

Preparation and characterization of polypropylene/ MgAl₂O₄.MgO nanocomposites

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Abstract

The polymer/inorganic nanocomposites have attracted much attention for research and industrial uses in recent decades because of their enhanced thermal and mechanical properties, improved barrier properties, optical properties and reduced flammability [1]. Recently, there has been considerable interest in the preparation of nanocomposites based on layered materials as guests and polymers as hosts [2]. These layered materials include silicates, manganese oxides, titanates and phosphates. Among the many inorganic solids, magnesium aluminate spinel (MgAl₂O₄) system has long been considered as an important ceramic material due to its superior mechanical, chemical and thermal properties [3, 4].

In this work, The MgAl₂O₄.MgO spinel nanoparticles were prepared. The spinel nanoparticles were used to prepare polypropylene (PP)/ MgAl₂O₄.MgO nanocomposites via the melt compounding method.

The thermal, flammability and mechanical properties of the prepared nanocomposites were studied and the obtained results were reported in detail.

In order to analysis of the resulting product, X-ray analysis has been used to confirm the dispersion of MgAl₂O₄.MgO nanoparticles in the PP matrix. These patterns showed the structural changes of the samples with the loading of PP/MgAl₂O₄.MgO [Fig.1].

The morphological nanostructure of PP/ MgAl₂O₄.MgO in this study was ascribed by SEM in Fig.2. Observation from SEM image showed that nanoparticles (MgAl₂O₄.MgO spinel) have a well dispersion in the PP matrix.

The influence of MgAl₂O₄ content on the mechanical properties of PP/ MgAl₂O₄ nanocomposites also was studied. According to the obtained results, the mechanical properties of the nanocomposites have enhanced with increasing the MgAl₂O₄.MgO content.

The limited oxygen index (LOI) value of PP was found to slightly improve with the addition of the MgAl₂O₄.MgO nanoparticles. These increases of the LOI values allow improvements on the inflammability of PP matrix by the effect of MgAl₂O₄.MgO nanoparticles.

The thermal properties of PP/MgAl₂O₄.MgO nanocomposites samples were also studied. It was observed that the thermal properties of the prepared nanocomposites were improved with the addition of the MgAl₂O₄.MgO nanoparticles to PP matrix.

Results showed that due to the well dispersion of PP/MgAl₂O₄.MgO nanoparticles in the polymer matrix, the polymer/ MgAl₂O₄.MgO nanocomposites have so better characteristics than pure PP.

References

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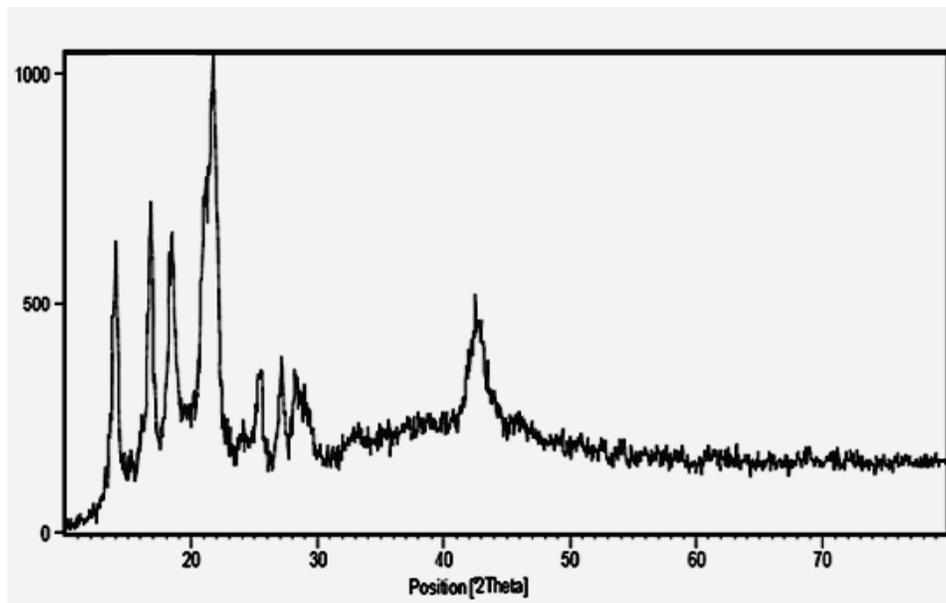


Fig.1. XRD pattern of PP/ MgAl₂O₄. MgO nanocomposites

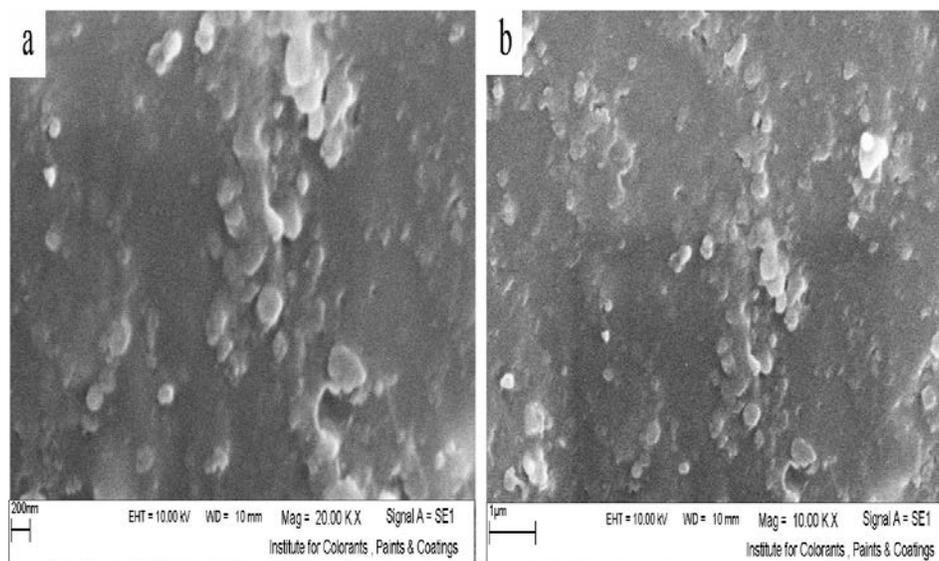


Fig.2. SEM images of sample of PP/ MgAl₂O₄. MgO nanocomposites