International Conference
"Functional Materials"
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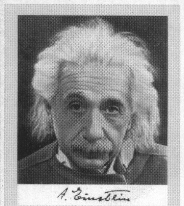
## ABSTRACTS



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## DQ-11/5 INVESTIGATION OF MOLECULAR MOBILITY IN NATROLITE "NANOTUBE" BY SOLID-ECHO METHOD

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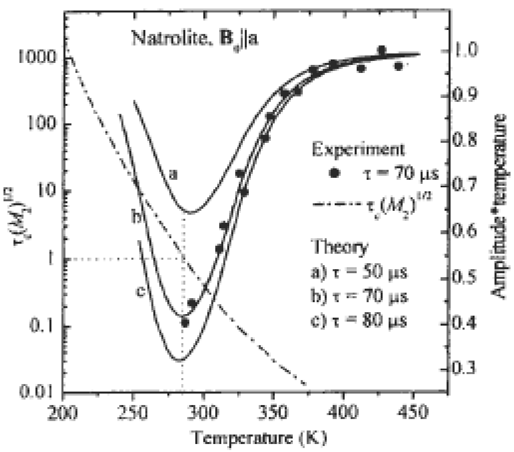
The solid-echo technique $90_Y–\tau–90_X–Acq(t)$ is a powerful NMR method for studying molecular structure and dynamics in solid state [1-5]. From our study it follows that the amplitude of the dipolar echo maximum depends on the correlation time $\tau_c$ of molecular motion. From theoretical estimation it follows [1,3] that dramatic changes in the solid-echo behaviour are observed in the slow motion region $(M_2)^{1/2}\,\tau_c \approx 1$, where the amplitude of the dipolar echo signal is reduced (Fig.1).




For study of molecular mobility in porous structures by solid-echo method we selected natural zeolite - natrolite ($Na_{16}[Al_{16}Si_{24}O_{80}]\cdot 16H_2O$). The natrolite structure contains channels with an average diameter 2.6 Å which running both perpendicular and parallel to the *c*-axis. Peculiarity of a natrolite structure is that walls of a zeolite channel are formed by oxygen of $AlO_4$ and $SiO_4$ tetrahedra of framework and by sodium ions also. So a chain $(-\,O_{1,2}\,-\,Na_{1,2}\,-)_\infty$ from these ions forms the spiral screwed on the *c*-axes of crystal [6]. Diffusion of water molecules at different directions in natrolite channel was investigated by *$^1$H-NMR line-shape analysis in [7]. It has been shown that for temperatures* higher 250 K in a natrolite there is the regular diffusion of water molecules in channel parallel to *c*-axis. The temperature dependence of magnitude $(M_2)^{1/2}\,\tau_c$ obtained from $^1$H experiments is shown on a fig.1. On this figure the experimental temperature dependence of the normalised amplitude solid-echo obtained for 70 μs delay between pulses and theoretical curves for three different delays between RF pulses are shown too. From the temperature position of an amplitude minimum of solid - echo signal it is possible to find the activation energy for a diffusion of water molecules [1]. We obtain the value $E_a$ = 39.7 kJ/mol which well coincides with ones obtained from the temperature dependence of the second moment and from spin-lattice relaxation date. In report it is discussed our other experimental results obtained for solid-echo signals in natrolite.

1. Sergeev, N. A., Ryabushkin, D. S., Moskvich, Yu. N.: *Phys. Lett. A*, **104**, 97 (1984).
2. Ryabushkin, D. S., Moskvich, Yu. N., Sergeev, N. A.: *Phys. Lett. A*, **121**, 357 (1987).
3. Bilski P., Sergeev N.A., Wąsicki J.: *Applied Magnetic Resonance*, **18**, 115 (2000).
4. Bilski P., Sergeev N.A., Wąsicki J.: *Solid State NMR*, **22**, 1 (2002).
5. Bilski, P., Sergeev, N. A., Wasicki J.: *Functional Mater*, **9**, 130, (2002).
4. Bilski P., Sergeev N.A., Wąsicki J., *Molecular Physics*, **101**, 335 (2003).
6. Sapiga A. V., Sergeev N. A.: Intern. Conf. «*Functional Materials*» P.287, (2003).
7. Sapiga A. V., Sergeev N. A.: *Cryst. Res. Technol.*, **36**, №8-10, 875 (2001).