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ABSTRACTS

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EQ – 11/3 **STUDY OF FUNCTIONAL MATERIALS BY NMR DIPOLAR ECHOES**

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In 1950 year E.Hahn demonstrated that the two-pulse sequence $90^0 - \tau - 180^0 - Acq(t)$ applied to the inhomogeneously broadening spin system (for example the nuclear spins in liquid) leads to appearance of the echo signal at $t = 2\tau$ [1]. The amplitude of Hahn's echo does not depend on τ. In the case of the homogeneously broadening spin system (for example the nuclear spins with dipole-dipole interaction between them) Powles, Mansfield and Strange proposed the "solid-echo" technique $90_Y^0 - \tau - 90_X^0 - Acq(t)$ [2,3]. The "solid-echo" technique is a powerful NMR method for studying molecular structure and dynamics in solid state [4 - 8]. As it was shown [2,3] in this case the echo signal is also observed at $t = 2\tau$. However the amplitude of solid-echo signal depends on τ as τ^4 and the echo signal may be observed only for small values of τ. The formation of solid-echo is contrasted to the Hahn's echo and this echo signal is not connected with inversion of dipole interaction Hamiltonian sign by RF pulses [4]. In this communicate the general "solid-echo" technique: $\alpha_Y^0 - \tau - 90_X^0 - Acq(t)$ has been proposed which allow at $\tau \to 0$ inverting the sign of dipole interaction Hamiltonian and observing the dipolar echo signal. The first RF pulse in this pulse sequence is the hard pulse α_Y^0, for which rotational angle of the RF pulse $\alpha = (2n+1)\cdot(\pi/2)$ $(n = 1,2,3,\ldots)$. The RF field of this pulse lies along the OY-axis in the rotating frame. The second RF pulse is the hard 90_X^0 pulse. It has been shown that at $M_2\tau_c^2 >> 1$ (the case of rigid lattice) and at $M_2\tau_c^2 << 1$ (the case of motional narrowed NMR line) the maximum of echo signal is observed at $t_e = 2\tau + t_2 - t_1/2$. Here M_2 is the second moment of NMR line in the case of rigid lattice and t_i ($i = 1,2$) are the widths of the RF pulses. The dramatically changes in echo signal behavior are observed in the slow-motion region ($M_2\tau_c^2 \approx 1$). In this region the amplitude of dipolar echo signal is reduced and the time position of the echo signal maximum is shifted to the end of the second pulse. The obtained theoretical results have been applied to the analysis of the temperature dependencies of dipolar echo signals in some functional materials. Comparison of the developed theory with experimental results demonstrates good agreement between them.

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