putra Malaysia (UPM) – Director of Pusat Islam, Dr. Razali Othman and Research Officer of Institut Teknologi Maju (ITMA), Dr. Ismayadi Ismail – recently won top awards of the Administrators of Public Universities Day.

Dr. Razali won an award under the Outstanding Administrator (Writing) category while Dr. Ismayadi came up top under the Outsanding Administrator (Research) category. Both received a trophy, certificate and books at the award presentation ceremony held at the Higher Education Leadership Academy (AKEPT) here.

On his achievement, Dr Razali said administrators of local universities were capable of coming up with good write-ups. What is important is that administrators should be given the opportunity to write according to their service at the university, he said.

"I hope this award will boost not only the spirit of administrative staff of UPM but also all other administrators at 20 local universities, to join hands and contribute towards university excellence in the form of writing in accordance with their respective areas of expertise," he said.
Dr Ismayadi, meanwhile, said the award proved that the role and contribution of administrative staff was never neglected.

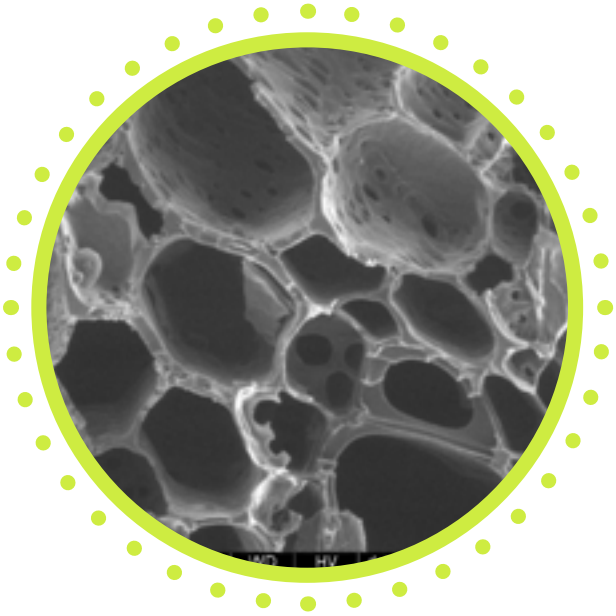
"I pray that my colleagues, especially Research Officers, will continue carrying out their research that can give great impact not only to the university but the country on the whole," he said, expressing his gratitude for winning the award.

Seven Outstanding Administrator awards were presented at the function in recognition of their contributions in supporting to help realize universities' missions and visions. Five other awards were MASTI Special Award, Outstanding Administrator Award (Community Service), Outstanding Administrator Award (Creativity & Innovation), Distinguished Administrator Award and MASTI Prime Leadership Award.

Earlier, during the convention of Administrators of Public Universities, the Higher Education Minister, Datuk Seri Idris Jusoh, who was represented by his deputy, Datuk Mary Yap Kain Ching, expressed his admiration over the initative taken by the Council Association of the Public University Administrator (MASTI) which managed to gather top leaders of MASTI from 20 public universities to attend the event.

A book, entitled *'Pentadbir Pemangkin Transformasi Universiti'* (Administrators Are Catalyst To University Transformation) authored by 17 administrators of public universities, was also launched at the event.

RESEARCH PROGRAMS



- Nanomaterials
- Materials Processing
- Sensor Technology
- Electron Devices
- Materials Technology
- Functional and Structural Materials

RESEARCH HIGHLIGHTS

Functionalized-Graphene Oxide as Hydrophobic Coating Materials

Assoc. Prof. Dr. Nor Azowa Ibrahim
Research Associate (MPTL)
azowa@upm.edu.my

The usage of hydrophobic material in recent years is very popular especially as a coating material due to the presence of desired features such as waterproof, corrosion-resistant and stability against bio-fouling and inorganic materials (in some cases). However, water is often detrimental to the materials when the surface is penetrated to moisture. This is because most of the surfaces are design to work under dry conditions.

Graphene, the two dimensional sp^2-hybridized carbon, is currently, without any doubt, the most intensively studied material. In spite of intense research into graphene, very few studies have examined water-graphene interactions, which could be an important study, if graphene has to be used in superhydrophobic coatings. Understanding the wettability of graphene is important for the in-depth study of graphene-based functional materials.

An alternative way to functionalize graphene oxide (GO) is by applying an irradiation technique by using ionizing radiation which includes gamma radiation (γ-ray) and electron beam. The advantage from this technique is that it is faster, safer and eco- friendly technology. In this work, GO was functionalized with alkylamine by γ-ray radiation. Functionalizing with different chain length of alkyamine such as dodecylamine (A12), Tetradecylamine (A14), hexadecylamine (A16), and octadecylamine (A18) on the GO surface is expected to improve the dispersion and results in the formation of superhydrophobic surfaces.

To demonstrate the potential applications of functionalized-GO as superhydrophobic materials, water contact angle analysis and surface energy of the materials were measured. Pristine GO had a contact angle of 28.77° with the surface energy of 62.02 mN/m. This high value of surface energy is due to the abundance of oxygen functionalities groups on GO showing the hydrophilic properties of GO. Functionalization of GO with alkylamine increased the water contact angle and this hydrophobicity is attributed to the natural hydrophobic property of the functional alkyl group attached to graphene. Based on XPS analysis, γ-ray irradiation technique successfully removed most of the oxygen functional groups, hence the remaining oxygen functionalities was less able to make hydrogen bonds with water.

This implies that chemical composition and surface roughness gives huge influences on the wetting properties of substance. This effect was more significant with increasing alkyl chain length. The simplest explanation of hydrophobicity is a surface having a static water contact angle higher than 90°. GO-A12 showed a contact angle of 91.12° while GO-A14 showed a contact angle of 104.72°. GO-A16 and GO-A18 exhibited the highest contact angle value (112.05° and 114.11°) which almost approached the value of water contact angle of GO-AC (132.30°) that has been functionalized by using the chemical method. The surface energy of GO decreases after functionalization, and the effects seem more significant with increasing alkyl chain length. GO-A12 has surface energy of 33.01 mN/m verify the changes in the nature of hydrophilic GO to hydrophobic. Meanwhile, GO-A18 has the lowest surface energy which is 14.86 mN/m. This surface energy revealed that the hydrophobic nature of functionalized-GO depended on the chain length of the grafted alkyl chain, and this may supported to an increase in the water contact angle values. Thus, it can be concluded that γ-ray irradiation is a prompt and effective alternative to produce hydrophobic materials that achieve comparable contact angle value with GO-AC.

Sample	Surface energy (mN/m)
GO	62.02
GO-A12	33.01
GO-A14	20.90
GO-A16	15.53
GO-A18	14.86
GO-AC	7.67

Table 1:
Surface energy of GO and fucntiopnalized-GO.

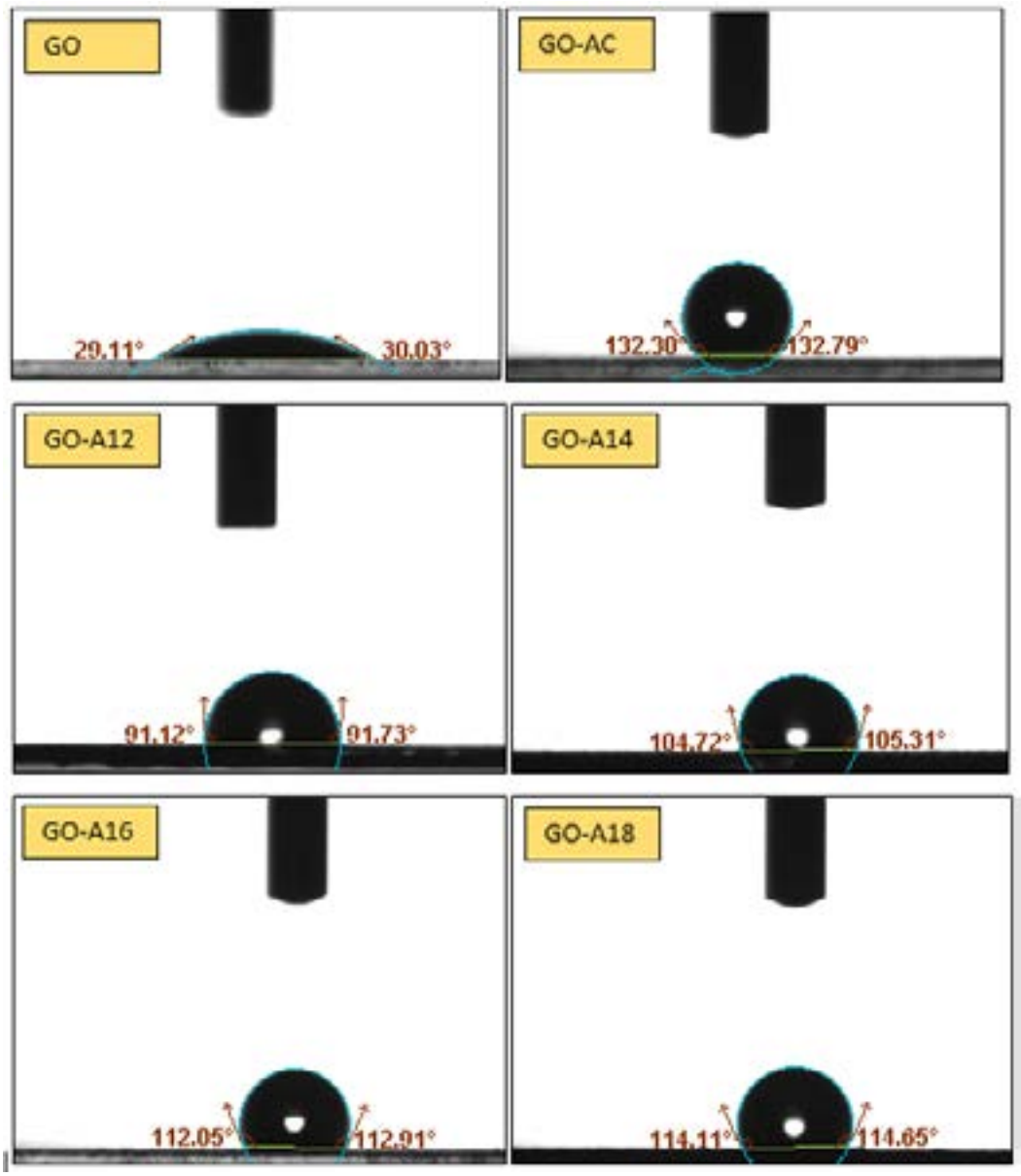


Figure 1:
Water contact angle of GO and functionalized-GO.

RESEARCH HIGHLIGHTS

Carbon Particles (CPs) from Dry Milled Biochar

Juraina Md. Yusof
Research Officer(MPTL)
juraina@upm.edu.my

Biochar is a solid residue, left behind during the thermal conversion of biomass into fuel products and has typically been considered a lower-value byproduct compared to the higher-valued syngas and bio-oil. These process produced massive amount of biochars thus drives the need to increase its utilization. Carbon particles is suitable as a filter in water or beverage purification and supercapacitor electrode in electrode production technology. The starting materials are a selection of biochars from kenaf, coconut and bamboo. Kenaf is a very versatile plant and it exhibits low density, high absorbent, non abrasiveness during processing, high specific mechanical properties and biodegradability. Meanwhile, coconut biochar is a discarded by-product from coconut which is salvaged for many applications such as granular activated carbon for filtration and in agriculture as soil stabilizer. Bamboo is used as scaffolding structure in the construction industries and the waste is used a starting material for the production of carbon char or activated carbon due to its high carbon content.

Crop biomass residue of kenaf, coconut and bamboo from pyrolysis process was further processed using high energy mechanical alloying equipment. Two hardened steel vials set were used as a milling media to mill the biochar samples of 7.5 gram each. The milling times were 3 hours and 12 hours and milling was interrupted in between for material sampling. The carbon particles were refined using 45µm sieve to get even and uniform distributions of particles.

The Raman spectrum of the three biochars after mechanical alloying process is presented in Figure 1. All samples showed a typical G-band which appears at 1593 cm^{-1} representing the C-C stretching mode of sp^2 bonded carbon in planar sheets. The broadened G-band shift from the observed samples showed the metallic electrical property getting better as milling time increased. A prominent D-band appears at 1350cm^{-1} represents the broken basic symmetry of the planar sheets caused by the high impact and friction of ball mills, vials perimeter and the particles itself.

The intensity for G and D band of coconut is higher than that of kenaf and bamboo which showed coconut has a significant structural defect after mechanical alloying process compared to the latter. Meanwhile, it is observed that coconut has the highest surface area as compared to kenaf and bamboo that is 39.347 m^2/g from Brunauer, Emmett and Teller (BET) analysis. It is also observed that the particle surface area of kenaf is 7.3399 m^2/g which is slightly higher than bamboo with surface area of 6.5904 m^2/g. It can be concluded that particles size reduction occurs during milling due to abrasion and shear forces. The structural transformation happened after 12 hours milling and the carbon particles tends to agglomerate easily as milling hours prolonged. There is a significant reduction in materials size as milling time gets longer as proven by the higher structural defects from Raman analysis. Coconut has the highest surface area than kenaf and bamboo which make it the most suitable biochar for further studies on activated carbon.

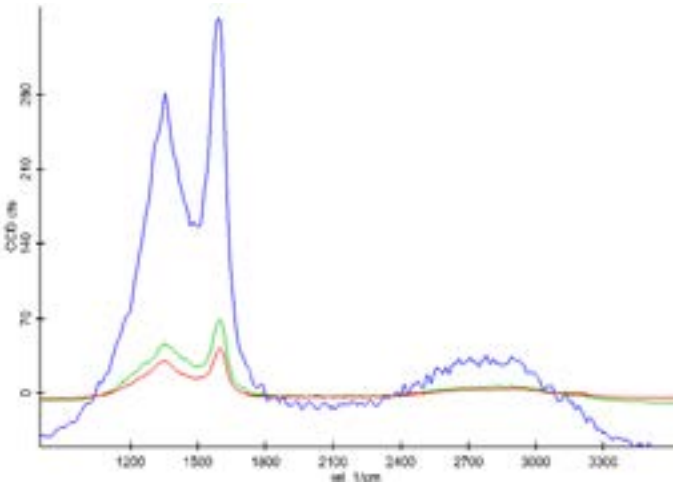


Figure 1

RESEARCH HIGHLIGHTS

UPCONVERSION OF INORGANIC NANOMATERIALS FOR THERMAL ENERGY STORAGE

Prof. Dr. Mohd. Zobir Hussein
Research Fellow (MSCL)
mzobir@upm.edu.my

The fast economic growth and high standards of living imposed the world to consume large amount of conventional energy resources, fossil fuels that drive environmental pollutions and climate changes. In addition, the dependency towards conventional energy resources will empties the sources more rapidly. Therefore, the effectiveness utilization of energy becomes a main issue recently.

Various renewable energy systems were developed to enhance energy efficiency such as thermal energy storage (TES) system. TES is the temporary energy storage medium for later use. It provides realistic solution to increase the efficiency of the energy utilization and management. This technology is an elegant energy technology which can be used in various industries, especially building industry.

TES based on phase change material (PCM) is lately gaining an increasing interest due to their advantages such as high storage density and constant temperature during phase change. In addition, TES based on PCMs shows the potential to shift electricity peak load which beneficial to reduce energy usage in buildings.

TES based on PCMs technology integrated in building would be of great importance energy systems in the future. The previous findings shows that the PCMs integrated into building components work well for keeping the internal buildings within thermal comfort. It was reported that the TES of the gypsum wallboard can be increased ten times by incorporation of PCMs. Concrete incorporated with 5% microencapsulated PCMs was reported could save energy up to 12%.

TES systems based on latent heat of PCM have attracted more attention lately due to their capabilities of high energy storage capacity, high density and narrow operating temperature range. This technology is believed useful to fulfill the gap between the global demand and supply of energy. This system also has been recognized as one of the most advanced energy technologies in enhancing energy efficiency. Hence, it can be used in various applications such as in smart textile, intelligent buildings, temperature-adaptable greenhouse, solar energy storage, thermal insulation, etc.

The organic PCM such as paraffins wax has a great potential to be used as TES in a wide range of applications. The organic PCM has advantages such as, available in a large temperature range, freeze without much sub-cooling, ability to melt congruently, self-nucleating properties, and compatible with conventional material of construction, no segregation and chemically stable, high heat of fusion, safe and non-reactive, and recyclable. However, two major drawbacks of organic PCM are low thermal conductivity and large volume change during their phase change processes which cause leakage if it is directly incorporated into building materials. The latter restricts their application. Therefore, encapsulation technique at nano-sized regime using polymer as capsules has been developed to expand their uses as the small diameter of the nano-encapsulated PCM materials, high ratio of the surface area to volume lead to higher heat transfer speed, which is expected to overcome the low thermal conductivity problem. The encapsulation can provide a space to control the volume changes during the phase change, increasing heat transfer area and good protection for PCM against external environment during their applications. In addition, the capsules containing PCM at ultra-small size can be easily incorporated into any matrix, which is compatible with the materials of the capsule.

PMMA (polymethyl methacrylate) is often used in a wide range of application due to its moderate properties, easy to handling and processing and non-toxic. Other attractive properties of PMMA are high impact strength and therefore can provide a good protection against external environment. Moreover, slightly hydrophilic properties of MMA give them higher solubility and reactivity in water, which finally improve the efficiency of PCM encapsulation. We believe that the use of PMMA as a shell could improve the characteristics of-

the resulting nano-encapsulated organic PCM and further broaden their potential application.

We have synthesized nano-encapsulated organic PCM, based on St/MMA copolymer shell using miniemulsion *in-situ* polymerization method. Parametric optimization resulted in the formation of fairly uniform core-shell nanocapsules of sphere shape of around 102 nm (Fig. 1).

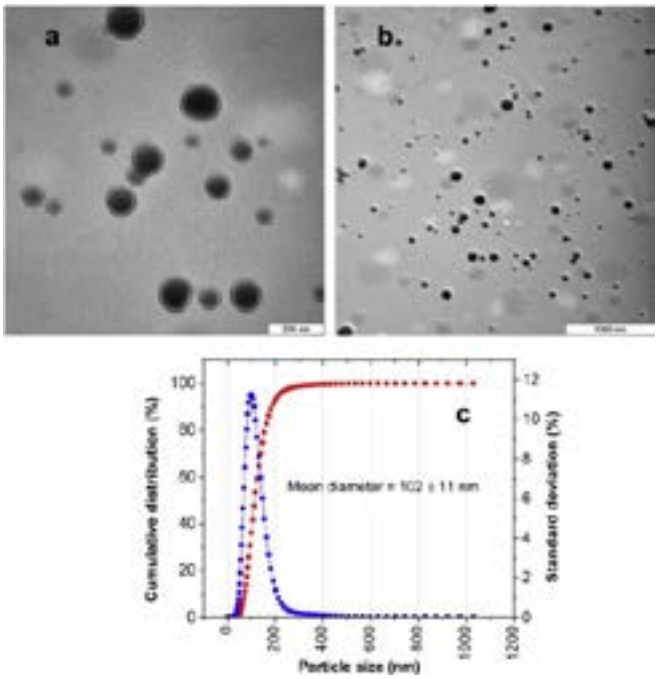


Fig. 1: Core-shell, nano-encapsulated organic PCM based on St/MMA copolymer shell and n-octadecane as the core, TEM image (a) magnification 100 k showing the core-shell structure (b) magnification 30 k showing the size variation of fairly uniform sphere structure and (c) particle size distribution measured using DLS technique.

In order to study the TES performance of the n-octadecane nanocapsules, smart gypsum composite boards (SGCBs) were fabricated using 0, 1, 5, 10, 20 and 30 %(w/w) n-octadecane nanocapsules to gypsum. It was found that the SGCB has good thermal energy storage properties which could be used as a smart heat storage medium for thermal comfort building application (Fig. 2). The study indicated that the incorporation of 10% (w/w) of the n-octadecane nanocapsules in gypsum was more beneficial than at higher percentages. Due to the nanocapsules are at the nano-sized regime, they are compatible with building matrix, the gypsum and still intact and in good shape even after the SGCB was crushed (Fig. 3).

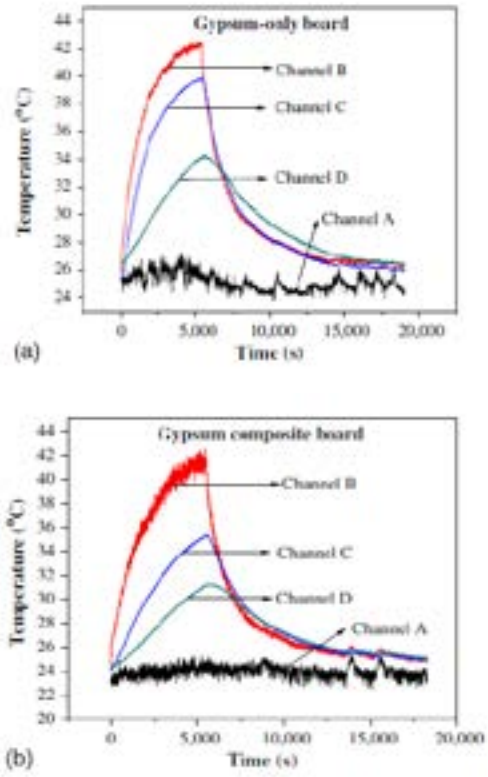


Fig. 2: Temperature profiles of smart gypsum composite board containing (a) 0 and (b) 10% by weight n-octadecane nanocapsules; Channel A= laboratory environment, B = external surface of the gypsum boards (outside wall) C: inside wall of the gypsum boards and D = indoor (the center of the test room).

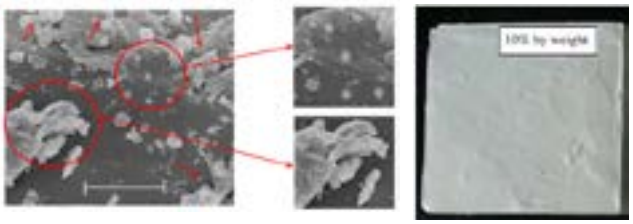


Fig. 3: FESEM images of a crushed smart gypsum composite board containing 10% (w/w) of the n-octadecane/St-MMA nanocapsules (right). Due to the nanocapsules are at the nano-sized regime, they are compatible with building matrix, the gypsum and still intact and in good shape even after the SGCB was crushed (left).

In addition to the core-shell nano-PCM work, other works on the upconversion of inorganic nanomaterials are also currently on going, focusing on different niche areas;

1. Development of graphene-based quantum dots for multimodal theranostics delivery systems.
2. Development of multi-drugs nanodelivery systems for anti-tuberculosis.
3. Single- and multiwall-functionalized carbon nano tubes for anticancer drug delivery applications.
4. Designing of core-shell nanoparticles for liver cancer drug application.
5. Development of gadolinium-based nanoparticles for MRI and cancer research application.
6. Development of agronanofungicides for ganoderma diseases treatment of palm oil.

RESEARCH HIGHLIGHTS

IMMUNO NANOSENSOR FOR ULTRASENSITIVE AND AFFORDABLE NAKED EYE DETECTION OF TUBERCULOSIS (TB)

Prof. Dr. Nor Azah Yusof
Director of ITMA
azahy@upm.edu.my

Immunosensors are biosensors that use antibodies or antigens as the specific sensing element and provide concentration-dependent signals. In recent studies, a variety of portable, rapid, and sensitive biosensors with immediate "on the spot" interpretation have been developed based on target protein and DNA. The proposed project is to develop a new electrochemical, plasmonic ELISA (optical) and lateral flow immunoassay for rapid detection of Tuberculosis in clinical samples.

Electrochemical based method utilize the sandwich immunoassay technique in which the surface of the sensor is first modified with nano fiber and functionalized with capture antibodies (Ab1) for the detection of the protein analyte of interest. After the sample is introduced and rinsed, a nanoparticle-labeled antibody (Ab2) is added to bind with the captured analyte protein. The application of multiply labeled antibodies or other amplification strategies can increase the sensitivity of the sensor. The major advantages of this technique are it requires lower sample volumes, miniaturizable and applicable for on-site detection.

Plasmonic ELISA has emerged as an ultrasensitive strategy enabling the detection of a few molecules of analytes with the naked eye. Rather than the most common ELISA catalyzing a colour change reaction of organic molecules, plasmonic ELISA performs the biocatalytic cycle of the enzyme label. The enzyme is linked to the growth of gold nanoparticles in order to obtain blue or red coloured solutions in the presence or absence of the analyte, respectively. In the absence of analyte, the reduction of gold ions with hydrogen peroxide occurs at a fast rate and expected to acquire a red colour. In the presence of analyte, the enzyme catalase consumes hydrogen peroxide which slows down the kinetics of crystal growth and the solution turns blue. The blue and red colours are easily distinguishable, therefore facilitating the detection of the analyte with the naked eye.

Lateral flow immunoassay (LFIA), also called a dry-reagent strip biosensor has received increased interest as a tool for screening. Gold nanoparticles are commonly used as labels for visual detection. Absence of colour at test line is an indication for the absence of analyte while appearance of colour both at test and control line indicates positive result. LFIA offers a low-cost, one-step analysis as well as an easy-to-use platform, which can be applied for routine use in research and clinical applications.

These proposed techniques have been developed and was successfully tested using clinical samples.

RESEARCH HIGHLIGHTS

Metal Oxide Doped Graphene Photocatalysts For Environmental Applications

Dr. Mohammed Husham Mohamed Ali
Post Doctoral (FDL)
husham@upm.edu.my

Environmental and energy issues urge the scientific community to look for sustainable, green solutions without imposing more strain on the environment. There is an evident need for an alternative energy source that can at least partially and progressively replace fossil fuels in the near future. As a clean and effective way to solve the global environmental and energy problems, visible-light-driven photocatalytic has attracted widely attention. Recently, several studies have been focused on the photocatalytic activity of metal oxide (MO)-based photocatalysts as purifying agents and for the production of clean energy from water by sunlight as a natural energy resource. However, the application of pure MO-based photocatalysis is limited, because it requires UV light, which makes up only a small fraction (<4%) of the total solar spectrum reaching the surface of the earth. Besides, bare MO-based photocatalysts suffering from low quantum efficiency, mainly due to the rapid recombination rate of photogenerated electron–hole (e–h) pairs within MO particles.

The recently discovered carbonaceous nanomaterial graphene has been widely studied for use in various applications due to its excellent electrical, optical, mechanical, and thermal properties. The hybridization of graphene with MO nanostructures can enhance the photocatalytic performance because of slowing down the recombination of photo or electro-chemically generated e–h pairs which significantly enhance the photocatalytic quantum efficiency and can also induce visible light activity in conventional photocatalysts by extending the photocatalyst response into the visible light region. It is believe that this type of hybrid materials can be effectively used as a highly active and stable photocatalysts. The MO/graphene is able to absorb a high amount of photo energy in the visible-light region. Therefore, a vast amount of light coming from the sun could be harvested and utilized to enhance the performance of the photocatalyst.

This research aims to investigate possible approaches to increase the activity of MO-based photocatalysts with the aim of showing how graphene and its derivatives are being applied in hydrogen production and organic pollution treatment. This project deals with wide-ranging environmental studies of MO-doped graphene materials on the adsorption of hazardous materials and photocatalytic degradation of toxic pollutants and the production of hydrogen gas. The function of graphene in the enhancement of light absorption, quantum efficiency, and photoactivity of the photocatalysts is investigated. This work is expected to could give a new train of thought on exploration of MO-based nanocomposites on wide range of energy and environmental research areas.

For visible-light-driven photocatalytic, we are currently working on the synthesis of TiO2 nanostructures doped graphene for the production of hydrogen gas via the water splitting process and for the treatment of organic pollution. Microwave-assisted chemical route methods are used as simple and cost effective approaches to the synthesis of high efficacy photocatalysts for environmental applications.

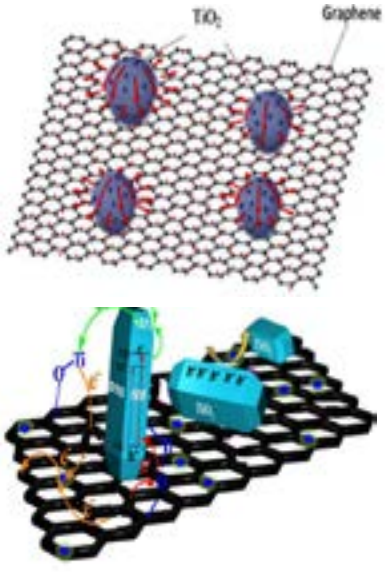


Figure 1: Schematic illustration shows different TiO_2

Materials Synthesis and Characterization Laboratory

MSCL

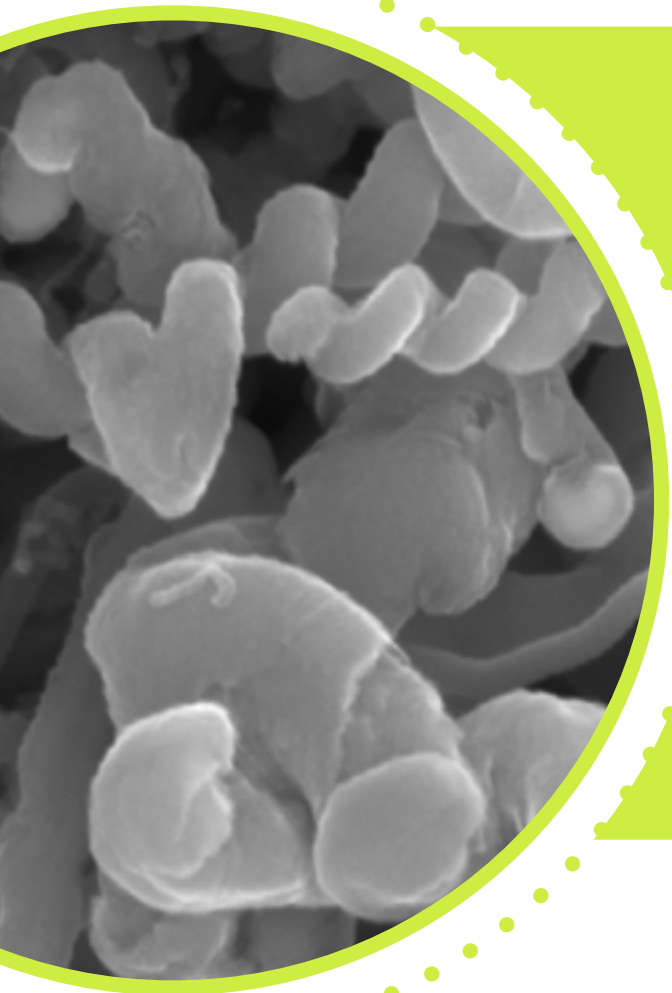
Materials Synthesis and Characterization Laboratory (MSCL) was established on 1st November 1999. It was formerly known as Advanced Materials Research Center (AMRC) and later was changed to Advanced Materials Laboratory (AML). In line with university's restructuring, its name was changed to Advanced Materials and Nanotechnology Laboratory (AMNL) in 2006. Recent restructuring in 2012 has seen AMNL evolving to Materials Synthesis and Characterization Laboratory (MSCL) to be in tune with advanced materials and nanotechnology research focus. This laboratory is one of the three research laboratories under the Institute of Advanced Technology (ITMA). MSCL focuses in three main activities :

1. Interdisciplinary research and development work in advanced materials and nanotechnology.
2. Postgraduate research programs.
3. Dissemination of innovative knowledge and technologies in advanced materials and nanotechnology.

OBJECTIVES

1. To be a leading research centre in advanced materials and nanotechnology.
2. To develop world class research laboratory in advanced materials and nanotechnology.
3. To disseminate knowledge and innovative technologies through publications, seminars and conferences.

MSCL Research Group



Nanomaterials

This program focuses on the synthesis and characterization of nanaomaterials and their building blocks which involves the use of nanosized materials.The study of these materials covers the fundamental aspects towards their potential application. The research on nanocomposite materials and nanostructured materials includes but is not limited to nanometals, nanoalloys, nanoceramics, carbon nanotubes and layered double hydroxides.

Functional and Structural Materials

This program focuses on synthesis and characterization of nanomaterials and their building blocks which involves the use od nanosized materials.The study of these materials covers the fundamental aspects towards their potential application.The research on nanocomposite materials and nanostructured materials includes but not limited to nanometals,nanoalloys, nanoceramics,carbon nanotubes and layered double hydroxides.

Laboratory Members

Assoc. Prof. Dr. Khamirul Amin Matori
Head of Laboratory
B. Sc. (Hons) (UPM), M. Sc. (UPM),
Ph. D (Sheffield, U.K)
Expertise :
Glass, Glass Ceramic

Prof. Dr. Mohd Zobir Hussein
Head of Nano Materials
B. Sc. (Hons) (UKM), Ph. D (Reading, U.K)
Expertise :
Nano Materials and Materials Chemistry

Assoc. Prof. Dr. Mansor bin Hashim
Head of Advanced and Functional Materials
B. Sc. (UM), M. Sc. (Dundee, U.K),Ph. D (Dundee, U.K)
Expertise :
Magnetic Materials,
High T_c Superconductor

Prof. Dr. Azmi Zakaria
Research Associate
B. Sc. (Hons) (UKM), M. Sc. (Belfast, U.K),Postgraduate Diploma (Wales, U.K),Ph. D (Wales, U.K)
Expertise :
Applied Optics (Photothermal Physics, Solar Energy), Material Science (Zinc Oxide based ceramics)

Prof. Dr. Zulkarnain Zainal
Research Associate
B. Sc. (Hons) (UKM), Ph. D (UMIST, U.K)
Expertise :
Physical Chemistry
High T_c Superconductor

Prof. Dr. Abdul Halim Shaari
Research Associate
B. Sc. (Hons) (UKM), M.Sc. (Southampton, U.K), Ph. D (Hull, U.K)
Expertise :
High T_C Superconductor, Magnetic Materials, Thin Films Physics

Prof. Dr. Taufiq Yap Yun Hin
Research Associate
B.Sc. (Chemistry) (UPM), M. Sc. (UPM),Ph.D (UMIST, U.K.)
Expertise :
Heterogeneous Catalysis, Selective Oxidation, Advanced Materials, Renewable Energy, Biodiesel Production, Biomass Conversion, Hydrogen Production and Natural Products Chemistry

Assoc. Prof. Dr. Abdul Halim Abdullah
Research Associate
B. Sc. (Hons) (New Brunwick),
Ph.D (Dundee, U.K).
Expertise :
Materials Chemistry

Assoc. Prof. Dr. Jumiah Hassan
Research Associate
B.Sc. (Northern Illinois, U.S.), M.Sc. (Washington State, U.S.), Ph.D (UPM)
Expertise :
Dielectric Properties of Materials At Microwave And Low Frequencies

Dr. Ismayadi Ismail
Research Officer
B.Sc. (UKM) , M.Sc. (UPM), Ph.D (UPM)
Expertise :
Magnetic Materials

Dr. Md Shuhazlly Mamat@ Mat Nazir
Research Associate
B.Eng (Hons) Nottingham, UK
Ph.D Nottingham, UK
Expertise :
Carbon nanostructures: Synthesis and applications Nanomaterials Characterisations PEM Fuel Cells and Electrolysers Nanomaterials Characterisations

Dr. Samikannu Kanagesan
Post Doctoral
M.Sc., Mphil., Ph.D.
Expertise :
Magnetic Materials

Lab Members

Rosnah Nawang
Research Officer
B.Sc. (USM), M.Sc. (USM)
Expertise :
Polymer Technology

Sarinawani Abdul Ghani
Science Officer)
B.Sc. (UPM)
Expertise :
Nano Materials

Nazrul Abdullah
Assistant Engineer
Bachelor of Engineering (Mechanical)
Diploma of Mechanical Engineering
Expertise :
Repairing of Computers and Electrical Equipment
Design 3D Modelling using Autodesk Inventor and Catia

Mohd Kadri Masaud
Assistant Engineer
Certificate of Electronic Engineering(Relationship),
Diploma of Electronic Engineering
Expertise :
Repairing of Computers and Electrical Equipment

Noor Lina Shamsuddin
Assistant Engineer
Certificate of Power Electronic Engineering,
Diploma of Electronic Engineering
Expertise :
Repairing of Computers and Electrical Equipment

Materials Processing and Technology Laboratory

MPTL

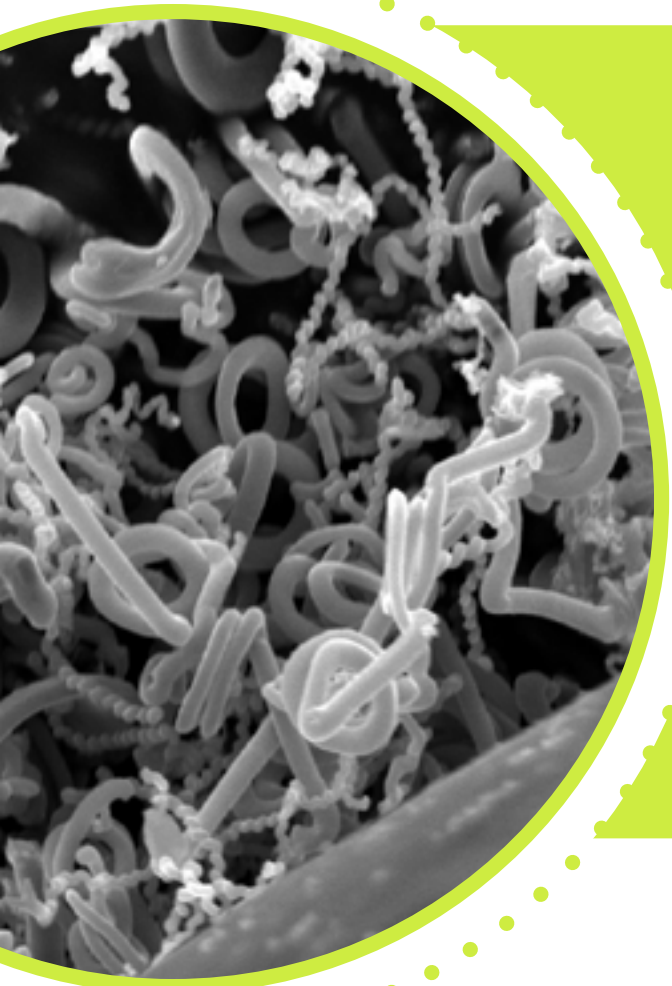
Materials Processing and Technology Laboratory (MPTL) was established to fulfill the research necessity in Advanced Materials Processing and Nano Materials. MPTL was developed to complement the ITMA ecosystem, which aims to be a leader in the field of Nanotechnology and Advanced Materials. MPTL focuses on developing and promoting research in Materials Technology and Advanced and Nano Materials Processing in Malaysia. The main activities of the laboratory are :

1. Conducting research in related fields.
2. Postgraduate research programs.
3. Provide trainings and consultancy services.

OBJECTIVES

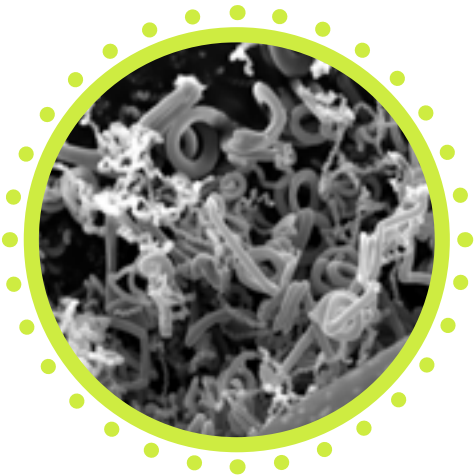
1. To be a leading research center in processing and technology for advanced materials and nanomaterials.
2. To produce experts in the field of processing and technology for advanced materials and nanomaterials.
3. To be a knowledge dissemination center of processing and technology for advanced materials and nanomaterials
4. To build a network of strategic partnership between local and international researchers from public and private institutions.

MPTL Research Group



Materials Processing

This program focuses on developing research related to scalable processing of advanced materials and nanomaterials. We have expertise in synthesis of carbon nanotructures such carbon nanotubes (CNT) and CNT cotton by both batch and continuous chemical vapour deposition (CVD) processes. The existing know how and facilities in CVD processing open other venues for research such as superconductor thin film and bottom-up synthesis of graphene and homologous graphene. Scalable top-down processes for preparation of graphene oxide and graphene quantum dots are also being actively pursued. Other scalable processes for synthesis of advanced materials and nanomaterials include hydrothermal and solvo thermal approaches.



Nanomaterials Technology

This program focuses on the development of innovative products using advanced materials and nanomaterials for various applications. The different types of nanomaterials used include carbon based nanostructures such as carbon nanotubes (CNT), graphene oxide and reduced graphene oxide, graphene quantum dots as well as other various types of metal oxide nanoparticles. The products being developed are diverse and include nanofluids such as nanomaterial enhanced drilling fluids and heat transfer fluids for microfluidics, nanoemulsion systems such as nanoemulsion fuels and pesticides, a wide range of nanocomposites, nanocatalysts, nanocoatings and smart materials. The nature of research under this program ranges from fundamental studies to applied research to proof of concept and performance testing.

Laboratory Members

Assoc. Prof. Dr. Suraya Abdul Rashid
Head of Laboratory
B.Eng. (Hons) (Nottingham), Ph.D. (Imperial College, London)
Expertise :
Nanotechnology and Nanomaterials

Prof. Dr. Robiah Yunus
Research Associate
B.Sc. (Alabama), M.Sc. (Leeds), Ph.D. (UPM)
Expertise :
Renewable Energy, Reaction Engineering, Process Engineering

Assoc. Prof. Dr. Nor Azowa bt. Ibrahim
Research Associate
B.Sc. (Kansas, USA), M. Sc. (Illinois, USA), Ph.D. (UPM)
Expertise: Polymer Chemistry, Environmental Chemistry

Dr. Dayang Radiah Awang Biak
Research Associate
B.Eng. (Hons) (CWRU), PhD (Birmingham)
Expertise :
Heat Transfer; Modelling; Food Processing; Crystallisation; Pharmaceutical Products, Nanoscale Technology

Dr. Siti Hajar Othman
Research Associate
BEng. (Vanderbilt), PhD (UPM)
Expertise : Nanotechnology, food packaging Engineering

Dr. Umer Rashid
Research Fellow
B.Sc. Lahore, Pakistan),M.Sc. Chemistry (Faisalabad, Pakistan), PhD. Faisalabad, Pakistan)
Expertise :
Renewable Energy (Biodiesel)

Dr. Mohamad Amran Mohd Salleh
Research Associate
B.Eng.Sc. (Western Ontario), Ph.D. (Birmingham)
Expertise :
Particle Technology, Biochar and Nanotechnology, Carbonaceous Particulates

Prof. Dr. Luqman Chuah Abdullah
Research Associate
B.Sc. (Hons) (UTM), Ph.D. (Birmingham)
Expertise :
Separation Technology, Chemical and Environmental Technology, Material Engineering (Polymer) and Particle Technology

Dr. Shafreeza Sobri
Research Associate
B.Eng. (Hons) (UTM), PhD (Newcastle)
Expertise :
Electrocrystallisation and Electrochemical Engineering

Dr. Faizah Mohd Yasin
Research Associate
B.Eng. (Hons) (UMIST), M. Sc. (UPM),
PhD (Univ. of Western Australia)
Expertise :
Nanotechnology, Advanced Materials

Dr. Nordin Bin Hj. Sabli
Research Associate
B.Eng (TUT), M.Eng (UPM), Ph.D (UPM)
Expertise :
Photoelectrochemical cell, Fuel Cell

Dr. Amir Reza Sadrolhosseini
Post Doctoral
B. Sc. (University Of Tehran),
M. Sc. (Azad University),
PhD (UPM)
Expertise
Nanomaterial, Plasmonic and Optical Sensor

Lab Members

Dr. Lim Bo Yuan
Post Doctoral
B. Eng. (Hons) (UM), Ph. D (UPM)
Expertise
Agricultural Machinery Design and Development, CFD Modeling

Siti Zulaika Razali
Research Officer
B. Eng (UKM), M. Sc. (UPM)
Expertise :
Chemical Engineering (Process)

Roslina Abdul Rashid
Science Officer
B. Sc. (Hons) (UPM)
Expertise :
Materials Science, Materials Characterization

Zakky Yamanie Jamiauddin
Assistant Engineer
Cert. Eng. (Politeknik TSB Kulim)
Expertise : Mechanical Engineering

Juraina Md Yusof
Research Officer
B. Eng (USM)
Expertise :
Electrical and Electronics Engineering-Control, Robotics and Automation

Mohd Ali Mat Nong
Research Officer
B. Eng (UPM)
Expertise :
Microelectronics

Ab Haffiz Ab Jalil
Assistant Engineer
Dip. Eng (Politeknik SSAAS)
Expertise : Electrical and Electronics

Functional Devices Laboratory

FDL

Functional Devices Laboratory (FDL), formerly known as Sensor Technology Laboratory (STL) had been restructured and renamed in line with ITMA new ecosystem. The laboratory aims to be a leader in sensor technology and electron devices for nanotechnology and advanced materials. The main activities of the laboratory are conducting research in related fields, postgraduate programs, provide trainings and consultancy services.

OBJECTIVES

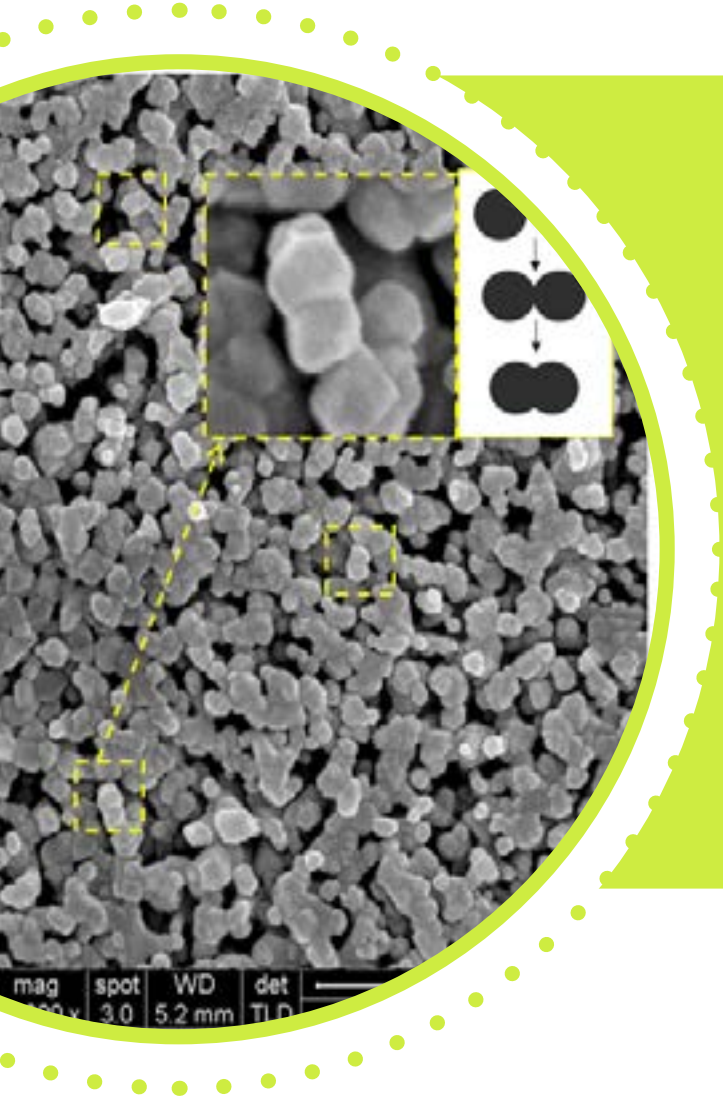
1. To be a leading research center in sensor technology and electron devices for advanced materials and nanomaterials.

2. To produce experts in the field of sensor technology and electron devices for advanced materials and nanomaterials.

3. To be a knowledge dissemination center of sensor technology and electron devices for advanced materials and nanomaterials.

4. To build a network of strategic partnership between local and international researchers from public and private institutions.

FDL Research Group

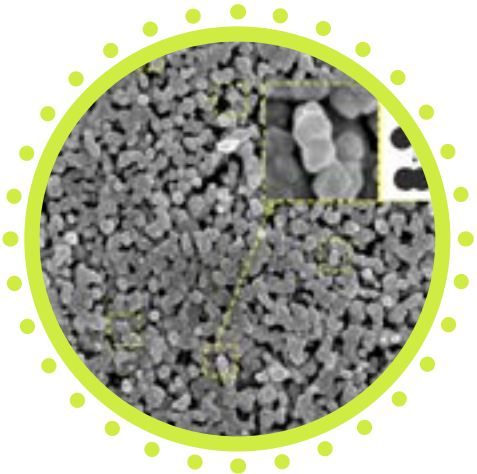


Sensor Technology

Sensor technology includes the study and preparation of sensing material and characterized by related transducer, signal processing and design of system or devices (including micro and nanoscale) in development of sensor to meet society and industrial demands. Sensor system includes (but not limited to) electronic sensors, biosensors, and chemical sensors. Sensor technology has a very important role as the key technology to support a wide variety of research and industrial applications. It is also a vital element that can be applicable to water security, environment and green technology.

Nanomaterials Technology

Electron Devices is a program that has been offered under this laboratory starting from 2012. This program aims to perform basic and applied research in the growth of semiconductors and related electronic materials, as well as micro analysis with the aim of developing new and improved electronic devices. The vision in this area is next generation electronic devices and sensors for improved performance and reliability in complex environments. Research areas include nanoelectronics and MEMS, RF and energy harvesting.



Laboratory Members

Assoc. Prof. Dr. Suhaidi Shafie
Head of Laboratory
B.Eng. University of Ryukyus, M.Sc. Tokyo University of Agriculture and Technology, Japan,
D. Eng. (Nanovision) Shizuoka University, Japan
Expertise :
CMOS Image Sensor, Porous Silicon, Solar Cell, VLSI Design, Analog TV/VCR Tuners

Prof. Dr. Nor Azah Yusof
Director of ITMA
B.Sc. (Hons), Universiti Kebangsaan Malaysia
Ph.D., Universiti Kebangsaan Malaysia
Postdoctoral in Institute of Biotechnology, University of Cambridge
Expertise :
Chemical and Biosensor, Molecular Imprinted Polymer

Prof. Ir. Dr. Mohd Zainal Abidin Abdul Kadir
Research Associate
B.Eng (UPM), PhD (Manchester), P.Eng, C.Eng (UK), MIET, SMIEEE, MIAENG
Expertise :
Lightning Protection, High Voltage Engineering, Insulation Coordination

Prof. Dr. Norhisam Misron
Research Associate
B. Eng. (Shinshu University, Japan), M. Eng. (Shinshu University, Japan), Ph.D Eng. (Shinshu University, Japan)
Japanese Language Intensive Course(UM, Malaysia)
Expertise :
Electrical Machine, Power Electronic Drive, Magnetic Sensor

Dr. Mohd Hanif Yaacob
Research Associate
B.Eng (Hons) Electronic Computer System (Salford University, U.K),
M.Sc. Communications and Network Engineering (UPM, Malaysia), Ph.D in Electricaland Computer Engineering (RMIT University, Australia)
Expertise :
Electronic & Optical Communication

Assoc. Prof. Dr. Mohamad Nizar Hamidon
Head of Electron Devices Program
B.Sc. Hons. Universiti Malaya, M.Sc. Universiti Kebangsaan Malaysia,
Ph.D (University of Southampton)
Expertise :
Microelectronics (Sensor Technology), MEMS, Devices Fabrication and Packaging, Wireless System

Dr Shahrul Ainliah Binti Alang Ahmad
Research Associate
B.Sc. (Hons) in Industrial Chemistry, Universiti Putra Malaysia, Ph.D in Physical and Analytical Chemistry, University Of Sheffield, Posdoctoral in Physical and Analytical, University Of Sheffield, Postdoctoral in Organic Synthesis , Surface Modification and Electrochemistry, University Of New South Wales
Kepakaran / Expertise :
Industrial Chemistry

Dr. Mohd. Nazim Mokhtar
Research Associate
B.Eng (Hons) (Surrey), Ph.d (Surrey)
Expertise :
Biomedical Nanoelectronics Engineering, Lab on a Chip, Energy Harvesting

Dr. Yap Wing Fen
Research Associate
B.Sc. in Physics (with education) , Ph.D in Applied Optics, Universiti Putra Malaysia
Expertise :
Optical Based Sensor

Dr. Janet Lim Hong Ngee
Research Associate
B.Sc. Oleochemistry, M.Sc. Catalysis and Surfantans Universiti Kebangsaan Malaysia,
Ph.D Material Science Universiti Putra Malaysia
Expertise :
Graphene Based Polymer Nanocomposites

Dr. Jaafar Abdullah
Research Associate
B.Sc. (Hons.) in Chemistry, Ph.D in Analytical Chemistry Biosensor, Universiti Kebangsaan Malaysia
Expertise :
Chemical and Biosensor

Lab Members

Dr. Nizam Tamchek
Research Associate
BSc. Kanazawa University(Japan),
M.Sc. University of Malaya, PhD. University of Malaya
Expertise :
Photonics

Dr. Nasri Sulaiman
Research Officer
B.Eng, Universiti Putra Malaysia, M.Sc., University of Southampton, Ph.D University of Edinburgh
Expertise :
Evolvable Hardware (EHW) and Digital Signal Processing

Dr. Mohd Khair Bin Hassan
Research Associate
Diploma of Electrical & Electronic Engineering ,ITM, B.Eng. (Hons) Electrical and Electronic Engineering, University of Portsmouth, UK , M.Eng. (Electrical) Major in Control System, Universiti Teknologi Malaysia, Ph.D. Automotive Engineering, Universiti Putra Malaysia
Kepakaran / Expertise :
Energy Engineering, Control System

Dr. Reza Hajian
Research Fellow
B.Eng, Universiti Putra Malaysia, M.Sc., University of Southampton, Ph.D University of Edinburgh
Expertise :
Evolvable Hardware (EHW) and Digital Signal Processing

Intan Helina Hasan
Research Officer
B.Sc. Yokohama National University
M. Sc. Universiti Putra Malaysia
Expertise :
Smart Technology and Robotics Engineering

Md. Ali Rani
Science Officer
B.Sc. Universiti Putra Malaysia
Expertise :
Forest Management

Dr. Suriati Paiman
Research Associate
B.Sc. in Industrial Pysics, M.Sc. (Physics) in Thin Film Physics Universiti Teknologi Malaysia, Ph.D in III – V Compaund Semiconductor Nanotecnology Australian National Nanotechnology
Expertise :
Compound Semiconductor Materials Science (III-V semiconductors), Compound Semiconductor Nanotechnology and Photovoltaics

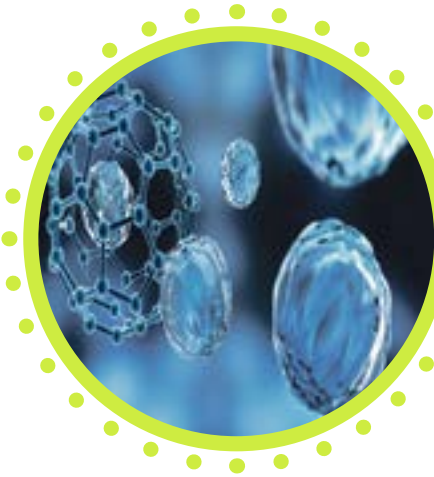
Dr. Yusran Sulaiman
Research Associate
B.Sc. (Hons) (UTM), M.Sc. (UTM),
Ph. D (Durham, U.K)
Expertise :
Electroanalytical Chemistry and Materials Chemistry

Dr. Mohammed Husham Mohamed Ali
Post Doctoral
PhD. Applied and Engineering Physics (USM)
Expertise :
Synthesis and Characterization of nano-structured Semiconductors for Electronics, Optoelectronics and Biomedicine.

Rosiah Osman
Research Officer
B.Sc. The University of Southwestern Louisiana (Lafayette), M. Sc. Universiti Putra Malaysia
Expertise :
Electrical and Electronics Engineering

Mohd Wafi Azimin Muhammad Jan
Assistant Engineer
Certificate of Electronic Communication
Expertise :
Electronics Communication

FIELD OF STUDY



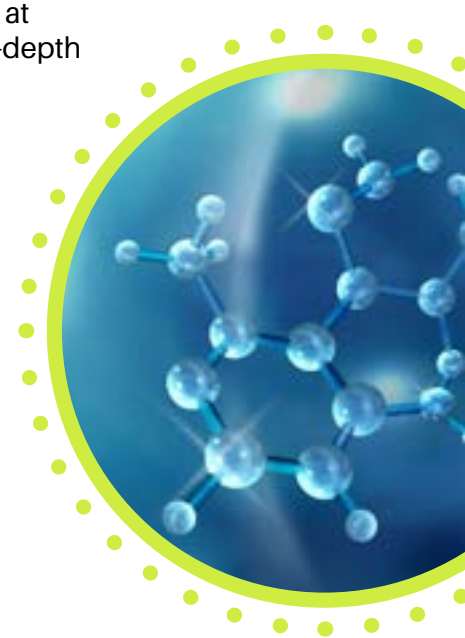
Nanomaterials

Nanomaterials exhibit novel and superior physical and chemical properties, phenomena and processes, which are different from those of bulk materials. Metal nanoparticles have been intensively studied recently due to their novel optical, electronic, magnetic and electrochemical properties. In particular, silver nanoparticles have many potential applications in optical waveguides, optical switches, molecular identification, catalysis, pronounced surface plasmon resonance absorption, surface enhanced Raman scattering and surface-enhanced fluorescence. The properties of metal nanoparticles depend on several factors such as the electron density, size and shape of the nanoparticles, dielectric constant of the medium. The group has embarked on the preparation of polymer/metal nanocomposites by reduction of g radiation, chemical and physical methods. Various characterization techniques are employed including SEM, TEM, XRD, UV-visible spectroscopy and electrical properties.

Nanotechnology has become one of the most important and exciting forefront fields. Various devices in the nanoscale will be created in the near future. Demands for nanosized materials are increasing due to new inventions and innovations in nanotechnology. One of nanomaterials that have garnered the interest of researchers in the world is CNTs which deemed to change the scale of our current equipment. Based on the need of rising interests in synthesizing CNTs for nanotechnology, commercial PLAD systems and components with low start-up cost must also reached the market . We have designed an inexpensive new chamber for the pulsed laser ablation deposition (PLAD) system to synthesis carbon nanotubes (CNTs). A T-shaped steel vacuum chamber was designed which has a cylindrical shape, with diameter of about 15cm and 45cm length.

Advanced Materials

Advanced Materials Engineering is designed to train students in the materials and processes fields, for the purpose of integrating them in high-tech and traditional technological industries or in materials research at advanced degree levels. This program aims at preparing students with in-depth multi disciplinary knowledge, current issues and practices in the field of Advanced Materials such as composite, ceramic, electronic materials, magnetic material, smart material, plastic and polymer.



Green Engineering

Green Engineering is the process and design of products that conserve natural resources, and impact the natural environment as little as possible. The term is often applied to system or device that requires engineering, and incorporates sound environment principles. Though green engineering is somewhat more expensive, many countries, recognizing the value of such work, have begun to offer tax breaks, and other incentives to those who incorporate its use.

Nanotechnology

This program aims at preparing students with knowledge related to Nanotechnology which deals with developing materials, devices, or other structures possessing at least one dimension sized from 1 to 100 nanometres. Nanotechnology is the study of manipulating matter on an atomic and molecular scale. Nanotechnology entails the application of fields of science as diverse as surface science, organic chemistry, molecular biology, semiconductor physics, microfabrication. Some of typical applications of nanotechnology are in sensor, in delivery system, nanoabsorbents, nano electronic, nano machine, nanocomposites, nanotubes, and nanocarbons.

Energy

The field of energy engineering covers both fundamental and applied research that involves development, design and usage of alternative energy, renewable energy and sustainable technology. Renewable energy covers solar, wind, hydro, tidal, biomass and hydrogen energies. Research areas for renewable energy covers machine development, instrumentation, energy generation, energy storage that are environmentally friendly. For development of solar energy system, its instrumentation covers solar tracking device, modification of stirling engine, water drainage system, solar mirrors and smooth operation for the energy generation for a solar bowl. Wind farm requires a generation system, energy distribution and energy storage facilities. Development of gasifier and purification of synthesis gas for generation of electrical energy direct from oil palm biomass and generation of gases from biomass and some aspects of biomass energy generation. Animal tracking system and development of automatics methane gas generation are challenges for this research. Development of smart window, smart chimney and use of photo voltaic in creating a healthy indoor environment are part of sustainable technology. Students are required to take courses in related fields as stated and to conduct research as well as presenting research results in seminars.

Sensor Technology

Sensor Technology Engineering is the design and development of sensors to meet the need of the growth in products and services that utilize information from different types of sensors. Sensor technology has a very important role as the key technology to support a wide variety of research and industrial application. It is also a vital element that can be applicable in agriculture, water security, environment and green technology. The term is applied mostly in development of sensor networks, which also include wireless sensor networks (WSN). Although sensors can include electronic sensors, biosensors, and chemical sensors, the focus will be on the development and design of the electronic sensors.

Credit : Marina (CosCOmm)

POST GRADUATES

PROGRAM	NATIONALITY	NO. OF STUDENT
PhD	Malaysia	56
	Iran	13
	Iraq	7
	Nigeria	5
	China	1
TOTAL		83

Number of Ph.D Students in 2016

PROGRAM	NATIONALITY	NO. OF STUDENT
Master	Malaysia	45
	Iran	3
	Iraq	1
	Nigeria	3
	Yemen	1
TOTAL		53

Number of Master Students in 2016

YEAR	2015	2016	Total
Master	9	9	18
PhD	9	10	19

Number of Students Graduated in 2016

Linkages & Networking

Visit to Schiffs & Industrie Technik (M) Sdn. Bhd.

February 25th, 2016. A group of 8 researchers, led by Assoc. Prof. Dr. Suraya Abdul Rashid visited Schiffs-& Industrie Technik (M) Sdn Bhd (SIT), located in Petaling Jaya, Selangor on Visitors were greeted by SIT's Managing Director, Mr. Marizan Nor Basirun and its Marketing Manager, Ms. Aliaa Marizan.

SIT is a manufacturer of CD92 systems which are able to reduce fuel wastage and improve fuel consumption. They also produce alternative diesel oil for commercial use which is called Orimulsion and Biofuel. If treated by CD92, these fuels can be combusted in engines and boilers efficiently. The deployment of CD92 systems is believed to improve engine management and also helps reduce maintenance, repairs and spare parts costs. Importantly, this system fulfills the requirements for environmental friendly operation by reduction of oil sludge and exhaust gas emissions.

A short discussion on the current products and research conducted by SIT was held followed by a two hour factory visit. The visit has given a new insight for MPTL researchers in emulsion fuel research and manufacturing.

Schiffs and Industrie Technik (M) Sdn. Bhd visit to ITMA

May 13, 2016, ITMA – ITMA received visitors from Schiffs and Industries Technik (M) Sdn. Bhd (SIT). A group of six people was led by SIT's managing director Mr. Marizan Nor Basirun and their marketing manager Ms. Aliaa Marizan. Visitors were greeted by Head of Materials and Processing Technology Laboratory, Assoc. Prof. Dr. Suraya Abdul Rashid and her team.

During the visit they were briefed on ITMA's history, background and achievements. They were also informed on facilities and services provided by ITMA. A short discussion took place on nano WiDE fuel and water diesel emulsion followed by future ITMA-SIT's research collaboration. The discussion opened up new networking opportunity and spark ideas between two parties on how to improve emulsified fuel for combustion process.

In the last session, visitors had a tour to Field Emission Scanning Electron Microscope (FESEM) room and Materials and Processing Technology Laboratory. They were very excited after seeing the high technology facilities and services in ITMA. The visit ended at 6 pm and we hope further collaboration between ITMA and SIT's will materialize soon.

WAMN 2016

(Workshop on Advanced Materials & Nanotechnology)

August 24, 2016,The Everly Putrajaya - Materials Synthesis and Characterization Laboratory ITMA has organized Workshop on Advanced Materials and Nanotechnology 2016 (WAMN2016) themed Nanodelivery.

A total of 70 participants attended this program and this program was officiated by the Director of ITMA Prof. Dr. Nor Azah Yusof. Participants are made up of researchers and students of UPM and also FRIM.

This program include the presentations from Japanese speakers which are Prof. Dr. Yuko Ikeda and Prof. Dr. Hirofumi Tanaka. While local speakers were Prof. Dr. Abdul Rahman Mohamed, USM, Dr. Abdul Kadir Masrom, MOSTI, Prof. Dr. Zobir Mohd Hussein, Prof. Dr. Zulkarnain Zainal da Prof. Prof. Dr. Janet Lim Hong Ngee from UPM.

The program also included a Best Poster Competition participated by the participants of the workshop. Three participants were selected as the winner and each of them won a cash prizes.

FACILITIES IN ITMA

NOVA NANOSEM 230 FESEM

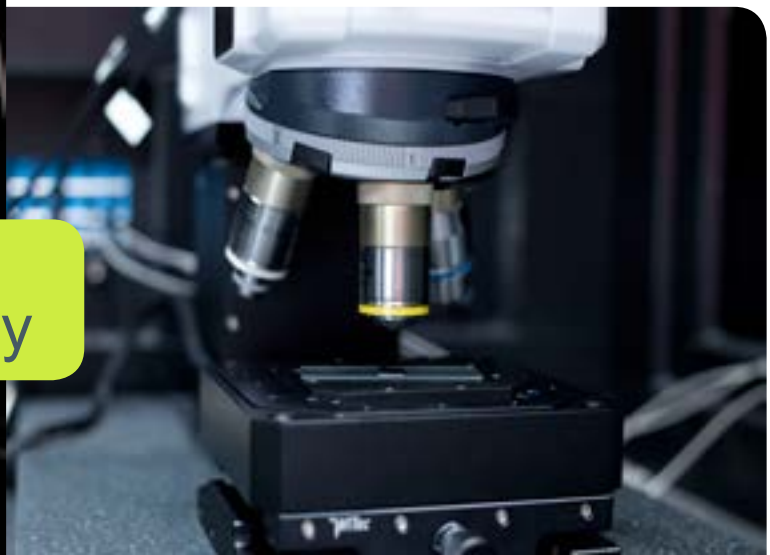
Ultra High Resolution Scanning Electon Microscope (FESEM) with Energy Dispersive X-Ray (EDX).

Able to produce enlarged images of a variety of specimens, achieving magnifications of over 500,000x providing ultra-high resolution imaging in a digital format. This equipment has two operating vacuum modes to deal with different types of sample i.e high vacuum (HiVac) dan low vacuum (LowVac).

ALPHA 300R RAMAN Spectroscopy

Able to determine the chemical structure of a sample and identify the compounds present by measuring molecular vibrations.

Available laser excitations are 488nm, 532nm and 633nm. There are several types of analyses such as single spectrum, mapping and line scanning.



UP PLUS 2
3D Printer

Precision Output : 10 Microns - 50 Microns
"Z" Thickness Resolution : 150 Microns - 400 Microns
Support Material : Smart Break-away support automatically generated by the 3D Printer

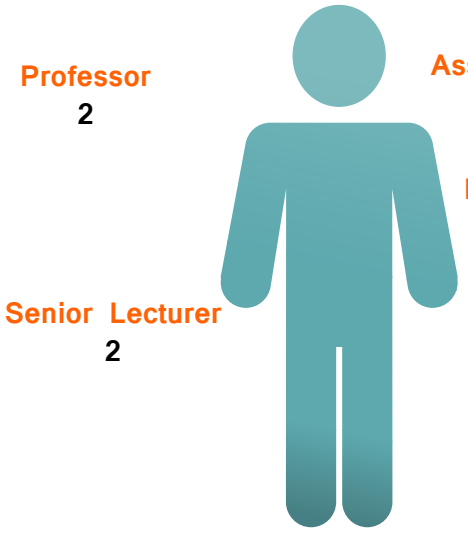
For those who need the analysis services using the above equipment, please fill the application form from Institute of Advanced Technology (ITMA) website and send to :

Email : itma_analysis@upm.edu.my
Fax : 03-8946 7006
Website : www.itma.upm.edu.my

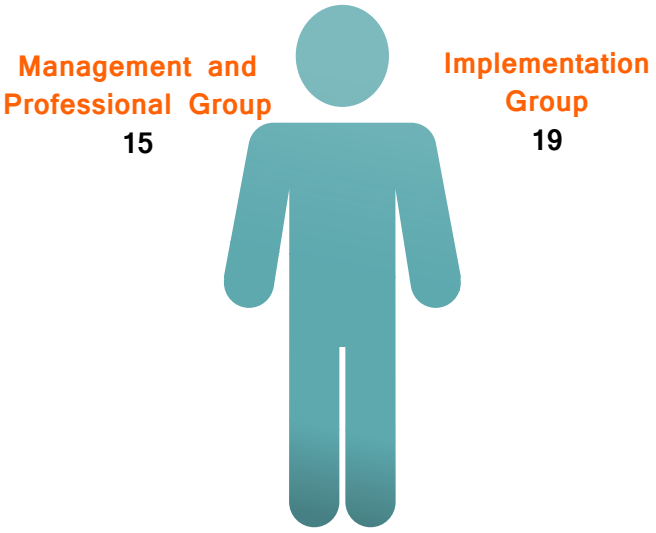
Human Resources

POST in ITMA

In 2016, ITMA has 51 staffs including 17 from academic position and 34 from non-academic position.



Number of Academic Position



Number of Non-Academic Position

Overall Total Staff by Grade in 2016

Position	Grade	Status		
		Permanent	Contract	Total
Professor	VK7	1	-	2
Associate Professor	DS54	4	-	3
Research Fellow	UDQ10 UDQ8 UDQ5	-	1 3 1	5
Post Doctoral	UPD10-1 UPD 9-1	-	4 1	5
Management Officer	N44 N41	1	1	2
Publication Officer	N41	-	1	1
Research Officer	Q52 Q48 Q43/ Q44 Q41	1 1 4 1	-	7
Science Officer	C41	3	1	4
Assistant Engineer	C44	6	-	6
Secretary	N28 N27	1 1	-	2
Administrative Assistant	N19 N22	4 2	2	8
Operation Assistant	N4 N1	1 1	-	2
Driver	R3	1	-	1
Total		**33**	**15**	**49**

UPM EXCELLENCE SERVICES AWARD

Each year, UPM will hold a ceremony to recognize employees who demonstrate a standard of excellence in work and provide a significant contribution to Universiti Putra Malaysia. The award announcement was made in May, 10th 2016 and was formally acknowledged at the Gemilang Putra 2016 event and Workers Day 2016 celebration.

Three of ITMA's staff were selected to receive the Anugerah Perkhidmatan Cemerlang (Excellent Service Award) for year 2015. A heartfelt congratulations to the recipients and may this reward further motivate ITMA's staff to consistently excel in their positions and demonstrate integrity and a strong commitment to the mission and values of the institution.



APC 2015 Recipient
Sarinawani Abdul Ghani - Science Officer
Md. Kadri Masaud - Assistant Engineer
Zamzurina Abdul Wahab - Operation Assistant

"We are what we repeatedly do. Excellence then, is not an act, but a habit."
-Aristotle-

LIST OF COMMITTEES

ITMA PUBLICATION & WEBSITE COMMITTEE

Introduction

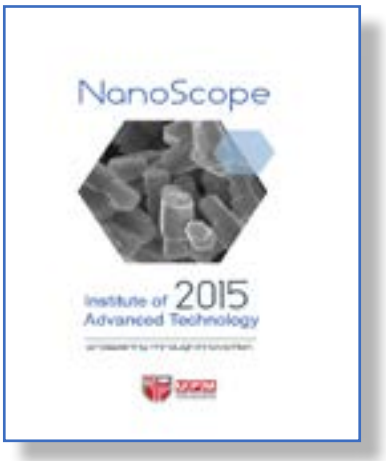
During the year 2015, ITMA's Publication & Website Committee managed to publish Nanoscope 2014 which has been distributed to all faculties, institutes and relevant centers of UPM. It is also given to visitors who visit our institute.

Committee Members

ITMA Main Publication & Website Committee
Chairman : Assoc. Prof. Dr. Suraya Abdul Rashid
Secretary : Muhamad Zuhairi Bin Zainul Abidin
Members :
News - Intan Helina Hassan
Annual Report - Marzieana Ab Rahman
Lab Reports Unit - Research Officers
Publicity / ITMA brochure - Marzieana Ab Rahman
Webmaster - Marzieana Ab Rahman
Publication Unit - Marzieana Ab Rahman
Cameraman - Muhammad Zuhairi Zainul Abidin
Photo Unit – Norliyana binti Mahat

Activities

a) Publication of NanoScope 2015.
a) Design brochures for MSCL, MPTL & FDL
b) Design and print banners, buntings & posters for programs organized by ITMA.
d) ITMA Publication & Website Committee has created a facebook page and Instagram as a communication channel so that the sharing of information can be made through the website and other social media effectively.



OCCUPATIONAL SAFETY AND HEALTH COMMITTEE

Introduction

ITMA's Occupational Safety and Health Committee (COSHC) was established for the following purposes:-

1. To ensure that ITMA complies with the Occupational Safety and Health Act 1994 (Act 514), the Atomic Energy Licensing Act 1984 (Act 304) and other related acts and regulations.

2. To carry out the internal inspection and be ready for occupational safety and health audit from UPM Occupational Safety and Health Office.

3. To carry out the investigations and accident studies, hazardous incident, occupational poisoning and diseases.

4. To plan, prepare and implement appropriate training programs on occupational safety and health.

5. To be responsible for any related matters on safety and health in ITMA and issue the directive thereon.

Committee Members

Chairman : Assoc. Prof. Dr. Khamirul Amin Matori (from 22 February 2015 - 17 August 2016)
Assoc. Prof. Dr. Abdul Halim Abdullah (From 1st Oktober 2016-present)

Deputy Chairman : Md. Ali Rani (from 12 May 2015 – present)
Secretary : Noor Lina Shamsuddin (2 November 2015)

Employer representative
Md . Ali Rani
Sarinawani Abdul Ghani
Roslina Abdul Rashid
Nurnazeera Zulkefli
Marzieana AB Rahman
Nazrul Abdullah

Employee representatives
Ab Haffiz Ab. Jalil
Mohd Wafi Azimin Mohammad Jan
Mohd Kadri Masaud
Zakky Yamanie Jamiauddin
Noor Lina Shamsuddin
Zamzurina Abdul Wahab

Activities

During 2016, ITMA OSHC has conducted several activities as follows:

Event : Workplace Audit by UPM OSH Team
Date : 6 Mac 2017

Event : Fire Drill Talk by UPM OSH Team
Date : 20 May 2016

Event : Fire Drill
Date : 26 May 2016

POSTGRADUATE CO-ORDINATOR

Introduction

The postgraduate coordinator's role is to monitor and complete the required candidature milestones (such as the core component of the structured program and annual review of progress) on time. Another role is to provide our students important sources of their study such as 24-hour access to students room and internet hotspot. We also help to provide useful sources of information from all around the world to our students to help them in their research or career advice.

The director of ITMA has the ultimate responsibility for the quality of supervision and the provision of resources for all postgraduate programs by research students within the institute. Our prospective students will be informed about the development components of the structured program offers the opportunity to acquire generic skills that may increase the employability, quality of research, high-impact publications and certificates will be awarded for any participation in training and courses.

Postgraduate Coordinator Members

Deputy Director : Associate Professor Dr. Mohd Nizar Hamidon
Administrative Officer : Norizanne Binti Abd Rahim
Administrative Assistant : Rokiah Deraman

Student Mobility (Inbound)

a) Institution :
National Institute of Technology Karnataka (NITK), Surathkal, India
Date : 10.05.2016 – 06.07.2016
Name : Yash Lara

b) Institution : Khartoum, Sudan
Date : 06.09.2016 – 06.02.2017
Name : Nada Hamid Talib Ismail

c) Institution :
Kyushu Technology University, Japan
Date : 10.10.2016 - 21.10.2016

Name :
1) Ihara Takeshi
2) Kawano Shota
3) Nagata Hiromu
4) Hayashida Norihiro
5) Matsumoto Shohei
6) Kurachi Kyohei
7) Seki Masaki
8) Uemura Shintaro
9) Maebashi Motoki
10) Maruno Hirotaka
11) Mizutani Koichi
12) Liu Weiguo
13) Hashimoto Ryunosuke
14) Mizuta Kazuhiro
15) Mouri Masayuki
16) Yamaguchi Erina
17) Kamikawatoko Atsuto
18) Hashimoto Kosei

Student Mobility (Outbound)

a) Institution :
Shinshu University, Nagano, Japan
Kyutech, Tobata Campus, Japan
Date : 12.12.2016 - 20.12.2016

Name :
1) Noor Diana Nordin
2) Norhidayah Azeman
3) Samaila Buda
4) Suhainie Ismail
5) Nazifah binti Ariffin
6) Intan Helina Hasan

ITMA LABORATORY ACTIVITIES

IN-DEPTH SEMINAR PRESENTATION

January 25th, 2016 - In-Depth Seminar Presentation entitled Refining, Fractioning, Texturization and Manufacturing of Edible Oil and Fats Downstream Product from Palm and Palm Kernel Oil was held at the Dewan Seminar, Faculty of Engineering. The seminar was organized by the Materials Processing and Technology Lab (MPTL) and was presented by Dr. Abdul Azis Ariffin. Dr. Abdul Azis has extensive experience in palm oil industry for about 30 years when he served as a research officer at Malaysian Palm Oil Board and Sime Darby. During the seminar, he shared his invaluable experience and practical knowledge to the attendees who consisted mostly of practitioners from the upstream and downstream of oil and fat industry.

Some of the seminar contents were principles and in depth understanding of refining, fractionation, texturization, and manufacturing of palm and palm kernel oil. The chemical and engineering aspects of oil refining activity and the effect of upstream oil input on processing for downstream oil products and its derivatives were also presented during the seminar. In addition, the chemical mix for manufacturing of edible food product, margarine,bread, chocolate to name a few were also shared with participants.

The benefits of the seminar include a greater understanding of activities and contributions of the respective planters, millers, and refiners which will lead to production enhancement and provide greater scope to generate more downstream products. This seminar was designed to allow especially refiners to appreciate more by having in depth understanding on the chemistry and engineering of the system that has made Malaysia rich. It also offered a deeper understanding in refining, fractionation, texturization and manufacturing process of multitude downstream edible products.

List of industries :

1. Intercontinental Speciality Fats Sdn Bhd
2. Keck Seng (M) Bhd
3. Outspan Malaysia Sdn. Bhd
4. Sime Darby Jomalina Sdn. Bhd.
5. Sime darby Research Sdn. Bhd.
6. Sinaran Palm Services Sdn. Bhd.
7. Lembaga Minyak Sawit Malaysia (MPOB)
8. Genting Musimas Refinery Sdn. Bhd.
9. Living Essentials Department, Mitsubishi Corporations

WORKSHOP ON GAS CHROMATOGRAPHY: FUNDAMENTALS, APPLICATIONS AND PRACTICAL

March 17th, 2016 - The Materials Processing and Technology Laboratory (MPTL) has successfully organized the Workshop on Gas Chromatography (GC): Fundamentals, Applications and Practical. The main objective of this workshop was to provide basic understanding on the fundamentals of chromatography, GC analysis and hands on testing.

The workshop began with a welcoming speech by the Head of MPTL, Assoc. Prof. Dr. Suraya Abdul Rashid. This one day workshop was facilitated by Dr. Umer Rashid, ITMA's Research Fellow who has over 10 years of experience in GC to characterize vegetable oil-derived specifically for biodiesel. The first part of the program was the talk session which was held at the MLA room, ITMA. The talks started with a brief explanation on fundamentals aspects of chromatography, introduction to GC system and its applications. It was later continued with GC analysis particularly on analysis for oil and its derivatives. The second part of the talk was the sample testing demonstration which was held at the Analysis Laboratory. There were demonstrations on sample preparation for biodiesel, hands on analysis and some basic handling tips of GC shared for the benefits of the committed participants.

19 participants attended this workshop which consisted of students and Science Officers from several faculties and institution in UPM. Lunch and a tea break were included and the workshop ended with certificate distribution session to all participants.

YOUNG SCIENTIST PROGRAM 2016

Bangi, April 2, 2016 - Functional Devices Laboratory, Institute of Advanced Technology (ITMA), Universiti Putra Malaysia (UPM) and Sekolah Menengah Sri Al-Amin Bangi had jointly organized a young scientist program namely 'Program Saintis Muda' which was held in the school's main hall. This event was done in collaboration with IEEE EDS under EDS-ETC Program which enables EDS chapter members to visit local schools to engage young students in the field of electrical engineering.

There were about thirty students who participated in the program. The program was divided into three sessions. The first session was for ice-breaking where the students enhanced their intelligence by playing puzzle blocks. In the second session, the students utilized the easy-to-use Elenco Snap Circuits® kits which gave them hands-on experience in assembling a series of electric circuits for some electronic applications. In the third session, the students had to design a water sensor circuit with the guidance from the facilitators. Besides the three sessions, there was an exhibition on solar panel power generation.

All the students seemed to be excited and satisfied with the program. The program ended with certificate give-away ceremony and a photo-session.

DYE-SENSITIZED SOLAR CELLS WORKSHOPS & HANDS ON TRAINING (DSSC)

Institute of Advanced Technology, Universiti Putra Malaysia, had organized the Workshop on 'Dye-Sensitized Solar Cells Workshops & Hands On Training (DSSC). The program was organized by Functional Devices Laboratory Institute of Advanced Technology (ITMA).

The program was supervised by Assoc. Prof. Dr. Suhaidi Shafie and attended by 30 participants who were divided into three groups. Activities of each group was held on 10 October 2016 until 21 October 2006 for the first group, 17 October 2016 until 28 October 2016 for the second group and 24 October 2016 until 4 November 2016 for the third group. The participants consisted of 18 students from Kyushu Institute of Technology (Kyutech), while another 12 were students of Universiti Putra Malaysia.

This program is the second series after the DSSC Workshop held in 2015. Among the contents of the program were activities that include laboratory experiments for the development of solar cells by using flowers and local fruits .Meanwhile for the introduction of the session, the participants also visited UPM's Malay Heritage Museum. The purpose of this visit was to introduce the Malay culture to the participants, especially participants from abroad.

ITMA ACTIVITIES

PROGRAM TRASFORMASI NEGARA (FIT UPM)

KBN Ulu Sepri, Rembau, Negeri Sembilan, August 14, 2016 - Bahagian Penjana Modal Insan (BMI) has organized the Program Transformasi Warga Kerja Universiti Putra Malaysia (UPM)on 12 to 14 August 2016 in KBN Ulu Sepri, Rembau, Negeri Sembilan.

A total of 88 participants attended the program which was held to foster a sense of nationhood and identity. Participants consisted of staff from ITMA, Institute of Bioscience, INSPEM, Halal Products Research Institute, the Institute of Agriculture and Food policy, IPSAS and INTROP.

Among the programs was the speech by the Deputy Vice Chancellor of Student Affairs and Alumni (HEPA), UPM, Prof. Dato 'Dr. Mohammad Shatar Sabran and six (6) exercises slots related to constitutional analysis. This program ended with a lecture entitled 'Malaysia Negara Berdaulat' presented by Senior Assistant Director of Human Capital Generators, Mr. Ardi Putra bin Darus.

ITMA GRADUATION CEREMONY 2016

Institute of Advanced Technology, October 19, 2016 - ITMA for the first time held the Graduation Ceremony 2016 for students who were graduated during the 40th UPM Convocation Ceremony 2016. All student supervisors, administration officers and students were invited to the Graduation Ceremony.

On that day, we had a very special guest, Mr. Ebrima Jawara, Financial Attache from The Embassy of The Islamic Republic of The Gambia. He was invited by Dr. Lamin Sanyang as he was the recipient of Best PhD Student in ITMA. He finished his PhD Program in 4 semesters and he was supervised by Prof. Dr. Sapuan Salit @ Sinon.

Moreover, Best Master Student in ITMA awarded to Miss Nur Alia Sheh Omar. She finished her Master Program in 4 semester and supervised by Dr. Yap Wing Fen. All her family members were at the ceremony to celebrate her special day.

AWARD: BEST PHD STUDENT
(Dr. Muhammad Lamin Sanyang)

AWARD: BEST MASTER STUDENT
(Miss Nur Alia Sheh Omar)

FAMILY DAY ITMA 2016

National Botanical Garden, October 1, 2016 - ITMA has organized ITMA Family Day 2016. The program was organized by ITMA Social Welfare Club to thank the employees for their hard work and effort they have put into throughout the year.

The theme of the program was "Mengeratkan Silaturrahim, Pemangkin Kecemerlangan Kerjaya " and were officiated by the Deputy Director of ITMA Associate Professor Dr. Mohd Nizar Hamidon.

The total number of participants were 80 persons, comprising 17 families.

To spice up the program, the committee had developed several games for children and adults followed by a lucky draw at the end of the session.

MUSTAFA PRIZE: THE SCIENCE AND TECHNOLOGY EXCHANGE PROGRAM (STEP) IN ISLAMIC COUNTRY

UPM Chancellory Hall, Disember 19, 2016 – Universiti Putra Malaysia had collaborated with Mustafa Prize Secretariate in the organization of the Science and Technology Exchange Program (STEP) in Islamic Countries themed Nanoscience and Nanotechnology.

ITMA participated as a participant and exhibitor at the 2016 STEP program which was conducted at the Chancellory Building Universiti Putra Malaysia. The purpose of this program was to promote science and technology and foster cooperation among great scientists of the Islamic State, who participated as a foreign delegation at STEP 2016.

This program which ran for two days was inaugurated by Professor Datin Paduka Dr. Aini Ideris, Vice Chancellor of UPM. Among the topics of discussion at the forum held on the second day was "How to Produce Environment For Discovery and Creativity at the University and the Research Institute".

The forum also discussed how to encourage researchers not to only focus on patenting their research or only produce high-impact publications but should also focus on producing products or machines that can be used by the industry.

"In Egypt, less than 1% of the industry that want to collaborate with the university because they are more focused on generating revenue. Therefore the researchers and students need to know how to stay committed in transforming the results of research to the prototype that can attract the interest of the industry, "said Prof. Wael Mamdouh from American University in Cairo.

Hopefully through this program will benefit not only to researchers from the field of nanoscience and nanotechnology, but also improve the scientific synergy in Islamic countries.

ITMA VISIT TO SHINSHU UNIVERSITY, JAPAN

Japan, December 12 ,2017 - Research cooperative relationships between Universiti Putra Malaysia and Japanese Universities are becoming stronger following the activities that have been carried out with Shinshu University and Kyushu Institute of Technology (Kyutech).

On December 14th and 15, ITMA and Shinshu University (SU) organized a visit by ITMA to Shinshu University and Seminar Presentation SU - UPM 2016 in Nagano. The participants were Prof. Dr. Nor Azah Yusof (Director of ITMA), Assoc. Prof. Dr. Mohd Nizar Hamidon (Deputy Director of ITMA), Assoc. Prof. Dr. Suhaidi Shafie (Head of FDL), Assoc. Prof. Dr. Suraya Abdul Rashid (Head of MPTL), Dr. Ismayadi Ismail (Research Officer of MSCL), Prof. Dr. Norhisam Misron (Research Associate of FDL), Intan Helina Hasan (Research Officer of FDL) and accompanied by institute officer Norizanne Binti Abd Rahim. Students from the ITMA, Syazwan Afif Mohd Zobir and Noordiana Noordin also joined the visit. On the first day, participants were brought to visit the Shinshu University in Matsumoto. In the morning, participants also visited Matsumoto Castle and were shown around the campus. In the afternoon a meeting was held with the President of Shinshu University, Prof. Kunihiro Hamada and also Prof. Kiyoshi Tanaka (Vice-President) and Professor Dr. Soichiro Nakamura (Executive Vice President). A discussion on university research strategies between the two universities lasted for 2 hours. The next day, a visit to a solar laboratory Campus Shinshu University in Nagano held in the morning and Research Presentation Seminar held at the Seminar Hall of Shinshu University in which 10 presenters included researchers from the ITMA and Shinshu University. The seminar was also attended by postgraduate students from SU.

Campus Visit At Shinshu University, Japan, Nagano Prefecture, Matsumoto, Asahi, Japan
(14 December 2016)

Visiting Matsumoto Castle Near Shinshu University Matsumoto Campus
(14 December 2016)

The 4th Symposium on Applied Engineering and Sciences (SAES2016) was held at Kyutech Tobata Campus on December 17th and 18th. Kyutech and UPM has been organizing this Symposium since 2013 which has greatly contributed to enhance research collaborations between KYUTECH and UPM. There were 9 participation from ITMA who gave oral and poster presentations.

Apart from the Keynote and plenary sessions, and the oral and poster presentations, other sessions were carried out in parallel sessions such as SATREPS session, Japan-Malaysia Science & Innovation network session (co-hosted with JETRO and Kyushu Economic Federation), and International Research Unit Workshop. The Symposium ended with great success with the largest number of participants exceeding more than 280 people, not only from Malaysia and Japan, but also other countries including the United States, Mexico, Turkey, India and Korea. The 5th Symposium (SAES2017) will be hosted by UPM in Malaysia in December 2017.

Meeting with Shinshu University President, Dr. Kunihiro Hamada, Vice President, Prof. Dr. Kiyoshi Tanaka and Executive Vice President, Prof. Dr. Soichiro Nakamura at Shinshu University Matsumoto Campus Meeting Room (14 December 2016)

Shinshu University – Upm Seminar at Shinshu University, Wakasato, Nagano Campus (15 December 2016)

2016 PICTORIAL

Brain Like devices based on carbon Nanotube based composites by Dr. Termeh Yousefi Amin (19 Feb 2016)

Density Functional Theory (DFT) Calculation Talk : A tool in Material Science and Reaction Mechanisms (17 Feb 2016)

Seminar Harta Intelek at UPM (22 Feb 2016)

OSH Race 2016 (22 April 2016)

Fire Drill (26 May 2016)

ITMA Hari Raya Celebration (13 July 2016)

Seminar on Robotic in Future Agriculture
(19 July 2016)

ITMA Innovation Open Day (20 July 2016)

Workshop on X-Ray Diffraction by Dr. Lim Kean Pah (27 July 2016)

Workshop on Advanced Materials and Nanotechnology 2016 (24 August 2016)

ITMA Graduation Ceremony 2016
(19 October 2016)

Pameran Penyelidikan & Inovasi (PRPI2016)
(15 November 2016)

Workshop on Indepth Study of Cyclic Voltametry
Talk (17 November 2016)

FURTHER INFORMATION

Contact Us

ITMA Publication
Institute of Advanced Technology
Universiti Putra Malaysia
43400 UPM Serdang, Selangor

T : +603-8946 7834
E : itma@upm.edu.my
W: www.itma.upm.edu.my

www.facebook.com/instituteofadvancedtechnology

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