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Dynamics and rheology of high molar mass polyethylene oxide solutions ABHISHEK SHETTY, MICHAEL SOLOMON, University of Michigan — We report dynamic light scattering (DLS), bulk rheology and turbulent drag reduction (TDR) measurements that investigate the structure and dynamics of high molar mass PEO solutions. Steady shear rheology of high molar mass PEO solutions, when modeled by the FENE-P constitutive equation, was consistent with viscoelastic relaxation times much larger than predicted by single polymer, dilute solution theory. DLS of dilute PEO solutions showed a single relaxation mode in the decay time distribution, which scales as q^{-3} rather than the q^{-2} scaling expected of diffusive dynamics. We interpret this result as consistent with the internal dynamics of large multichain domains, clusters or aggregates in the high molar mass PEO solutions. By means of DLS, we also show that the aggregation state of dilute solutions of high molar mass PEO can be manipulated by addition of the chaotropic salt guanidine sulfate or the divalent salt magnesium sulfate. Addition of these salts shifts the power law scaling of the relaxation time from q^{-3} to q^{-2}. This shift of relaxation time scaling from one indicative of aggregate dynamics (q^{-3}) to one characteristic of polymer center-of-mass diffusion (q^{-2}) shows that these salts are effective de-aggregation agents for PEO. We discuss the results in light of the potential connection between aggregation behavior and polymer TDR of high molar mass PEO.

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