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Effect of Electron Beam Irradiation on Rheological Behavior of PS/PVME Polymer Blends

*Z. Ahmadi (a), H. Nazockdast (a), F. Afshar-Taromi (a), N. Mohammadi (a), S. M. Haji-Saeid (b)

(a) *Polymer Engineering Faculty, Amirkabir University of Technology, Tehran, Iran*
(b) *Atomic Energy Organization, Tehran, Iran*

Morphology and interfacial adhesion between phases are among the most important parameters effecting the properties and behavior of multiphase polymer blend. One of the method used for obtaining multiphase polymer blends with ordered structure is freezing the concentration fluctuations structure developed at different stages of spinodal decomposition process in polymer blends which can be stabilize by imposing electron beam radiation crosslinking process. Polystyrene (PS) and Poly vinyl methyl ether (PVME) are a rather unique pair of polymers in that they are dissimilar in chemical structure and their response to irradiation, also in rheological behavior. The PS/PVME blend exhibits a lower critical solution temperature (LCST) thermodynamic behavior, i.e. phase separation upon heating. The combination of dissimilarity provides the necessary prerequisites for a unique and informative study of radiation effect on rheological behavior of polymer blend. The main objective of present work was to study the melt state linear viscoelastic properties of irradiated PS/PVME blend samples at temperature above their LCST, in order to understanding of irradiation effect on microstructure of samples. Blend samples irradiated at different dose 50, 100 and 150 KGy were prepared by using Rhdotoron TT200 source. The result of melt state linear viscoelastic obtained by using Rheometrics Dynamic Spectrometer (RMS UDS200) showed a pseudoplastic type flow behavior for all irradiated samples even dose containing 40% gel content; indicating that irradiated PS/PVME samples does not lead three dimensional networks, but it cause a district gel dispersion in a continuous matrix. However a non terminal behavior was observed for storage modulus of the irradiated samples which could be attributed to the gel formed in these samples. From the results of relaxation time distribution ($H(\lambda)$) it was found that the PS/PVME samples in their single and two phase states exhibit a two phase behavior at a temperature above their LCST. The melt viscoelastic properties of the irradiated samples also showed that the irradiation can induced copolymerization and/or crosslinking between two phases whose extent was found to be increased with increasing the radiation dose.