

CELEBRATING
COMMERCIALISATION
YEAR 2014

iiindex 2014

AN INTERNATIONAL EXPOSITION ON RESEARCH AND INNOVATION

invention
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exposition 2014

INNOVATEUR
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2014

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UNIVERSITI TEKNOLOGI MARA
MALAYSIA

*Bridging
the valley of death :
advancing the
commercialisation
of research*

RESEARCH BOOK

iiindex 2014

AN INTERNATIONAL EXPOSITION ON RESEARCH AND INNOVATION

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FOREWORD

The Honourable Minister of Science, Technology and Innovation (MOSTI) has launched 2014 as Malaysia Commercialisation Year 2014 (MCY2014) with the theme Science Technology and Innovation (STI) for Wealth Creation. In line with this theme, Invention, Innovation, Design & Exposition 2014 (iidex2014) is an annual exposition organized by UiTM and is the ultimate platform to highlight and commercialise new inventions and innovations. Researchers and inventors will exhibit their products which cater to the needs and wants of the community and the country.

The iidex2014 creates a new dimension by fusing two competitive concepts, a competition among innovative products and a competition to invite Innovateur Wannabes to perform live pitching of their products to the audience. The iidex2014 focuses on comprehensive commercialization and creating opportunities for entrepreneurs to carry out R&D as well as to provide avenue to commercialise their products. Through expositions such as iidex2014, MOSTI hopes to inculcate the culture of commercialisation of new technology designed and created by Malaysians.

I wish to congratulate all the participants of the iidex2014 and this is the opportunity for all researchers to show their ideas and exhibits their products and creativity. Apart from showcasing their products, innovators will have the opportunity to provide a window to the industry for business matching during the exposition.

Tan Sri Dato' Sri Sallehuddin Mohamed
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NEW ADVANCED IRRADIATED RUBBER TOUGHENED POYAMIDE 6/ HIGH DENSITY POLYETHYLENE FOR ENGINEERING APPLICATION

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This research is investigating at the effective toughening of polymer nanocomposites. Till to date little work has been done on combination of both polymer nanocomposites technology with polymer blend and rubber-toughening technology. It is interesting to look at the system where rubber-toughened thermoplastics blends combined with nanofillers. Besides, irradiation technique was incorporated in this research for new exploration. Therefore, the current research deals with the combination of nanocomposites, polymer blends, rubber-toughened thermoplastics and irradiation technique. The main objective of this research is to develop new advanced polymeric composite materials namely irradiated rubber toughened polyamide 6(PA6)/high density polyethylene (HDPE) nanocomposites and to investigate the effect of elastomer to the mechanical properties of rubber toughened PA6/HDPE nanocomposites. Besides, the performance of irradiated rubber toughened PA6/HDPE nanocomposite was also studied. Rubber toughened PA6/HDPE nanocomposite was prepared by melt blending using twin screw extruder followed by injection moulding. HDPE-g-MAH, montmorillonite (MMT) organoclay and ethylene vinyl acetate (EVA) were used as compatibilizer, reinforced materials and elastomer respectively. The mechanical properties were tensile, flexural, impact and hardness. Meanwhile thermal properties were characterized by Differential Scanning Calorimetry (DSC) and Thermogravimetric Analyzer (TGA). The functional group was proven by Fourier Transform Infrared (FTIR) spectrophotometer. Besides, X-ray diffraction (XRD) and transmission electron microscope (TEM) were used for morphology characterization. For optimum formulation, PA6/HDPE blends were blended with 1 to 5 phr of EVA with incorporation 3-7 wt% organoclay MMT in the presence of HDPE-g-MAH (2-8 wt%). The samples were cross-linked by electron beam and irradiated at the dosage range of 0-200 kGy and 3.0 MeV. The result found that incorporation of 2 wt% of HDPE-g-MAH and 5 wt% of organoclay increased the strength and stiffness but reduced toughness of the nanocomposite as earlier expected. The results exhibited enhancement of mechanical properties with incorporation of 1 phr EVA but slightly decreased for further addition of EVA content. Conversely, addition of EVA has greatly increased the impact strength and improved the toughness of the nanocomposite. The results indicated increased tensile strength, tensile modulus, and hardness at the dosage 150 kGy but slight decline at dose up to 200 kGy. XRD measurement indicated that MMT organoclay was exfoliated and intercalated during melt processing. The morphology was improved and become more homogenous after radiation and proven by TEM result. The FTIR result also showed the successful incorporation of MMT organoclay in PA6/HDPE blend and both samples with and without EVA presented almost the same trend. Meanwhile DSC test showed that degree of crystallinity, X_c was improved after irradiation. Finally, the results revealed that this new formulation advanced irradiated rubber toughened PA6/HDPE nanocomposite have balance of stiffness, strength and toughness at the dosage of 150 kGy.