ADVANCES IN MATERIALS ENGINEERING

Volume 1

Edited By:
Zahurin Halim
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Chapter 004

Effect of Maleic Anhydride Polyethylene on Damping Properties of HDPE/EPDM Nanocomposite

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Keywords: Dynamic mechanical analysis, maleic anhydride polyethylene, polymer blends, organophilic montmorillonite, nanocomposite.

Abstract. Polymer alloy or polymer blend is a technology to compound polymers, additives and fillers for varieties of applications. In this project, the main key is to develop high density polyethylene (HDPE)/ethylene propylene diene monomer (EPDM) blend and OMMT filled HDPE/EPDM nanocomposite. The effect of compatibilizer agent and 4 vol% organophilic montmorillonite clay (OMMT) on dynamic mechanical analysis (DMA) was investigated. Both HDPE/EPDM blend and OMMT filled HDPE/EPDM were first prepared via intercalation technique at 4 vol% OMMT content. In the current study, maleic anhydride polyethylene (MAPE) was applied as compatibilizer agent. The effectiveness of MAPE agent was then compared with control one and analyzed based on dynamic mechanical behaviour and field emission scanning electron microscope (FESEM) examination. DMA test revealed that MAPE agent along with the addition of 4 vol% OMMT had attained the highest increased in both storage modulus, E' and tan δ, δ values as compared to the control system. This is evidenced by the finer surface and less formation of void with MAPE agent.

Introduction

Nanotechnology means building things from the bottom up, with atomic precision [1]. Polymer layered silicate (PLS) is also classified as hybrid materials which composed of organic polymer matrix in which inorganic particles with nanoscale dimension are embodied [2-4]. While polymers are light weighted, conformable, flexible, and easy to process, they remain relatively poor in thermal, mechanical, optical and electronic performances.

On the other hand, inorganic materials usually exhibit good physical properties but are heavy, rigid and difficult to process. By nanosizing an inorganic material and dispersing it into a polymer to make polymer layered silicate (PLS), it is possible to utilize the merits of both materials [5-7]. Different types of fillers are utilized for the preparation of nanocomposites. Amongst these, the most common is a nano clay called montmorillonite (MMT), a layered smectite clay.

The current study focused on the dynamic mechanical analysis or DMA. DMA is a tool commonly used to study the material responses toward stress, temperature and frequency. DMA measures stiffness and damping, which are reported as modulus and tan δ. In the current study, DMA was performed in order to study the effect of compatibilizer agent along with the addition of 4 vol% organophilic montmorillonite clay (OMMT) on the storage modulus, E' and tangent delta, δ of both high density polyethylene (HDPE)/ethylene propylene diene monomer (EPDM) blend and OMMT filled HDPE/EPDM.