

Copolymer Micelle Kinetics and Morphology Development in Immiscible Polymers Blends with Copolymer Additives

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Blends (or emulsions) of immiscible polymers are commonly used as commodity plastics. Industrial formulations of such mixtures often contain a block copolymer surfactant. Adsorption of copolymer to internal interfaces allows the creation of a finer morphology during melt mixing, and can also improve interfacial strength in the final solid. In cocontinuous blends, which are formed by mixing similar volumes of materials with similar viscosities, the effect of copolymer upon morphology development is directly related to its effect upon interfacial tension. Addition of high molecular-weight copolymer during blending is often strikingly ineffective, however, because of a tendency of copolymers to become trapped in micelles, rather than adsorbing to macroscopic interfaces. Recent experiments by Macosko and coworkers [1] on cocontinuous blends with copolymer additives have shown that appropriately chosen copolymers can arrest the coarsening that, in the absence of copolymer, is driven by interfacial tension. This creates a strongly metastable non-equilibrium state similar in structure to an equilibrium bicontinuous microemulsion, but with a characteristic length scale that is tunable over a wide range. I discuss how the level of interfacial adsorption in these systems is effected by limitations on the rates at which micelles can dissolve or form, among other processes, and how an understanding of the relevant molecular processes can be used to control blend morphology.

REFERENCES

1. Galloway, J.A.; Jeon H.; Bell, J.R.; Macosko C.W., *Polymer* **2005**, *46*, 183.