MAR05-2004-000041

Abstract for an Invited Paper
for the MAR05 Meeting of
the American Physical Society

Controlling Polymer Rheology and Blend Thermodynamics Through Chain Architecture

DAVID LOHSE, ExxonMobil Research & Engineering Co.

A great deal of progress has been made in determining how the chemical architecture of macromolecules determines the properties of polymeric materials, but much remains to be done. Central to this effort has been the ability to make polymers where such structure is well controlled and well known, and improvements on this will be key to extending the knowledge of how molecular structure controls performance. I will illustrate the current state of knowledge and suggest where new efforts should be directed in several areas. The melt rheology of linear polymers depends critically on the degree to which the chains entangle, and the state of entanglement has now been shown to depend in a simple way on the dimensions of the molecules, for polymers from polyolefins to acrylates and even to polymeric sulfur. A deeper understanding of the flow of linear polymers will depend on the synthesis of well-characterized polymers with a wider range of stiffness. It is now clear that the miscibility of polyolefins also depends on the size of the chains, and the way this knowledge can be used to design new materials will be illustrated. I will describe the kinds of new polymers that will need to be made to enhance this understanding of structural effects, as well as illustrate how this can be used.