UNIVERSITI TEKNOLOGI MARA

EFFECT OF IMPACT MODIFIER TO THE PERFORMANCE OF POLYAMIDE 6/HIGH DENSITY POLYETHYLENE NANOCOMPOSITE

FARIZAH BINTI HAMID

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Chemical Engineering

October 2014

AUTHOR'S DECLARATION

I declare that the work in this thesis/dissertation was carried out in accordance with the regulation of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of student	: Farizah Binti Hamid
Student I.D. No.	: 2011286358
Programme	: Master of Science
Faculty	: Chemical Engineering (EH780)
Thesis Title	: Effect of Impact Modifier to the Performance of Polyamide 6/High Density Polyethylene Nanocomposite
Signature of Student	:
Date	: October 2014

ABSTRACT

Blending of polyamide 6/high density polyethylene (PA6/HDPE=70/30 wt%) was prepared by melt compounding using a twin screw extruder followed by injection moulding. For optimum formulation, PA6/HDPE blends were blended with 1 to 5 phr of ethylene vinyl acetate (EVA) with incorporation of 3-7 wt% organoclay (MMT) and in the presence of HDPE-g-MAH (2-8 wt%) as compatibilizer. The effect of electron beam irradiation on mechanical properties of PA6/HDPE/EVA/HDPE-g-MAH/MMT nanocomposite were investigate at the dosage range of 0-200 kGy and 3.0 MeV. The mechanical properties of the samples such as tensile test, flexural test and elongation at break were measured by universal tensile machine. Hardness and impact test were measured using Zwich Roell hardness tester and Izod Impact Tester. The nanocomposites were characterized by Fourier Transform Infrared (FTIR) spectrophotometer, differential scanning calorimetry (DSC) and Thermogravimetric Analyzer (TGA). X-ray diffraction (XRD) and transmission electron microscope (TEM) were used for morphology characterization. The result revealed that incorporation of 2 wt% of HDPE-g-MAH and 5 wt% of organoclay increase the strength and stiffness of the sample but reduced the toughness property. The results exhibited enhancement of mechanical properties with incorporation of 1 phr EVA but slightly decreased for further addition of EVA content. The result shows the increasing of tensile strength and hardness at the dosage 150 kGy but slightly decline at dose up to 200 kGy. From XRD measurement, not all characteristic basal appear in the range of $2\theta = 2\text{-}10°$ which indicated that organoclay are exfoliated and intercalated during melt processing. The TEM result shows that the morphology was improved and become more homogenous after radiation. The FTIR result also shows the successful incorporation of MMT in PA6/HDPE blend and both samples with and without EVA presented almost the same trend. DSC test showed that degree of crystallinity, X_c was improved after irradiation. Meanwhile TGA test showed that both irradiated and unirradiated samples almost have same trend characterization.

ACKNOWLEDGEMENTS

بسم الله الرحمن الرحيم

I would like to express my gratefulness to Allah S.W.T. for giving me strength and wisdom in my research work. In preparing this thesis, I was in contact with many people including researchers, academicians, technicians and practitioners. I would like to forward my appreciation and utmost gratitude to my main supervisor Prof Dr Ku Halim Ku Hamid and my co-supervisor Suffiyana Akhbar. Special thanks to my second co-supervisor, Mohd Faizal from Malaysia Nuclear Agency, Bangi for his guidance and help. A loving gratitude to my dearest husband, Ahmad Shafiq Mohamad and my beloved parent for their understanding, moral support and motivated me to complete this research. I would also very thankful to postgraduate coordinator, Dr Junaidah Jai for her support and believe in me during my studies.

I'm very thankful to Universiti Teknologi Mara (UiTM) for providing good facilities in the campus and Malaysian Nuclear Agency for giving me permission to use all the equipments needed to complete my research. A big appreciation goes to Fundamental Research Grant Scheme (FRGS) Malaysia for financial support. Special thanks to all the technical staff in the Faculty of Chemical Engineering and Electron Beam Irradiation Centre (ALURTRON) in Malaysian Nuclear Agency for assist, information require and cooperation during the experiments carried out.

My sincere appreciation also extends to my family for their mental and physical support. Last but not least, all my fellow colleagues and others who have provided assistance at various occasions. Their views and tips are useful indeed. Thank you for the time sacrificed to accompany me.

TABLE OF CONTENTS