ABSTRACT

The poly(ester-amide) (PEA), poly(etherester-amide) (PEEA), and poly(ether-amide) also known as polyether block amide (PEBA) are the different types of segmented polyamide block copolymers. The polyether block amides, with varying hard and soft block molecular weights, have been chosen in the present study. The effect of molecular weight variations in the hard and soft blocks on the dynamic mechanical, mechanical, hysteresis, dielectric, rheological, adhesion, thermal degradation and aging properties of the polyether block amides have been investigated in the present thesis. Atomic force microscopy (AFM) and transmission electron microscopy (TEM) have been used to study the morphology of these polymers.

The dynamic mechanical measurements of the polyether block amides reveal that the polymers with high hard block molecular weight of 7400 and 4100 exhibit three peaks, designated as α, β and γ in the tanδ-temperature curve. The α and β transitions merge to give a single transition for the rest of the polymers. The mechanical properties and percent crystallinity decrease with a decrease in the hard block molecular weight or an increase in the soft segment molecular weight.

The dielectric constant at 100°C at a frequency of 1000 Hz decreases with a decrease in the hard block molecular weight. However, the variation of dielectric constant with the soft segment molecular weight is irregular. The activation energy for the various dielectric relaxations decreases with a decrease in the hard block molecular weight.

The rheological behaviour of the polyether block amides reveals that these systems exhibit pseudoplastic flow behaviour. The shear viscosity decreases with a decrease in the hard block molecular weight. However, at low shear rates, the shear viscosity shows marginal change

with an increase in the soft segment molecular weight. The activation energy of the melt flow process increases with rate of shear in most of the cases.

From the adhesion study it is observed that the peel strength increases with a decrease in the hard block molecular weight or an increase in the soft segment molecular weight. The nature of the substrate, rate of peeling, cooling in different environments and thermal aging have significant effect on the peel strength of the joints.

The thermal degradation,in air, of the polyether block amides shows two stage decomposition process, whereas in nitrogen the decomposition occurs in a single stage. In both the atmospheres the degradation, however, follows a first order decomposition kinetics. The infrared spectroscopic analysis of the degraded products reveals that the decomposition occurs in the polyether linkage followed by the polyamide hard block. The retention of physical properties is better with higher hard block molecular weight polymers.

Key words: Polyamide block copolymer, polyether block amides, triblock copolymer, segmented block copolymer, mechanical properties, dynamic mechanical properties, dielectric properties, rheology, viscosity, die swell, stress relaxation, activation energy, adhesion, peel strength, thermal degradation, aging.