THE EFFECTS OF SECONDARY FILLER ON THE IMPACT BEHAVIOUR OF HYBRID POLYMER COMPOSITES

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Contents

2. Letter of Offer (Research Grant)

UNIVERSITI TEKNOLOGI MARA

PEMENANG Anugerah Kualiti Perdana Menteri 2008

Surat Kami : 600-RMI/ST/FRGS 5/3/Fst (161/2010)
Tarikh : 24 Ogos 2010

Dr Anizah Kalam
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Y. Bhg. Prof/Prof. Madya/Dr./Tuan/Puan

KELULUSAN SKIM GERAN PENYELIDIKAN FRGS FASA 02/2010

Tajuk Projek	:	The Effects Of Secondary Filler On The Impact Behaviour Of Hybrid Polymer Composites
Kod Projek	:	600-RMI/ST/FRGS 5/3/Fst (161/2010)
Bidang	:	Teknologi dan Kejuruteraan
Tempoh	:	01 September 2010 – 31 Ogos 2012 (24 bulan)
Jumlah Peruntukan	:	RM 43,860.00
Ketua Projek	:	Dr Anizah Kalam

Dengan hormatnya perkara di atas adalah dirujuk.

2. Sukacita dimaklumkan pihak Kementerian Pengajian Tinggi melalui surat JPT.S(BPKI) 2000/011/010 Jilid. 4 (4) telah meluluskan cadangan penyelidikan Y. Bhg Prof/Prof. Madya/Dr./Tuan/Puan untuk di biayai di bawah Skim Geran Penyelidikan Fundamental (FRGS) Fasa 02/2010.

3. Bagi pihak Universiti kami mengucapkan tahniah kepada Y. Bhg. Prof/Prof. Madya/Dr./Tuan/Puan kerana kejayaan ini dan seterusnya diharapkan berjaya menyiapkan projek ini dengan cemerlang.

4. Untuk tujuan mengemaskini, pihak Y. Bhg. Prof/Prof. Madya/Dr./Tuan/Puan adalah di minta untuk mengisi borang setuju terima projek penyelidikan dan menyusun perancangan semula bajet yang baru seperti yang diluluskan. Sila lihat lampiran bagi tatacara tambahan untuk pengurusan projek.

Sekian, harap maklum.

"SELAMAT MENJALANKAN PENYELIDIKAN DENGAN JAYANYA"

Yang benar

MUSTAFAR KAMAL HAMZAH
Ketua Penyelidikan (Sains dan Teknologi)

Penolong Naib Canselor (Penyelidikan) : 603-5544 2094/2095
Bahagian Penyelidikan : 603-5544 2097/2091/2101/5521 1462
Bahagian Perundingan : 603-5544 2100/2787/2092/2093
Bahagian Inovasi : 603-5544 2750/2747/2748
Bahagian Penerbitan : 603-5544 1425/2785
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5. Report

5.1 Proposed Executive Summary

Oil Palm fruit bunch fibre (OPFB) derived from empty fruit bunch (EFB) that are abundantly available in Malaysia as oil palm mill waste, is worthy to explore its capability as filler in composites. Previous work [1-2] showed that the addition of PPnanoclay into OPFB/PP composites has improved its tensile modulus, flexural properties and impact strength. The study has also found out that the combination of clay and coarser OPFB particles (250 μm) indicated more properties improvement [2]. Thus this study will further investigate the effect of clay as secondary fillers on the impact behaviour of OPFB/PPnanoclay/PP hybrid composites at various PPnanoclay loading and OPFB size of greater than 250 μm (however less than 500 μm within the capability of available injection moulding). The optimum PPnanoclay loading and OPFB size will be investigated for those composites. Thereby, hybrid composites consisted of oil palm fruit bunch (OPFB) fibre, polypropylene-clay (PPnanoclay) nanocomposite and pure polypropylene at various PPnanoclay loading and OPFB size will be compounded by using thermal mixer. The test samples will be prepared by using injection moulding machines. The composite samples will be characterized according to ASTM standard for tensile, flexural and impact tests. Fracture surface observation will also be conducted to have further understanding on the role of secondary filler in hybrid composites.

Some basic mechanical properties and the impact strength of the composites will be obtained to complement the existing data or information on OPFB filled polymer composites. The information is expected to be useful in promoting OPFB as natural filler in polymer composites especially for automotive application.

5.2 Enhanced Executive Summary

(Abstract of the research)

This study focussed on the usage of oil palm fruit bunch fibres as the secondary filler or reinforcement in polypropylene-clay nanocomposites. The main aim of this research was to achieve a greater understanding on the various parameters that contribute to the mechanical properties and to manipulate these parameters in order to produce an improved oil palm fruit bunch fibre reinforced polypropylene-clay composites. Characterization techniques, such as tensile test, flexural test, impact test and water absorption analysis were used to assess the effect of each parameter. OPFB/PP composites at four different sizes of 250 μm, 180 μm, 125 μm and 100 μm were investigated on the water uptake ability and were found to increase as the OPFB size increase. Meanwhile the thermal stability decrease at temperature range of 200°C - 450 °C. The investigations also showed that the tensile and flexural properties were increased with the increasing of OPFB size and indicated that the 250 μm OPFB/PP composites had the most enhances mechanical properties. PPnanoclay/PP composites were compounded at four PPnanoclay loadings of 10 phr, 25 phr, 40 phr and 100 phr. The water uptake of PPnanoclay/PP composites was found to increase as the PPnanoclay loading increase followed by the increase in thermal stability as well. Tensile tests, flexural tests and impact tests revealed that the optimum composite consisted of polypropylene with 25 phr PPnanoclay loading. Combination of OPFB and PPnanoclay as fillers in PP indicates that the tensile modulus, flexural modulus and flexural strength has increased at lower PPnanoclay loading and decreased at higher PPnanoclay loading. The optimum loading of PPnanoclay in OPFB/PPnnoclay/PP hybrid composites was also found to be at 25 phr. Further investigation on the effects of OPFB size in OPFB/PPnnoclay/PP hybrid composites showed that the 250 μm size gave the most mechanical properties enhancement. Properties improvement after OPFB treatment and increase of MAPP loading with the increase of OPFB loading suggested that the good bonding between filler and matrix contributed to the mechanical properties enhancement, decrease of water uptake and increase of thermal stability.