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ABSTRACTS

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NON-DEBYE RELAXATION AND TEMPERATURE DEPENDENCE OF THE SECOND MOMENT OF NMR LINE

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The temperature dependence of the second moment M_2 of NMR line is determined by expression [1]

$$M_2(T) = \frac{1}{\pi} \int_{-\infty}^{\infty} J_0(\omega) d\omega, \quad (1)$$

where the spectral density $J_0(\omega)$ is the Fourier transform of the dipolar correlation function $h(t)$ ($t > 0$) [1]

$$J_0(\omega) = \text{Re} \int_{-\infty}^{\infty} h(t) \cdot \exp(i\omega t) dt. \quad (2)$$

Usually the dipolar correlation function is selected as exponential Debye function $h(t) = h(0)\exp(-t/\tau_c)$, where τ_c is the correlation time described the relaxation of the dipolar correlation function. The Fourier transform of this function gives the Debye (or Bloembergen-Purcell-Pound) form of the spectral density $J_0(\omega)$ [1]

$$J_0(\omega) = \frac{2h(0) \cdot \tau_c}{1 + (\omega \cdot \tau_c)^2}. \quad (3)$$

However the non-exponential relaxation processes are often observed in the different range of physics (see [2-5] and references there). The non-exponential relaxations give the spectral densities $J_0(\omega)$ differed from the Debye form. At present it is well known the several spectral densities functions described the non-Debye relaxation [2-5]. It have been used frequently the Cole-Cole function; the Cole-Davidson function; and Havriliak-Negami function [3-5]. These functions may be wrote by one expression [3]

$$J_0(\omega, \varepsilon, \delta) = \frac{2h(0) \sin \left[\varepsilon \cdot \arctan \left[\frac{(\omega \tau_c)^\delta \sin(\delta\pi/2)}{1 + (\omega \tau_c)^\delta \cos(\delta\pi/2)} \right] \right]}{\omega \cdot \left[1 + 2(\omega \tau_c)^\delta \cos(\delta\pi/2) + (\omega \tau_c)^{2\delta} \right]^{\varepsilon/2}}, \quad 0 < \delta \leq 1, \quad \varepsilon \leq 1/\delta. \quad (4)$$

Spectral density (4) coincides with Debye function (3) if $\varepsilon = \delta = 1$ [3].

In the present communication it will be discussed the temperature dependence of the second moment of NMR line for the case of non-Debye (non-exponential) relaxation. The temperature dependences of the spin-lattice relaxation time have been considered in [3.]

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