PREDICTION OF ELONGATIONAL VISCOSITY OF LDPE WITH CAYLEY TREE STRUCTURE BASED ON MSF THEORY

M. Abbasi, N. Golshan Ebrahimi, M. Khabazian Esfahani, M. Nadali

Tarbiat Modares University, Chemical Engineering Department, Polymer Group, Tehran, I.R.Iran

m_abbasi@modares.ac.ir

Molecular stress function (MSF) theory based on Doi-Edwards (DE) model is a successful constitutive equation to predict the elongational viscosity of various polymers with different molecular structure. The last version of this theory for long chain branched polymers has two nonlinear material parameters β and f_{max} that govern the slope of strain hardening and steady state viscosity in extensional flows, respectively. These fitting parameters can be related to the molecular structure of branched polymers. Parameter β represents the ratio of number of segments in a molecule to the number of segments in the backbone. In the present work, we analyze the rheological properties of two high molecular weight CSTR-LDPEs that are reported by Stadler et al. [Rheol Acta 48:479-490, 2009]. Our finding shows that high molecular weight fraction of LDPEs has Cayley tree structure while low molecular mass fraction has Comb-like structure. These materials depict an increasing ability of strain hardening with strain rate decrease. This leads to the prediction of different f_{max} values for each strain rate. A correlation between f_{max} and normalized elongational rate with zero shear-rate viscosity is proposed.