ABSTRACT

Polymer, in its pure state suffers from several shortcomings and thus finds limitations for its application in a particular field of interest. Nanofillers having different shapes and properties are incorporated into the polymer matrix to tailor its properties and make it a suitable for desired application. When the improvement in thermal and mechanical properties of polymer becomes the prime motto, nanoclay can be chosen as the most efficient candidate. Montmorillonite (MMT), belonging to smectite group, is a widely accepted layered silicate, serving itself for the last several years. Most of the polymers are hydrophobic in nature and thus incompatible with MMT, which is inherently hydrophilic. To avoid this mismatch, bulky quaternary ions are generally incorporated into the interlayer spaces of clay silicate layers, being electrostatically aggregated through sodium and calcium cations.

Polycarbonate (PC), an amorphous engineering thermoplastic, is very much attracting for its excellent thermal stability, heat distortion temperature (HDT) and optical transparency. The conventionally used quaternary ammonium ions fail to sustain at the very high processing temperature (~ 280 ^{o}C) for PC and thus degrades during melt processing. The radical fragments formed during degradation of quaternary ammonium ions promote the degradation of PC. As a result, the molecular weight of PC gets reduced with significant deterioration in mechanical strength, glass transition temperature (T_g), optical transparency of PC and the nanocomposites become intensely coloured.

Several thermally stable phosphonium modified MMTs (P-MMTs) were developed through ion exchange reaction following their incorporation into the PC matrix through both the melt and the solution blending process. The high thermal stability of the P-MMTs not only restricted degradation of the PC matrix through radical fragmentation, but also favored the dispersion of the MMT layers into PC due to the conservation of the layered space during processing. High degree of exfoliation was evident in our prepared nanocomposites and most facilitated with the clay containing modifier of greater chain length. Some theoretical models were also proposed to theoretically explore the actual state of dispersion of clay into the PC matrix. Mechanical, as well as, thermal properties of PC were increased in the presence of clay. Lastly, the optical transparency of PC retained in the nanocomposites in the presence of P-MMT and solely found to be determined by the thermal stability of the modified clay.

Keywords: Polycarbonate, Optical Transparency, Clay, Exfoliation, Mechanical properties.