PREPARATION, CHARACTERISATION AND MECHANICAL PROPERTIES OF MONTMORILLONITE POLYANILINE NANOCOMPOSITES

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The montmorillonite (MMT) clay was intercalated with polyaniline (PANI) to prepare montmorillonite - polyaniline nanocomposites (MMT-PANI). The MMT clay was ion exchanged with H^+ and dried at 120 ^{0}C for 2 hours. The H^+ present in the clay was then exchanged with anilinium ions. The anilinium ions present within the intergalleries were polymerized by a chemical oxidation route using $S_2O_8^{2-}$. The resultant slurry was dried under room temperature for 3 to 4 days. The green coloured polyaniline form known as the emeraldine salt (EMS) containing MMT composite (EMS – MMT) was obtained. Various compositions with different clay contents (2 g, 3 g, 4 g, 5 g, and 10 g) were prepared with constant polymer content and named as EMS-MMT2, EMS-MMT3, EMS-MMT4, EMS-MMT5 and EMS-MMT10 respectively. X-ray diffraction spectra (Seimens D-5000, Radiation Cu K_α λ = 0.1540562nm) were obtained for raw MMT clay, H^+ treated MMT and for the EMS-MMT series.

Rectangular bars with dimension (40 x 5 x 5) mm were pressed uniaxially at 4 M Pa for making the test samples and vacuum dried at ambient temperature for 2 hours prior to the testing. Mechanical properties were investigated using a mechanical testing machine in the ceramic laboratory. Four-point bending was used to investigate the modulus of rupture (MOR) and Young's modulus (Y). The fracture toughness (K_{IC}) was determined using a single edge notch beam. The EMS-MMT series showed a drastic increase in the MOR, Young's modulus and the fracture toughness compared to the neat polymer and neat MMT clay at rather low clay content. These property enhancements are achieved due to increased interfacial areas, improved bond characteristics and unique phase morphology of the EMS-MMT nanocomposites.

The results indicate that the mechanical properties mostly improve even at low clay loadings. Further work is necessary to investigate the enhancement of other properties.

Financial assistance by the National Science Foundation Grant No. RG/2005/FR/04 is acknowledged.