CLAY POLYMER NANOCOMPOSITES: INVESTIGATION OF MECHANICAL, THERMAL AND OPTICAL PROPERTIES OF SELECTED NANOCOMPOSITES

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Clay-Polymer nanocomposites are a new class of materials which recently attracted a great deal of attention as they offer enhanced mechanical, thermal and optical properties compared to their conventional materials. Because of these enhanced properties they find application in the fields of electronics, automobile industry, packaging and construction.

Three types of nanocomposites were prepared and their mechanical, thermal and optical properties were investigated in this study. A conducting polymer polyaniline (PANI) and a smectite type clay montmorillonite (MMT) were used to synthesize MMT-PANI nanocomposites, a thermoplastic polymer poly (vinyl) alcohol (PVA) and MMT were used to prepare MMT-PVA nanocomposites and PVA was used with kaolinite (K) clay to make K-PVA nanocomposites. Several compositions with various clay contents were prepared for each nanocomposite.

The MMT-PANI nanocomposites exhibited enhanced mechanical properties over the pristine clay and neat polymer. The MMT-PANI nanocomposites that have the lowest clay contents showed the maximum enhancement in the mechanical properties as it has a structure in which the clay layers are randomly oriented or exfoliated giving good interfacial interactions between the polymer matrix and clay fillers. It is the nature and degree of such interactions that play a pivotal role on the characteristics of the resultant nanocomposites.

The MMT-PVA nanocomposites also displayed improved mechanical, thermal and optical properties compared to the neat polymer or clay. The PVA containing 4 wt% of MMT nanocomposite became superior to the other nanocomposites, probably due to its exfoliated structure. The dispersed clay layers are well embedded with PVA matrix *via* strong interatomic interactions enhancing their aforementioned material properties. Clay aggregates, flaws and the trapped air bubbles attribute to the poor mechanical, thermal and optical properties.

The K-PVA series formed micro composites rather than nanocomposites as the polymer was adsorbed only at the edges of the clay particles as kaolinite has low cation exchange capacity and low swell/shrink ability. The K-PVA micro composites showed poor material properties compared to the MMT-PVA nanocomposites. The clay aggregates, micro-voids and the trapped air bubbles may have attributed to the poor material performance.

In conclusion, it was observed that the MMT clay is suitable to synthesize clay polymer nanocomposites with various polymers in right proportion to give materials with enhanced mechanical, thermal and optical properties.