

ADVANCES IN MATERIALS ENGINEERING

Volume 1

Edited By:
Zahurin Halim
Iskandar Idris Yaacob
Md Abdul Maleque



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Polymer Clay Nanocomposites: Part I

Noor Azlina Hassan¹, Norita Hassan²

¹ Faculty of Engineering – International Islamic University Malaysia

² Fakulti Sains dan Teknologi, Universiti Kebangsaan Malaysia

✉ : noorazlina_hassan@iium.edu.my

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The purpose of this paper is to present an overview on polymer clay nanocomposite.

Introduction

Nanocomposites have changed the perception towards the concept of polymer composite. They are the emerging polymer composites of the 21st century. The importance of these products are growing from industrial and research point of view. Nanocomposite show drastic improvement in the properties derived from the addition of few percent of the clays in the polymer matrix. These composites exhibit new and improved properties as compared to their micro and macro-composite counterparts. This improvement in the properties is the result of the ultra fine phase dimension of the filler. A nanocomposite is defined as “a material having two phases, one of the phases is uniformly dispersed into the second phase on nanoscale level (10^{-9} m)”. The dimension of the first phase is in the nanometer range of 1 to 100 nm [1]. Nanocomposites typically contain 1-5 wt % of filler loading on weight basis depending on the final properties to be achieved [2]. Nanocomposites promise to be the wave of future by having major implications in industry and technology [3].

Materials

Polymer. Polymer clay composites have been classified into three categories namely, conventional composite, intercalated nanocomposite and exfoliated nanocomposite depending on the type of dispersion. In conventional composites the filler loading is on the higher side (30-60 vol %) as compared to the nanocomposites (1-5 wt %) [1]. In intercalated nanocomposites regular insertion of the polymer in between the silicate layers at the molecular level is observed while in exfoliated nanocomposites individual layers of the silicate layers are randomly dispersed into the polymer phase [3,4].

Different polymers have been used for the synthesis of the polymer clay nanocomposites in the last decade. These polymers are divided into two different classes [3];

- Thermoplastics
- Thermosets

Thermoplastics. The first polymer clay nanocomposite synthesis was reported by Toyota Central R & D a dozen year ago. Researchers have gone a long way since then in this arena and had developed various nanocomposites by making use of different polymer and clay combinations. Out of various thermoplastics used; polyamide-6 is the most studied and reported nanocomposite. Injection molded polyamide-6 nanocomposite showed excellent mechanical, barrier, heat distortion property and reduced flammability^{5,6} without sacrificing its impact strength⁴. Various polyamide-6 nanocomposite products have already been commercialized.