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Shear and Elongational Rheology of LLDPE/LDPE Blends

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Shear and elongational data of blends of a linear (LLDPE) and a branched (LDPE) polyethylene are reported. Blends show thermo-rheological complex behavior. Also, in unidirectional shear or elongational flow, the linear-viscoelastic deformation regime of the blends is significantly reduced, and the terminal relaxation times of the blends are shifted in the direction of the LDPE homopolymer. Quantitative analysis of elongational viscosity data by use of the Molecular Stress Function (MSF) model reveals that the strain hardening behavior of LLDPE/LDPE blends is completely determined by the LDPE component. While the linear-viscoelastic response changes with blend composition, the nonlinear strain measure is independent of blend composition for blends with LDPE contents between 100% (homopolymer) and 20%. Even for blends containing only 5 or 10% of LDPE, the LDPE strain measure gives a good qualitative description of the strain hardening observed. We argue that this complex behavior of LLDPE/LDPE blends can be understood by assuming the existence of two phases in the blends, (a) one phase composed of highly branched low molecular weight (MW) chains from both the LLDPE minority phase and the low MW part of LDPE and, (b) one phase composed of the high MW (more linear) part of LLDPE and the higher MW part of LDPE. Composition of the phases is both temperature and deformation dependent.