Synthesis of Graft Interpenetrating Polymer Networks Based on Epoxy and Urethane

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The interpenetrating polymer networks (IPNs) are a unique class of polymer alloys which define as a mixture of two or more crosslinked polymer networks that have partial or total physical interlocking between them. In this paper the preparation of Epoxy/Urethane (EP/PU) graft interpenetrating polymer networks by a simultaneous polymerization method was described and the effect of EP/PU weight ratio on the mechanical and morphological properties of the g-IPN system was investigated. Here, g-IPN was prepared by thorough mixing of a synthesised isocyanate-terminated urethane prepolymer with an epoxy resin followed by simultaneous curing of the resins. Polytetrahydrofuranate was used to prepare the urethane prepolymers. Accomplishment of the reactions were followed by Fourier Transform Infrared spectroscopy, showing curing of the resins. SEM was used to study morphological properties of the prepared systems. As it could be observed in Table 1 the distinct increase in tensile strength and modulus at EP/PU weight ratio 75/25 can be due to the a good interpenetration of epoxy and urethane chains which leads to creation a fine and uniformly dispersed morphology. Such enhanced penetration brings about improvement in compatibility of two component, fills the defects existing in the single polymers, and increases the effective crosslinking density. Also, the increase in interpenetrating surface area leads to a more energy absorption by PU phase. Moreover, PU particles embedded in epoxy phase acts as stress concentration points which can initiate crazes and stop its development, thus toughness and εb amount increases. Results showed that the best mechanical properties were obtained at EP/PU weight ratio 75/25 which also showed finely dispersed PU phase in epoxy matrix, while For EP/PU 15/85, the size of the dispersed phase was much bigger than that of with EP/PU weight ratio 75/25.