ADVANCES IN MATERIALS ENGINEERING

Volume 1

Edited By:
Zahurin Halim
Iskandar Idris Yaacob
Md Abdul Maleque

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Table of Content

Chapter 010

The Effect of Processing Parameter on Tensile Properties of Thermoplastic Natural Rubber Nanocomposites

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Abstract. Thermoplastic natural rubber (TPNR) nanocomposites were prepared via melt blending with nanoclay type Nanolin DK4 as filler. The blending were carried out at various conditions (mixing temperatures, mixing speed and mixing times). The TPNR was blend from linear low density polyethylene (LLDPE), natural rubber (NR), liquid natural rubber (LNR) at ratio of (70:20:10) in Thermo Haake internal mixer. This preparation of nanocomposites was performed using in-situ polymerization method. Tensile test shows that the optimum processing parameter for TPNR-clay nanocomposites were at 135°C with 110 rpm mixing speed and 13 minutes processing time. The optimum of clay loading was obtained between 2-4 wt%.

Introduction

In recent years, polymer-clay nanocomposites have attracted much academic and industrial interest because of the anticipated improvements in properties, such as stiffness, gas barrier, flammability, etc. when the alumino-silicate platelets of clays like montmorillonite are well-exfoliated into polymers [1,8,12,13]. The development and characterization of nanostructured polymer-clay nanocomposites has been a subject of raising interests because of it appearance as a new class of materials, compared to the conventional filled polymers [2,6,11]. Due to cost and availability, there is currently a great deal of focus on nanoclay fillers. These fillers are slightly more expensive than glass, yet generally much less expensive than carbon. Additionally, the small amount of nanofillers is only required to enhance properties which enables this materials to compete more effectively than traditional glass-fiber reinforcements [1,3,4].

Nanoclays are minerals with a high-aspect ratio and with at least one dimension of the particle in the nanometer range. Reinforcements in the nanometer size range closely approach the molecular size of the polymer [3,11]. This makes for an intimate encounter between the two materials. With proper modification, the filler particles and polymer interact to create constrained regions at the particles surface. This immobilizes a portion of the polymer chain, creating a reinforcement effect. Toyota research group revealed a major breakthrough in polymer-clay nanocomposite technology with the success of in-situ polymerization of nylon 6-clay nanocomposites. This synthesis method economically suitable for industrial production [5,8].

This paper discussed on the effect of processing parameters (mixing temperatures, mixing speed and mixing times) on the tensile properties and the optimum percentage of filler loading that affect the tensile poperties of nanocomposites. Morphology is presented and discussed as supporting tool for tensile properties.