Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Failure of Tube Models to Predict the Linear Rheology of Star/Linear Blends RYAN HALL, PRIYANKA DESAI, University of Michigan, BEOMGOO KANG, University of Tennessee, MARIA KATZAROVA, Illinois Institute of Technology, QIFAN HUANG, University of Michigan, SANGHOON LEE, TAIHYUN CHANG, Pohang University of Science and Technology, DAVID VENERUS, Illinois Institute of Technology, JIMMY MAYS, University of Tennessee, JAY SCHIEBER, Illinois Institute of Technology, RONALD LARSON, University of Michigan — We compare predictions of two of the most advanced versions of the tube model, namely the Hierarchical model by Wang et al. (J. Rheol. 54:223, 2010) and the BOB (branch-on-branch) model by Das et al. (J. Rheol. 50:207-234, 2006), against linear viscoelastic data on blends of monodisperse star and monodisperse linear polybutadiene polymers. The star was carefully synthesized/characterized by temperature gradient interaction chromatography, and rheological data in the high frequency region were obtained through time-temperature superposition. We found massive failures of both the Hierarchical and BOB models to predict the terminal relaxation behavior of the star/linear blends, despite their success in predicting the rheology of the pure star and pure linear. This failure occurred regardless of the choices made concerning constraint release, such as assuming arm retraction in fat or skinny tubes, or allowing for disentanglement relaxation to cut off the constraint release Rouse process at long times. The failures call into question whether constraint release can be described as a combination of constraint release Rouse processes and dynamic tube dilation within a canonical tube model of entanglement interactions.

Ryan Hall
University of Michigan

Date submitted: 04 Nov 2015 Electronic form version 1.4