

CLAY-CONTAINING POLYMER NANOCOMPOSITE TECHNOLOGY: THE STAPLE FOR MODERN PLASTIC INDUSTRY

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ABSTRACT

For the preparation of advanced plastics with balance of properties, it is important to introduce the additives and fillers into the polymer matrices. The current use of nano-fillers pushes this strategy to the next level by exploiting the advantages that nanometre-size particulates offer compared with conventional fillers such as huge interfacial area per volume of particles, large number density of particles per particle volume, and particle-particle co-relation arising at low volume fraction. The nanoscale fillers-containing polymer composites are generally known as Polymer Nanocomposites (PNCs). The value of PNC technology is not solely based on the mechanical enhancement of the neat resin or the direct replacement of current filler and blend technology. Rather, its importance comes from providing value-added properties not present in the neat resin, without sacrificing the resin's inherent processability and mechanical properties, or by adding excessive weight.

Over the last few years, various types of nanofillers such as nanoclays, carbon nanotubes, nanosilica, nanocalcium carbonate, graphene, and various metal nanoparticles have been developed for the preparation of PNCs with almost all types of polymer matrices. However, PNCs based on clays and polymers have attracted greater interest in today's materials research, as it is possible to achieve impressive enhancements of properties when compared with neat polymers. These improvements can include high moduli, increased strength and heat resistance, decreased gas/vapor permeability and flammability, and increased degradability of biodegradable polymers. On the other hand, there has been considerable interest in theory and simulations addressing the preparation and properties of these materials, and they are also considered to be unique model systems to study the structure and dynamics of polymers in confined environments. All these issues will be discussed in this presentation.