PMMA-Epoxy-Clay Ternary Blends: Synthesis and properties

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The present research reports the preparation, results and analysis of PMMA-epoxy-clay ternary composite. Studies related to ternary blends containing thick layered silicates at the present time are limited[1,2,3]. The interest of this research is to gain information about the influence of poly (methyl methacrylate) (PMMA), montmorillonite layered silicates (Cloisite30B) and dispersion mechanism on morphology, curing kinetic and mechanical properties of a three phase epoxy nanocomposite. Two processing techniques have been used and compared for this study: one employing melt intercalation and the other using ultrasonic processing. In order to understand the exfoliation mechanisms in this ternary blend, we will follow the dispersion of platelets during the curing reaction and we will investigate the influence of the preparation method on the final morphologies obtained. Ternary composites were characterized by Wide-angle-X-ray (WAXS), Transmission Electron microscopy (TEM) and Small angle X-ray scattering (SAXS). *In-situ* SAXS and reaction kinetic studies of both systems were also carried out to gain an understanding of morphological development of composites during processing. Organoclay particles were finely dispersed into thermosetting network and predominantly delaminated in ultrasonic-blending, whereas organoclays formed micrometer-sized aggregates in melt-blending. For reacted systems an exfoliation of platelets can occur through the de-aggregation of large agglomerates into smaller particles composed of a few platelets. For *in-situ* SAXS studies the distribution of the thicknesses of diffusing entities and the evolutions of this distribution with reaction time were followed. The kinetic model has showed that presence of clays does change the reaction rate but it will not change the conversion at the cloud point (but it will be change the cloud point), In addition the clay doesn't have any effect on the reaction induced phase separation phenomenon. The glass transition temperature of the system obtained by ultrasonic dispersion is lower than the sample gotten by met dispersion. Mechanical properties (DMA and fracture) are presented, and discussed with the presence and nature of PMMA and the influence of the different dispersion tools used.

References

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