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Deuteron and proton spin-lattice relaxation dispersion of polymer melts: Intrasegment, intrachain, and interchain contributions

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Abstract

Proton and deuteron field-cycling NMR relaxometry was applied to deuterated and undeuterated bulk polyethyleneoxide and polybutadiene melts and mixtures thereof with molecular weights above the critical value. Spin-lattice relaxation data due to intrasegment (quadrupolar) couplings and intra- and interchain (dipolar) interactions were evaluated. Diverse dynamic limits are identified both with the proton and deuteron frequency dispersion data. The comparison between the intrachain and the interchain contributions leads to the conclusion that only model theories based on largely isotropic chain dynamics can account for the experimental findings. The extremely anisotropic character of the well-known tube/reptation model is too restrictive in this respect. © 2007 American Institute of Physics.

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