International Conference "Functional Materials" ICFM 2005 Crimea

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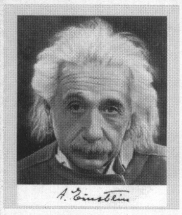
ABSTRACTS



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DQ-11/9 NMR MAGIC ECHOES IN SOLIDS WITH THERMAL MOTIONS

P.Bilski[1)], M.Olszewski[2)], N.A.Sergeev[2)], J.Wąsicki[1)]

[1)]Faculty of Physics, A.Mickiewicz University, 61-614 Poznań, Poland
[2)]Institute of Physics, University of Szczecin, 70-451 Szczecin, Poland

Among the most extraordinary phenomena in NMR of solids is the magic spin echo [1-3]. The influence of the thermal motions of nuclei on NMR magic echoes were considered in [4-6]. In this report we analyse the effect of the thermal motions on the modified pulse sequence WHH-4, which also allows to obtain the magic echo.

The modified pulse sequence WHH-4 is [3]

$$90^0_{Y} - [\tau(1-d) - 90^0_{-X} - \tau(1+\frac{d}{2}) - (90^0_{Y}) - 2\tau(1+\frac{d}{2}) - (90^0_{-Y}) - \tau(1+\frac{d}{2}) - (90^0_{X}) - \tau]_n - t$$

Here $d = \delta/\tau$ $(0 \le d \le 1)$. This pulse sequence gives the echo signal at $t = 6n\tau \cdot (1 + d/2)$.

Assuming that $n\tau >> \tau_c$ (τ_c is the correlation time of the thermal motions) we obtain the following equation for the effective relaxation rate T^{-1}_{2eff} of magic echo signal ($d = 1$)

$$T^{-1}_{2eff} = \frac{1}{6}\Delta M_2 \tau_c \left(4 - \frac{th\beta}{\beta}\right).$$

Here $\beta = 3\tau/2\tau_c$ and ΔM_2 is the change of the second moment of NMR line due to the molecular motions.

It can be seen from the dependences of $T_{2eff} \cdot \Delta M_2 \tau$ on τ_c/τ for some values of n and d shown on the figure that for given value of τ the effective relaxation time T_{2eff} decreases when parameter d increases from 0 to 1. The minimum of $T_{2eff} \cdot \Delta M_2 \tau$ for given n shifts to the large values of τ_c/τ with increasing d and it gives the possibility to investigate the largest correlation times τ_c of the molecular motions in solids than can be investigate by WHH-4 experiment.

The obtained results have been used at the experimental study of the molecular motions in C_6H_6 and NH_4Cl by NMR magic echo method.

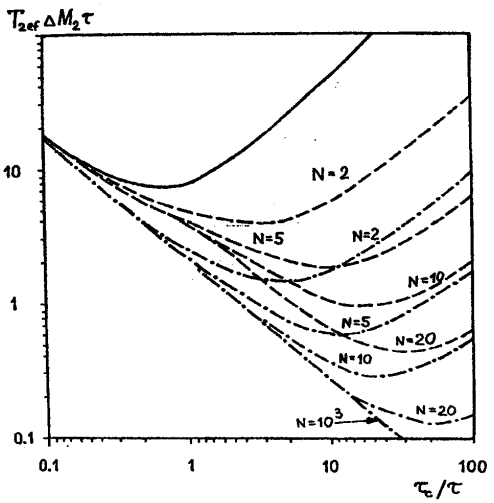

Figure. The dependences of $T_{2eff} \cdot \Delta M_2 \tau$ on τ_c/τ for WHH-4 pulse sequence (—) and for modified pulse sequence WHH-4 at $2\delta = \tau$ (——) and $\delta = \tau$ (– · – · –).

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