TEMPERATURE DEPENDENCE OF POLYMER FLOWS BY CONTROL THEORY

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Abstract

Models of the temperature dependence of polymer flows are discussed, and a new procedure to model polymer flows is presented. We have previously [1–3] applied control theory to model the relationship between the relaxation modulus, dynamic viscosity, transient flow effects and molecular weight distribution (MWD). We have found that the MWD computed from the relaxation modulus or complex and shear viscosity is not temperature sensitive, although their absolute values make them appear obviously very temperature dependent.

This mystery conflicts with earlier studies in rheology, and the results from our model—which is much more accurate than all previous models—encouraged us to continue our development work. We found that master curves of the time-temperature superposition are not viable for detecting the MWD, with only the original measured segment at a single constant temperature without any post-treatment being usable. Master curves can sometimes be used for very rough estimations of viscoelastic properties. We have also found that this control theory schema can be used for modelling viscoelasticity and time and flow dependences as functions of temperature. Also, a simple linear model is presented for previously developed control theory parameters: elasticity value P' and viscosity value P". Finally, relations to the tube theory are discussed.

References

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