Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Fingerprinting molecular deformation of entangled polymers by small-angle neutron scattering YANGYANG WANG, ZHE WANG, CHRISTOPHER LAM, WEIYU WANG, Oak Ridge National Laboratory, JIANNING LIU, University of Akron, YUN LIU, National Institute of Standards and Technology, KUNLUN HONG, CHRISTOPHER STANLEY, WEI-REN CHEN, Oak Ridge National Laboratory — During the last several decades, the study of the dynamics of entangled polymers has been focusing on the application of the tube model. Despite the tremendous success of this theoretical approach, a key hypothesis of the tube model concerning nonlinear viscoelasticity has not been fully validated by experiments. In this work, we critically examine the molecular deformation of entangled polymers by small-angle neutron scattering (SANS) experiments. A new approach, based on spherical harmonic expansion analysis, has been developed to decompose the 2D anisotropic scattering pattern. This development makes it possible to unambiguously examine the deformation mechanism predicted by statistical and molecular models of entangled polymers at the microscopic level. Our SANS measurements on uniaxially stretched polystyrene melts show that the tube model could not describe the Q-dependent spherical harmonic expansion coefficients determined from experiments, as it significantly overestimates the deformation anisotropy. The failure of the model stems from its assumption of *chain retraction within an affinely-deformed tube*. New insights for understanding the nonlinear flow behavior of entangled polymers will be discussed in this talk.

Yangyang Wang
Oak Ridge National Laboratory

Date submitted: 11 Nov 2016 Electronic form version 1.4