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June 1, 1985 - May 31, 1988

Phase Relations in Multicomponent Polymer Systems

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The research project under Contract N00014-85-K-0245 has had the aim of studying the miscibility and phase transition behavior of polymer blends and, in particular, those blends containing block copolymers. The light scattering technique was utilized to determine the onset of phase separation, while the small-angle X-ray scattering technique was utilized to study the structure of block copolymer ordered phase and the onset of order-disorder transition. The material systems investigated include (1) poly(α-methylstyrene)-polystyrene and poly(α-methylstyrene)-polybutadiene systems and the effect of deuteration of polystyrene on the miscibility behavior, (2) the effect of addition of random or block copolymer of styrene and butadiene on the miscibility of polystyrene-polybutadiene blend, (3) the micelles formed when styrene-butadiene diblock copolymer was added to polybutadiene, and (4) the effect of added polystyrene on the order-disorder transition temperature of styrene-butadiene diblock copolymer. The review article (Technical Report No. 4) published in Adv. Polymer Sci. summarizes much of the results we obtained as well as related findings by others available in the literature.

The following personnel participated in the project:

D. Rigby	Post-doctorate	1985-1986
J. L. Lin	Graduate Student	1985-1987
S. Nojima	Post-doctorate	1985-1987
J. H. Chen	Post-doctorate	1987-1988
D. W. Park	Graduate Student	1985-1988

List of Technical Reports and Publications Acknowledging ONR Support:

1. Compatibilizing Effect of Random or Block Copolymer Added to Binary Mixture of Homopolymers, by D. Rigby, J. L. Lin and R. J. Roe.
   Technical Report No. 1, August 1, 1985,
   Macromolecules 18, 2269 (1985).

2. SAXS Study of Micelle Formation in Mixtures of Butadiene Homopolymer and Styrene-Butadiene Block Copolymer. 2. Effect of Block Lengths, by D. Rigby and R. J. Roe.
   Technical Report No. 2, November 1, 1985,
   Macromolecules 19, 721 (1986).

3. SAXS Study of Micelle Formation in Mixtures of Butadiene Homopolymer and Styrene-Butadiene Block Copolymer. 3. Comparison with Theory, by R. J. Roe.
   Technical Report No. 3, January 15, 1986,
   Macromolecules 19, 728 (1986).

4. Phase Relations and Miscibility in Polymer Blends Containing Copolymers, by R. J. Roe and D. Rigby.
   Technical Report No. 4, April 15, 1986,
   Adv. Polymer Sci. 82, 103 (1987).

5. Small Angle X-ray Scattering Study of Micro- and Macro-Phase Separations in Blends of Block Copolymer with Homopolymer, by R. J. Roe and S. Nojima.
   Technical Report No. 5, December 15, 1986,
   Mat. Res. Soc. Symp. Proc. 79, 151 (1987).

6. Relationship Among Polymer-Polymer Interaction Energy Densities and the Deuterium Isotope Effect, by J. L. Lin and R. J. Roe.
   Technical Report No. 6, February 20, 1987,
   Macromolecules 20, 2168 (1987).

7. Effect of Molecular Weight of Added Polystyrene on the Order-Disorder Transition of Styrene-Butadiene Diblock Copolymer, by S. Nojima and R. J. Roe.
   Technical Report No. 7, July 1, 1987,
   Macromolecules 20, 1866 (1987).