

## **Development and Processing of Nanocomposites for Several Applications**

In the majority of conventional polymer composites, i.e., immiscible systems, the weak interaction between organic and inorganic phase leads to not enhanced mechanical and thermal properties. On the other hand, strong interaction between the polymer and organically modified clay (organoclay) leads the dispersion on the inorganic phase in nanometer scale and this favor the nanocomposites formation. As a result, the nanocomposites present unique properties that not were observed in conventional composites. The small amounts used of organoclay (<10 wt.%) in the polymer matrices enhance several properties significantly such as: mechanical, thermal, optical, electric, dimensional, flammability and barrier due to the large contact area between polymer and clay on a nanoscale as reported on literature. The incorporation of organoclays into polymer matrices has been known for 50 years and one of the pioneering works was from Toyota. Considering the dimensions of polymer chains and their crystalline assemblies, it can be said that all polymer have structure on the nanometer size scale and, further that the mechanical properties of polymer are governed by the interactions of these nanostructures to another. The most commonly used clay to prepare nanocomposite is from the smectite group, such as montmorillonite (MMT). In this clay mineral the silicate layers are joined through relatively weak dipolar Van der Waals forces and the cations  $\text{Na}^+$  and  $\text{Ca}^{2+}$  are located in the interlayer. The sodium and calcium ions usually can be replaced by organic cations through an ion exchange reaction by exchange cations present on the surface and in the basal spacing of the clay with surfactants cations such as primary, secondary, tertiary and quaternary alkylammonium ions to convert an organophilic silicate. This will improve the interaction with many polymers. However, the organic salt molecule should have a large organic group (at least 12 carbons) and a cationic polar group (hydrophilic). The addition of the organic salt molecules of large sizes increases the basal spacing ( $d_{001}$ ) of the clay and then the organoclay and the thermoplastic matrix will have better interaction. As mentioned above, these polymer-clay nanocomposites exhibit superior strength, modulus, heat distortion temperature, optical properties, water and gas barrier properties, flame retardancy and with comparable impact strength as neat polymer. Moreover, reinforcing character of the organoclay particles within of polymer nanocomposite is due too polymer chains mobility restriction when they are contact with the clay layers. In the nanocomposites of polymer/organoclay the disperse phase is in the form lamellar of typically 1 nm in thickness and hundreds of nanometer in width and length. The purpose of this work is to obtain organoclays and with them to produce polyethylene, nylon6 and nylon66 nanocomposites for several applications. The organoclays are prepared using a montmorillonite sample from the Brazilian state of Paraíba and testing different types of quaternary ammonium salts to investigate their performance. The morphology, thermal, barrier and mechanical properties of the nanocomposites are investigated. It has been observed that the properties of nanocomposites are enhanced in relation to pure polymers.