Structure-Property Relationship of Wholly Aliphatic and Aliphatic-Aromatic Copolyamides

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Six types of nylon salts such as hexamethylenediammonium adipate (6.6), hexamethylenediammonium terephthalate (6.T), hexamethylenediammonium isophthalate (6.I), p-xylylenediammonium adipate (PXD.6), m-xylylenediammonium adipate (MXD.6), and m-xylylenediammonium isophthalate (MXD.I) were copolymerized with caprolactam. The glass transition temperatures of copolyamides had significant dependence on copolymer composition and comonomer structure. For the melting temperature depression Flory's equation with volume fraction was used and the steepness of the slopes of the plots $1/Tm^*$ versus $-\ln(1-v)$ was in the order of copolyamide 6/6.T, 6/MXD.I, 6/6.I, 6/PXD.6, 6/MXD.6, and 6/6.6, indicating that the Flory equation based on comonomer exclusion was not applicable to the case. The rate of isothermal crystallization decreased with increasing comonomer content and the decreasing tendency was in the order of copolyamide 6/6.T, 6/MXD.I, 6/6.I, 6/MXD.6, 6/PXD.6, and 6/6.6. From the result of selective degradation experiments it was found that copolyamide 6/6.6 showed nearly the uniform inclusion of comonomers and copolyamide 6/PXD.6 did partial

inclusion whereas copolyamide 6/MXD.I exhibited nearly the exclusion of comonomers. These results were strong evidences for the supposition that the differences in Tm depression and isothermal crystallization rate were due to the partial inclusion of comonomers in the crystalline lattice.