Invited talk

PDV-1

PROTON SPIN KINETICS IN POLYMER MELTS: NEW PERSPECTIVES FOR EXPERIMENTAL INVESTIGATIONS OF POLYMER DYNAMICS

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An essential progress was made in recent years in understanding of the proton spin kinetics in polymer melts. Generally, the proton spin kinetics is determined by intramolecular and intermolecular magnetic dipole-dipole contributions of proton spins. During many decades it was postulated that the main contribution is coming from magnetic dipole-dipole interactions of intramolecular protons belonging to the same polymer segment. It appears that this postulate is far from reality. The relative weights of intra and inter contributions are time dependent and sensitive to details of polymer chain dynamics. It is shown, that for isotropic models of polymer dynamics the influence of the intermolecular magnetic dipole-dipole interactions increases faster with increasing evolution time (decreasing frequency) than the corresponding influence of the intramolecular counterpart. On the other hand, an inverted situation is predicted by the tube-reptation model: here the influence of the intramolecular magnetic dipole-dipole interactions increases faster with time (inverse frequency) than the contribution from intermolecular interactions. The intermolecular contribution in the proton relaxation in polymer melts can experimentally be isolated using the isotope dilution technique. It will be shown that data of this sort contain dynamic information about the mean squared displacement of polymer segments on different macromolecules relative to each other at time interval $10^{-9} \div 10^{-3} s$. The authors are grateful to R. Kimmich, who actually pioneered investigations in this field, for valuable discussions and many years fruitful cooperation.