Intermolecular Spin-Spin Coupling in Highly Fluorinated Solutions of Galvinoxyl Free Radical

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Overhauser effect type dynamic nuclear polarization experiments were performed to study the solutions of the stable free radical Galvinoxyl in highly fluorinated aliphatic and aromatic solvents. Mainly the Overhauser effect, which normally arises due to both dipolar and scalar interactions between the unpaired electrons of the free radical molecules and fluorine nuclei of solvent molecules, occurs here in the solutions, which are examined in this study. As solvent, N-methyl-bis-trifluoroacetamide and octafluorotoluene were used. The experiments were performed at a low field double resonance nuclear magnetic resonance (NMR) spectrometer, which operates at 1.53 mT. The NMR enhancements depend on competition between intermolecular magnetic interactions. We investigated the NMR enhancement factors depending on the electron spin resonance (ESR) frequency, which is modulated by the interaction between the electron spin of the free radical and the nuclear spins in its vicinity, at four different temperatures. It was found that the electron spin of the free radical interact very strongly with the nitrogen atom of the N-methyl-bistrifluoroacetamide molecule rather than hydrogen atoms of own radical molecule. Galvinoxyl free radical doesn't show this interaction with the other solvents at the weak field. This effect, which has been reported as an intramolecular interaction previously, is observed for the first time as an intermolecular coupling in this study.

Key words: Dynamic Nuclear Polarization; Overhauser Effect; Fluorine-Electron Double Resonance; Free Radical; ESR Spectra.