ABSTRACT

The thesis aims to explore the structure-property relationship between the TPU and the TPU-modified Laponite clay nanocomposites prepared following solution mixing, *ex-situ* and *in-situ* techniques by using various modified clays. Laponite clay has been modified by ionic, covalent and dual modification techniques. Initially, modified clays were dispersed in the commercial TPU by using simple solution mixing technique. Finally, the most suitable grade of the modified Laponite clay was used for the preparation of TPU-clay nanocomposite by using *ex-situ* and *in-situ* techniques using the in-house synthesized TPU as a matrix. Effect of tethering with functional modifiers has also been compared by using another grade of modified Laponite prepared in a similar technique. The modified Laponite clays have been found to act as hard domain markers. Improvements in technical properties including the thermal stability have been observed to be a strong function of the degree of dispersion of the modified nanoclays in the TPU matrix. Novel tubular and elliptical morphologies have been evolved by using dual modified Laponite clays in combination with the hard domains of the TPU. The thermal stability of the nanocomposite has been found to increase by 35 ^{o}C, as compared to the neat TPU. The tensile strength has been observed to increase by 67% as compared to the neat TPU with merely 3% clay content. Increased numbers of tethering in the modified clays have been observed to be detrimental to the improvements in technical properties of the TPU-clay nanocomposite systems. In the system studied *ex-situ* prepared nanocomposites have been found to offer better improvements in technical properties as compared to the *in-situ* prepared nanocomposites.

Key Words: Thermoplastic polyurethane, Laponite clay, Dual modification, Nanocomposite, Morphology, Thermal stability