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Self-Diffusion and Nuclear Magnetic Relaxation of Dendritic Macromolecules in Solutions

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Abstract

The self-diffusion and nuclear magnetic relaxation of poly(butylcarbosilane) and poly(allylcarbosilane) dendrimers dissolved in deuterated chloroform and poly(amidoamine) dendrimers with hydroxyl surface groups in solutions with methanol have been studied. The diffusion rates (D) have been measured by the pulsed-field-gradient nuclear magnetic resonance. It is shown that experimental concentration dependences D(φ) obtained for macromolecules in the dendrimer-solvent systems studied can be reduced to a unified view, and thus, the generalized concentration dependence of the normalized diffusion rates of dendrimers can be obtained. In the macromolecular volume concentration range from 0.01 up to 0.55, the generalized dependence of the normalized diffusion rates for dendrimers coincides with the analogous dependence for globular proteins in aqueous solutions; the last result suggests that self-diffusion features of dendrimers and globular proteins are in general similar. It is also shown that the experimental data obtained permit one to characterize the changes of the own monomer density of dendrimers depending on their molecular weight and, as a consequence, to make a conclusion about the swelling of dendritic macromolecules in the solutions studied.