A STUDY ON THE EFFECT OF MECHANICAL PROPERTIES AND RHEOLOGICAL BEHAVIOUR OF POLYPROPYLENE REINFORCED MONTMORILLONITE

Normuhaizah Binti Mohd Zain (2006131637)

Advisor: Prof. Madya Nor Aini Wahab

Bachelor Of Engineering (Hons) Mechanical

Faculty of Mechanical Engineering, Mara University Of Technology (UiTM)

ISO 9001:2000 Cert. No. 404071

ABSTRACT

Objective:

i) To determine the mechanical properties of polypropylene reinforced montmorillonite nanocomposite with different concentration (2 wt%, 4 wt%, 6 wt% , 8 wt% and 10 wt%) of montmorillonite and neat polypropylene as a bench mark.

ii) To study the Rheological behavior of the polypropylene reinforced montmorillonite nanocomposite.

Methods :

In this research, the percentage of MMT nanoclay with different concentration (2 wt%, 4 wt%, 6 wt% , 8 wt% and 10 wt%) were used and neat PP as a bench mark. PP and MMT were mix by using Dispersion Mixer. The material was mixed at temperature 190°C. The next step, the mixer was fabricated by using hot press with 190°C for both upper and lower compressor. Mechanical properties of the sample were evaluated by tensile test, impact test, and three point bending test according to BS EN ISO 527, BS EN 60811 and BS 6319 respectively. The rheology behavior also studied.

Results :

Based on all the testing being done, the result showing that, the tensile modulus increased by addition of clay loading and they remain almost constant with further addition of MMT. It also increased the tensile strength but only at 2wt.%. By loading 4wt.% until 10wt.% of clay, the tensile strength were decrease but still large than the neat PP. The flexural strength and flexural modulus were decrease by about 59% compared to neat PP matrix and they remain almost constant with further addition of MMT content The highest energy absorb at the 4wt.% of MMT with 3.27 J by 29% increase from neat PP. The rheological behavior also determined. All the concentration have pseudoplastic characteristic, but the better pseudoplastic are 8wt.% of loading clay.

Significant : The main significant of this research will generally contribute to industries which make use of nanocomposite materials as mains component for product manufacturing especially in the automotive industries.

INTRODUCTION

Thermoplastic is a material that is plastic or deformable, melts to a liquid when heated and freezes to a brittle, glassy state when cooled sufficiently. One of the reasons for adding fillers to polymer is to improve their mechanical performance. In traditional composites, this often comes at the cost of a substantial reduction in ductility and sometimes in impact strength, because of stress concentrations cause by the fillers. Therefore, nanofillers have been used to overcome these problems, where it can improve the modulus and strength and maintain or even improve ductility because their small size does not create large stress concentration. Some of these properties that have a great impact when be added with the nanofillers. The main reason for these improved properties in nanocomposites is the stronger interfacial interaction between the matrix and layered silicate.

METHODOLOGY

Mixing of material

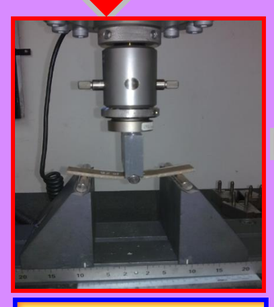
Crushing the composite

Hot press process (moulding)

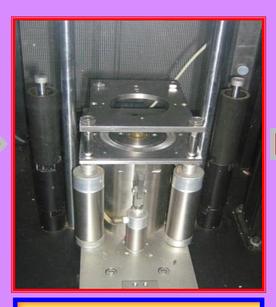
Hot press process

Cutting Process

Tensile test



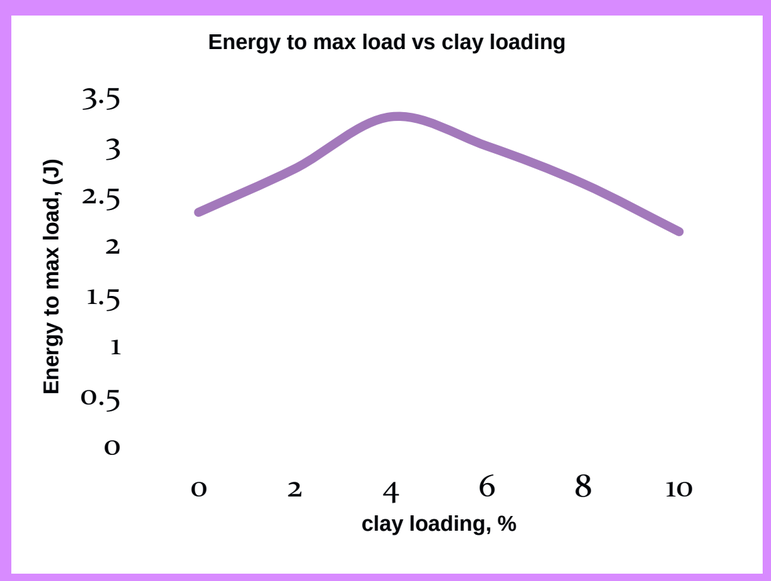
Flexural test



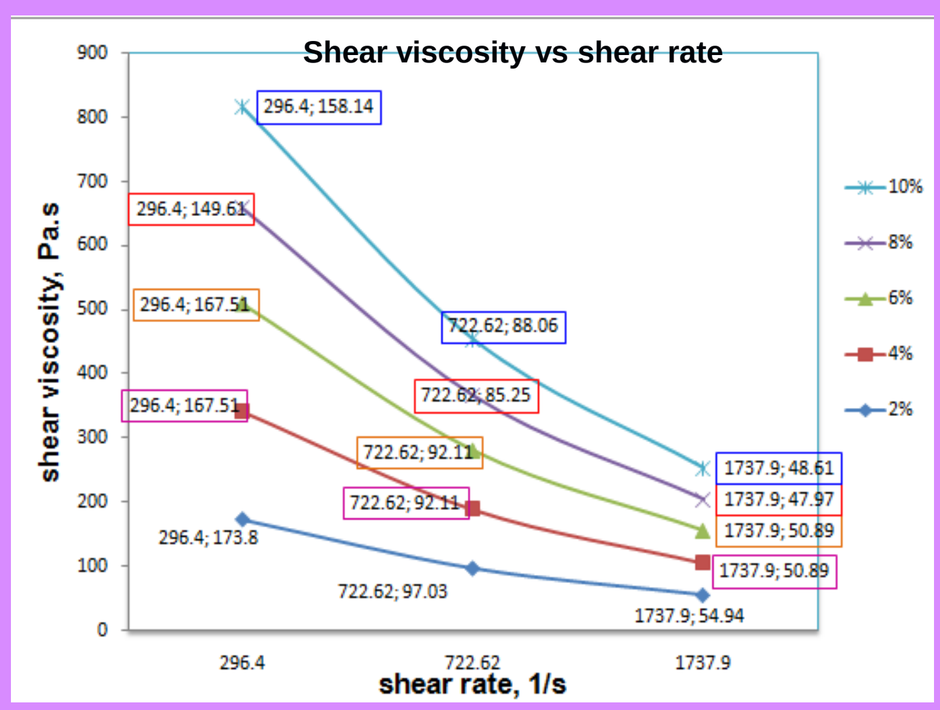
Impact test

Rheology analysis

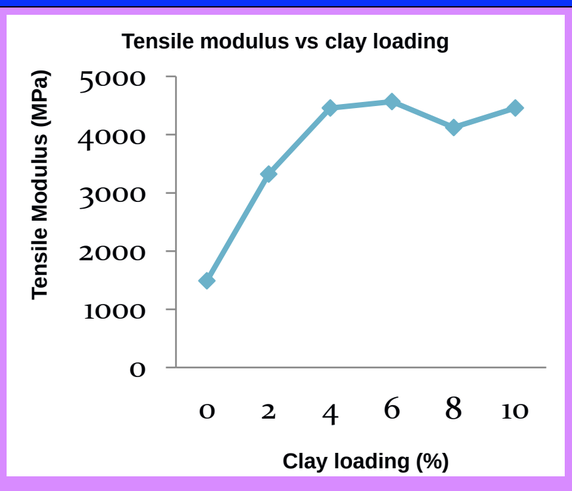
IMPACT TEST RESULT

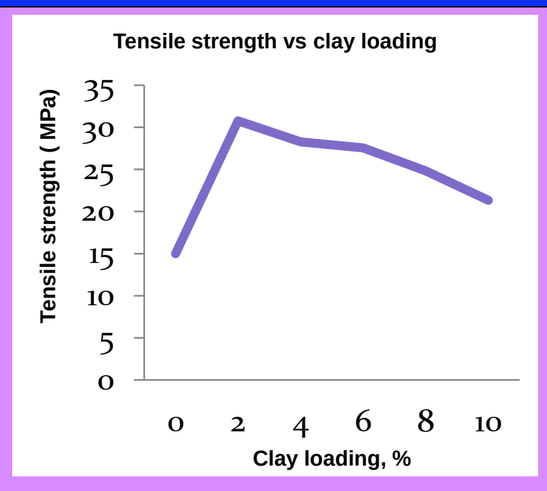


RHEOLOGY ANALYSIS

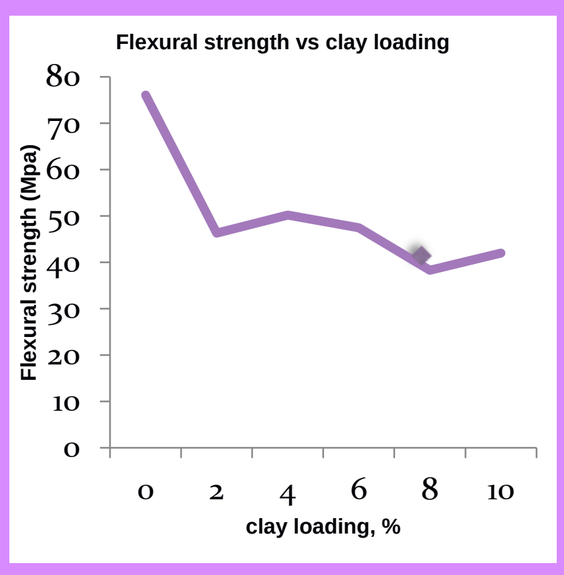


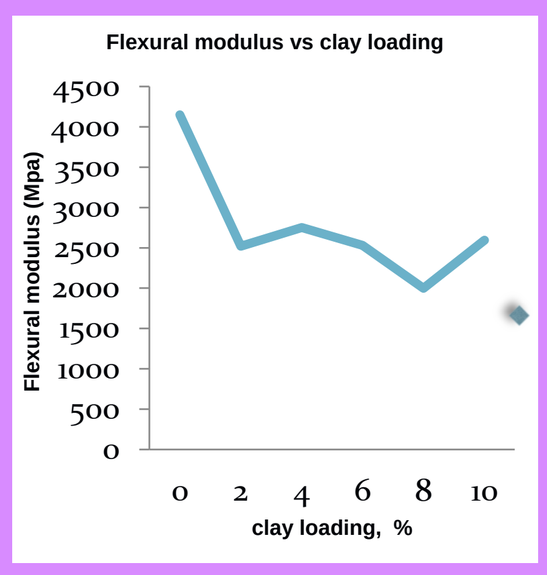
TENSILE TEST RESULT





FLEXURAL TEST RESULT





CONCLUSION

As a conclusion, The best mechanical values for tensile strength were observed in 2wt.% of montmorillonite organoclay . The flexural strength and flexural modulus were decrease by about 59% compared to neat PP matrix and they remain almost constant with further addition of MMT content. The best percentage of impact test at 4wt.% of clay loading. The highest energy absorb at this concentration with 3.27 J by 29% increase from neat PP. For rheology analysis, all feedstock exhibit good rheological behavior because it's fulfill the range of shear viscosity, 10Pa.s and 1000Pa.s and shear rate range between 100 and 10000^{s-1}. But the viscosity of the feedstock 8wt.% of MMT can be considered as the most appropriate for injection since has the small value of the shear viscosity and large shear rate.

RECOMMENDATION

Finding from this research, the following items are recommended for future research:

i) It is advisable for the future researcher to make an enhancement of a new composition of PP/MMT nanocomposite with fiber such as kenaf or palm oil.

ii) To avoid the problem that has been encountered that is with the forming of bubbles. Use a larger mould that has air way so that the composite pallet can be mixed together before it is block the air way of the mould.