

**MATERIALS SCIENCE AND TECHNOLOGY RESEARCH CLUSTER**

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| RESEARCH CLUSTER CODE               | MST   |
| NO. OF PROGRAMME                    | 4   |
| NO. OF GROUP                        | 13  |
| NO. OF RESEARCH CENTRE              | 1   |
| SYNOPSIS                            | <p><i>Materials science &amp; technology research cluster covers various multi and transdisciplinary research programs that converge on the integration between fundamentals and technology in response to the challenges to enhance human productivity. Among the focus areas are Composites Technology, Functional and Structural Materials, Catalysis Science and Technology, and Nanomaterials and Nanotechnology. There are still significant inroads to be made in these multidisciplinary areas as we are facing energy and natural resource depletion challenge in the years ahead. Therefore research in material science and technology must be enhanced to ensure sustainability of produce materials and products. Since Malaysia is blessed with abundant of biomass resources and UPM itself is rich in biodiversity, the R&amp;D should exploit this strength to come forth with sustainable material science and technology. Consequently, we focus mainly on bio-based materials, polymers, glass and ceramics, catalysts, nanomaterials and nanotechnology, smart materials, composites, sensor materials, metals and alloys, electronics and optoelectronics materials, magnetic and superconducting materials.</i></p>  |
| DESCRIPTION<br>(with NABC elements) | <p><i>Materials science and technology is the area of research that transforms Earth's materials through extraction and fabrication into useful products. Portable phone, electrical appliances, automobiles, and computers are made possible through interdisciplinary efforts of material science, technology, architecture, engineering, and social science to enhance the human productivity. It's difficult to quantify exactly the economic value of materials technology but the absence of it will cripple the whole economic system. The R&amp;D effort should also become one of the priority research clusters in any leading R&amp;D institution such as UPM. Since Malaysia is blessed with abundant of biomass resources and UPM itself is rich in biodiversity, the R&amp;D should exploit this strength to come forth with sustainable material science and technology. This would include sustainable technology in advanced composite, nanotechnology, functional and smart materials, and catalysis. Among the potential projects to be explored include kenaf fiber composite, carbon nanomaterials and graphene from biomass, dolomite based catalyst, and biodegradable materials. Strategic partnership with leading universities such Kyutech, Shinshu, Cambridge and MIT would significantly enhance the R&amp;D by exploiting the Partner University advanced R&amp;D combining with UPM R&amp;D strength in agro-based materials to emerge with sustainable material science and technology. Partnership with industry would encourage industry driven innovation research that would generate IP and support commercialization activities. The research cluster certainly has the potential to contribute significantly and importantly in academic publications but more importantly would have lasting impact to the world community to live sustainably while enjoying wealth of materials. No monetary value can be possibly put into sustainable materials science and technology as sustainable meaningful life is priceless.</i></p> |

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| Code  | Research Programme   | Synopsis  | Leader of Research Programme                                       | Research Groups  |
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| MST01 | Composites Technology<br>- Engineering Composites<br>- Bio-composites Technology | Advanced composites are composites with high-performance characteristics, generally strength and stiffness, and they are called high performance composites. Advanced composites could also be used to describe composites that can produce parts at sufficient speeds and low enough costs to obtain them cost-effectively. These composites are normally termed cost-performance composites. In this research programme, both high-performance composites as well as cost-performance composites are covered. Current Research Group in Advanced Composites Research program include Engineering Composites, Bio-composite Technology and Design, Fibre characterization and processing, and Phytoresources, Selection and Plantation.  | Prof. Ir. Dr. Mohd. Sapuan Salit (FK)<br><br>sapuan@eng.upm.edu.my | 1. Engineering Composites - Prof. Ir. Dr. Mohd. Sapuan Salit (FK)<br>2. Fibre Characterization & Processing Technology - Prof. Madya Dr. Edi Suhaimi Bakar (INTROP)<br>3. Biocomposite Technology and Design - Dr. Dayang Laila Abang Abdul Majid (INTROP) |
| MST02 | Catalysis Science and Technology   | Catalysis is a technology which increases the rate of a chemical reaction. It is an essential technology for chemical and materials manufacturing, for fuel cells and other energy conversion systems, for combustion devices, and for pollution control systems which greatly impact everyone on our planet. Catalysts will be used to produce clean energy from renewable energy sources, such as hydrogen for fuel cells and transportation fuels from non-edible biomass. Current research topics in the Catalysis Science and Technology Research Centre (PutraCAT) UPM include solid states chemistry, surface chemistry, material chemistry, nanomaterials, petrochemicals, oleochemicals and biomass conversion to chemicals and biofuels.<br><br><b>Keywords:</b> Heterogeneous Catalysis, Nanocatalysts, Renewable Energy | Prof. Dr. Taufiq Yap Yun Hin (FS)<br><br>yap@science.upm.edu.my    | 1. Catalysis Science and Technology - Prof. Dr. Mohd Zobir Hussein (RC / FS)   |
| MST03 | Functional and Structural Materials  | Functional materials are generally characterised as those materials that display  | Prof. Dr. Abdul Halim Shaari (FS)                                  | 1. Materials Processing and Technology - Dr. Mohd Amran Mohd Salleh (ITMA)   |

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|       |                                  | <p>ferroelectricity, superconductivity, piezoelectricity, magnetism, energy storage functions etc. Functional materials are found in all classes of materials - ceramics, metals and polymers (organic and non-organic).</p> <p>Smart materials are materials with specific properties, inducing them to react to external stimuli. These external stimuli are e.g. light, acidity, temperature, magnetic fields, and mechanical loads. The reaction can yield various results, such as changes in viscosity, colour, shape.</p> <p>Processing of functional and smart materials is of critical importance as it can lead to enhancement of particular functional properties. These materials are often used in electromagnetic applications from KHz to THz, at optical frequencies and are also of critical importance in materials for energy such as electro- and magnetocaloric materials, for energy storage and for solar harvesting functions.</p> <p>Current projects include</p> <ul style="list-style-type: none"> <li>• Novel multiferroic bulk and thin films</li> <li>• Multifunctional oxides – materials to devices</li> <li>• Molecular thin films: growth, magnetism and spintronic applications</li> <li>• Soft Functional Materials – the synthesis, characterisation and application of organic and macromolecular materials.</li> <li>• Smart piezoelectric sensors and actuators</li> <li>• self-healing materials and bio-mimetic materials (materials that resemble natural materials)</li> </ul> <p><b>Keywords:</b> Ferroelectricity, piezoelectricity, magnetism, energy storage functions, smart sensors</p> | <p>ahalim@science.upm.edu.my</p>                                     | <ol style="list-style-type: none"> <li>2. Analytical Method and Material - Prof. Madya Dr. Abdul Halim Abdullah (FS)</li> <li>3. Materials Chemistry - Prof. Dr. Zulkarnain Zainal (FS)</li> <li>4. Magnetic and Superconducting Materials Group - Prof. Dr. Abdul Halim Shaari (FS)</li> <li>5. Polymer and Derivatives - Prof. Dr. Luqman Chuah Abdullah (INTROP)</li> <li>6. Condensed Matter - Prof. Dr. Zainal Abidin Talib (FS)</li> </ol> |
| MST04 | Nanomaterials and Nanotechnology | <p>Nanomaterials is a field of study that takes fundamental science approach to nanotechnology. It covers materials with special</p>  | <p>Prof. Dr. Robiah Yunus (ITMA/FK)</p> <p>robiah@eng.upm.edu.my</p> | <ol style="list-style-type: none"> <li>1. Nano Materials &amp; Processing - Prof. Madya Dr. Suraya Abdul Rashid (ITMA)</li> <li>2. Nanomaterials Synthesis</li> </ol>  |

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|  |  | <p>properties stemming from their nanoscale size regime, 1-100 nm. The engineering and exploitation of materials at this size regime, the so-called nanotechnology, give impetus to new applications of nanomaterials due to their novel physico-chemical properties different from their bulk counterparts.</p> <p>Current research topics include a wide range of interdisciplinary research from fundamentals to applications. The nanomaterials of current interest are nanocomposites, nanodelivery systems, carbon nanostructures, nanocatalysts, ceramics and bioceramics, to be used for various structural and functional applications.</p> <p><b>Keywords:</b> Nanomaterials, Nanotechnology, Drug nanodelivery, Carbon nanostructures.</p> |  | <p>Programme - Prof. Dr. Mohd Zobir Hussein (ITMA)</p> <p>3. Nanostructured Polycrystalline Materials</p> |
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Tarikh Kemaskini: 27 Mac 2013