Studying the dynamics of linear, star and ring polymers in fast extensional flow by combining filament stretching rheometry with ex-situ SANS

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Extensional rheology of polymer melts is highly sensitive to molecular structure. Accurate and reliable stress-strain measurements of model polymers in fast extensional flow play a crucial role in understanding nonlinear rheological properties. In this work, we compare the extensional rheology of nearly monodisperse linear, star and ring polystyrene melts with the same molecular weight as well as the same span molecular weight. Measurements of uniaxial extensional flow up to steady state, as well as uniaxial extensional flow followed by stress relaxation, have been performed using a filament stretching rheometer. In order to relate the rheological behavior to molecular conformation, ex-situ small angle neutron scattering (SANS) measurements have been performed on quenched filaments. The SANS results for the star polystyrene quenched from fast steady flow and at different time during stress relaxation will be presented.