Concentrated Polymer Solutions are Different from Melts: Role of Entanglement Molecular Weight

We compare viscoelastic properties of several polystyrene solutions and melts with the same number of entanglements. It is demonstrated that the modulus and time can be shifted such that the linear viscoelastic properties are identical provided the number of entanglements are identical. However the nonlinear properties in strong extensional flow are different with polymer solutions showing markedly stronger extensional hardening than the corresponding melts. While increased chain extensibility for solutions may provide part of the explanation, it is demonstrated that other mechanisms are needed for a full explanation for the differences between solutions and melts.