

**ADVANCES
IN MATERIALS
ENGINEERING**

Volume 2

**Edited By:
Md Abdul Maleque
Iskandar Idris Yaacob
Zahurin Halim**



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Polymer Clay Nanocomposites: Part II- Synthesis of Polymer Nanocomposites

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Abstract. The purpose of this chapter is to present on the synthesis of polymer nanocomposites.

Introduction

Polymer clay nanocomposites, which are the subject of the present contribution, are prepared by incorporating finely dispersed layered silicates materials in a polymer matrix [1]. However, the nanolayers are not easily dispersed in most polymers due to their preferred face-to-face stacking in agglomerated tactoids. Dispersion of the tactoids into discrete monolayers is further hindered by the intrinsic incompatibility of hydrophilic layered silicates and hydrophobic engineering plastics. Therefore, layered silicates first need to be organically modified to produce polymer-compatible clay (organoclay). In fact, it has been well-demonstrated that the replacement of the inorganic exchange cations in the cavities or ‘galleries’ of the native clay silicate structure by alkylammonium surfactants can compatibilize the surface chemistry of the clay and a hydrophobic polymer matrix [2]. Thereafter, different approaches can be applied to incorporate the ion-exchanged layered silicates in polymer hosts by in situ polymerization, solution intercalation or simple melt mixing. In any case, nanoparticles are added to the matrix or matrix precursors at 1-100 µm powders, containing associated nanoparticles. Engineering the correct interfacial chemistry between nanoparticles and the polymer host, as described previously, is critical but not sufficient to transform the micron-scale compositional heterogeneity of the initial powder into nanoscale homogenization of nanoparticles within a polymeric nanocomposite [3].

Nanocomposite Synthesis

Nanocomposites can be synthesized by different routes. Most commonly used routes are

- Melt-intercalation process
- In-situ polymerization process
- Solution process
- Emulsion polymerization

Melt Intercalation Process (Compounding process)

This method involves mechanically blending organically modified clays with polymer matrix. The nanocomposite is formed by addition of swollen and pre-treated layered silicate to the