



Assessment of Scattering Rate and Mechanical Properties of Blends of Polypropylene / Polyamide Containing Modified Nano Clay and Compatibilizer

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(Received: November 12, 2014; Accepted: December 04, 2014)

<http://dx.doi.org/10.13005/ojc/31.Special-Issue1.31>

ABSTRACT

In this research, dispersion and mechanical properties of polypropylene and polyamide polymers blended with Nano clay (Cloisite 15A) and compatibilizer maleic anhydride (PP-g-MA) was studied. Two kinds of Nano composites-profile (PP / PA / Nano clay 50/50/5 W / W / phr) and PP / PA / PP-g-MA / clay (50/50/5/5, W / W / phr / phr) were compared. SEM images clearly showed that improved dispersion and compatibility of the polymer and Nano clay increased. Mechanical test results showed that the addition of PP-g-MA compatibilizer for PA / PP and PP/ PA improved adhesion to each other and increase the tensile strength, flexural strength and impact strength of the PA/PP.

Key words: Nano composites, Polypropylene (PP), Polyamide (PA), Nano clay, Blending, compatibilizer.

INTRODUCTION

One of the earliest applications of Nano filler production Nano technology was to improve mechanical properties of composites. Interest in production of composite materials with reinforcements at Nano level has grown quickly in recent years [1, 2]. Recently there has been a growing interest for the development of polymer/clay Nano composites due to their dramatic improved properties compared to the conventional filled polymers in a very low fraction of filler addition

[3,4].the intrinsic incompatibility of hydrophilic clay layers with hydrophobic polymer chains prevents the dispersion of Nano clay layers within polymer matrix and causes to the weak interfacial interactions. Incompatibility and weak interfacial interactions hinders the exfoliation and preparation of dispersed stable Nano composite with improved properties. Modification of clay layers with hydrophobic agents is necessary in order to render the clay layers more compatible with polymer chains [5,6].

In general, the structures of polymer/clay Nano composites are classified according to the level of intercalation and exfoliation of polymer chains into the clay galleries. Various parameters including clay nature, organic modifier, and polymer matrix and preparation method are affective on the intercalation and exfoliation level [7]. The first and important goal in the application of fillers to the polymer is improvement in the mechanical properties and therefore fillers are commonly called as reinforcement agents [8-11]. It should be noticed in higher loadings of compatibilizers, they may cause to the some degree of plasticization due to their lower molecular weight, which negatively affect on the modulus of Nano composite [12,13].

Blending of polymers is an attractive method to obtain new polymeric materials. However,

compatibilization is generally required to control the morphology and to improve the interfacial properties of immiscible polymer pairs [14-15]. Polypropylene(PP) useful polymers Which has the advantages of low cost, easy to molding, and general properties are suitable. The incorporation of PA, PP can of advantages the relatively good mechanical properties PA and PP should be easy to molding. Because of its high polarity and hydrogen bonding properties of polyamides Strong, normally with most polymers are not incorporation of. Therefore, theTo fixes this limitation it is necessary to used the compatibilizers .With maleic anhydride polypropylene bonded to(PP-g-MAH) Can be used as a compatibilizer for the incorporation of PA and PP. By adding PP-g-MAH, the adhesions between the phases of the PA and PP Increased by

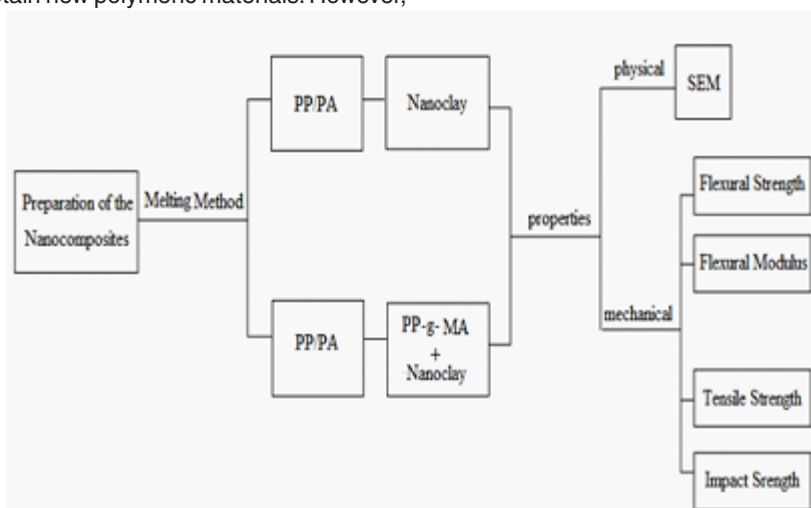


Fig. 1: Structure of the research is as follows

Table. 1: Chemical structure and properties of modified Nano-clay (Cloisite15A) used in Nano composites

| Commercial Name | The Chemical Structure | Organic Modifier | Modifier Concentration CEC (Meq/100) | Beam x-ray Diffraction (d_{001} A°) |
|-----------------|--|--------------------|--------------------------------------|--|
| Cloisite15A | $\text{CH}_3 - \text{N}^+ \begin{array}{c} \\ \text{CH}_3 \\ \\ \text{HT} \end{array} - \text{HT}$ | 2M2HT ⁺ | 125 | 31.5 |

*2M2HT: dim ethyl, dehydrogenated tallow, quaternary ammonium

Table 2: Shown are blends of Nano composites

| Blends | Polypropylene (PP)W% | Polyamide (PA) W% | PP-g-MA (MA) (phr) | Cloisite 15A |
|--------------------------|----------------------|-------------------|--------------------|--------------|
| PP/PA | 50 | 50 | 0 | 0 |
| PP/PA/PP-g-MA | 50 | 50 | 5 | 0 |
| PP/PA/Nanoclay | 50 | 50 | 0 | 5 |
| PP/PA/PP-g-MA / Nanoclay | 50 | 50 | 5 | 5 |

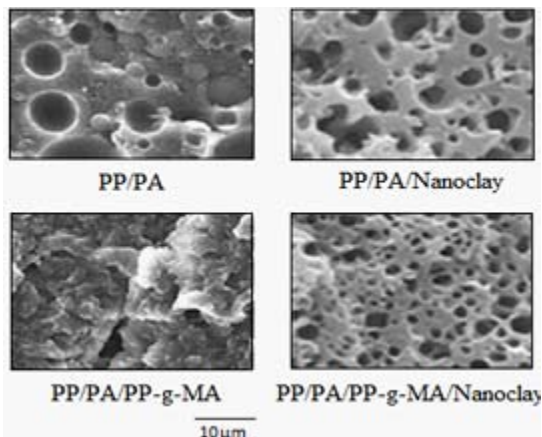


Fig. 2: SEM Images show Blends PP / PA, PP / PA / MA, PP / PA / Nano clay, PP / PA / MA/Nano clay

mechanical properties improves[16-22]. structure of this research is as follows:

Methods and devices

The aim of this study is to investigate the effect of the addition of Nano clays in polymer. PA/PP/Nano clay and PA/PP/PP-g-MA/Nano clay (50/

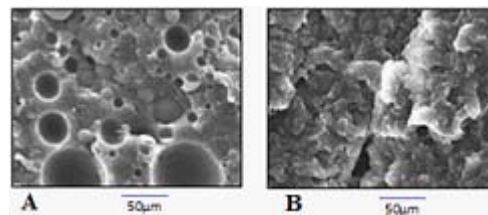


Fig. 3: SEM Images show Blends PP / PA, PP / PA / PP-g-MA

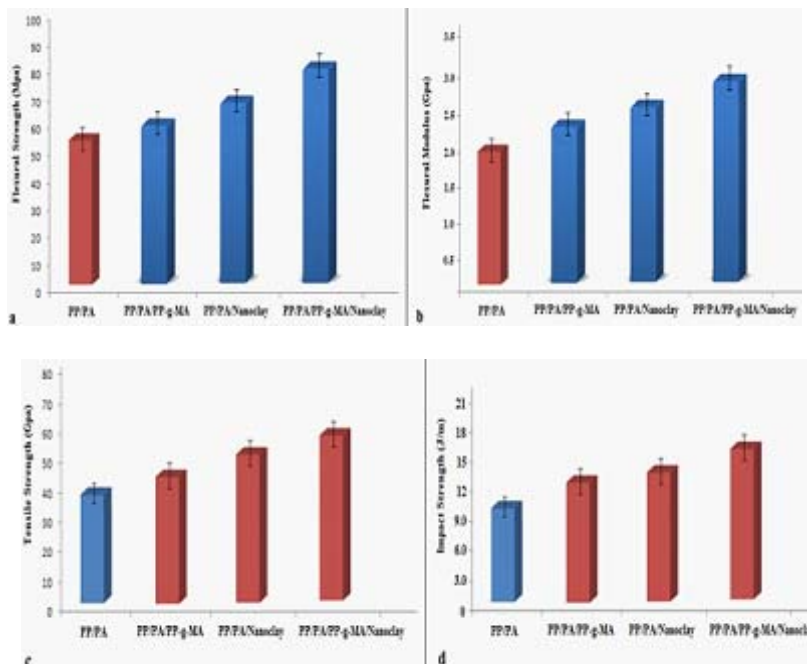


Fig. 4: a-d Combination mechanical properties of polypropylene / polyamide using 5% and 5% compatibilizer modified Nano clay shows

50/5,w/w/phr, and, 50/50/5/5, w/w/phr/phr, respectively) Nano composites are prepared in a co-rotating twin screw extruder at a screw speed of 180 rpm, a throughput of 3 kg/h and a set temperature of 210 °C. The samples were analyzed using scanning electron microscopy. The results showed a fine morphology for both blends. Polypropylene, PP, (Moplen V30S – Arak petrochemical) with Melt flow index 19gr/10min, Polyamide, PA, Akulon F223-Da company DSM with Melt flow index 13gr/10min ,commercial Nano clay produced by America's southern-clay company Cloisite 15A (C15A) consisting of MMT modified organically with quaternary alkyl ammonium salts and PP grafted with maleic anhydride, PP-g-MA (kimia javid esfahan) were used Table1. Table 2 shows the composition of the blends and Nano composites prepared for this research. Before compounding, Materials were dried under vacuum at 80 °C during 20-24 hours, and then tumble mixed with PP or PP-g-MA.

Device Analysis (mechanical testing)

Tensile test according to ASTM D638 standard speed of 50 mm / min bending test standard ASTM D790, 30 mm distance between the support and the speed of 3 mm / min was performed

RESULTS AND DISCUSSION

To view (to see) the effects of adding PP-g-MA on the uniformity blend and dispersion PP / PA and also modified clay in the polymer, SEM Images of the impact fracture sections were prepared (fig 2).

In Fig 3-A are Shown, PP and PA without compatibilizer reluctant to mix with each other and

form two distinct phases, including phase to form spherical particles with a diameter of more than 50 microns in both these phases fields were observed.

Mechanical test results also show that the blend PA6/PP Has favorable mechanical properties According to the fig 2, addition of 5 phr compatibilizer, PP-g-MATo improve the adhesion between the two phases, homogeneous structure established. The results of the experiments showed that the compatibility strength, tensile strength and impact strength, there was a good correlation. The fig 4(a-d) shows the Blends of mechanical properties of polypropylene / polyamide 5% compatibilizer and 5% in the use of the modified Nano clay shows.

Results of mechanical testing revealed that the use of 5% compatibilizer and 5% Nano clay modified blends polypropylene / polyamide, flexural strength of 33%, flexural modulus of 45%, tensile strength 40% impact strength 41% Increases. Surface modification of Nano particles using melt mixing conditions imposed for compatibility and mixed and samples of the extruder and injection device, an important role in determining the uniformity of the samples, the distribution of particles and polymer particles and adhesion qualities have played.

CONCLUSION

SEM images of polymer clay improve the dispersion and compatibility is clearly indicated. Mechanical test results showed that the modified Nano clay improve the compatibility and adhesion to each other and improve tensile strength, flexural strength and impact strength are significantly increases.

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