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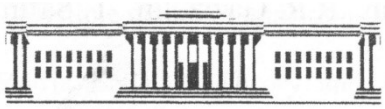

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Van Vleck paramagnets – new features in comparison of $LiTmF_4$ and $Li(Tm_{0.02}Y_{0.98})F_4$: NMR study

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Both of the $Li(Tm_{0.02}Y_{0.98})F_4$ and $LiTmF_4$ are Van Vleck paramagnets (VVP). They have a singlet ground state and the nearest excited doublet state of the ground multiplet in a paramagnetic rare-earth ion [1]. Van Vleck paramagnets could be researched by NMR method due to a gigantic induced magnetic field at the rare-earth nucleus as a consequence of strong hyperfine interaction. We reported the study of ^{169}Tm nucleus in diluted single crystal VVP $Li(Tm_{0.02}Y_{0.98})F_4$ in comparison with our the newest obtained data of $LiTmF_4$.

Van Vleck paramagnets $LiTm_{0.02}Y_{0.98}F_4$ and $LiTmF_4$ both have a tetragonal structure of scheelite ($CaWO_4$) with a space group C_{4h}^6 [2]. NMR studying of VVP single crystals were carried out by pulse home-built spectrometer. Magnetic field range was 0–0.8 T, working frequencies were 14.15 MHz, 8.43 MHz and 8.16 MHz, temperature range was 2–4.2 K.

As a result of a series of experiments, an anisotropy of the spin-spin relaxation rate (T_2^{-1}) close to the direction [001] were measured and calculated for both VVP single crystals $Li(Tm_{0.02}Y_{0.98}F_4)$ and $LiTmF_4$. Angular dependence of a spin-lattice relaxation rate (T_1^{-1}) were measured for a diluted VVP $Li(Tm_{0.02}Y_{0.98}F_4)$. The inhomogeneous linewidth was obtained for the $Li(Tm_{0.02}Y_{0.98}F_4)$ and compared with a results for concentrated VVP $LiTmF_4$.

Temperature dependencies of T_1^{-1} and T_2^{-1} were measured for the $Li(Tm_{0.02}Y_{0.98}F_4)$. Energy interval between the singlet ground state and first excited doublet state was obtained from approximation of experimental results and reached 25.9±0.2 cm^{-1} in approach of two-phonon Aminov-Orbach relaxation process. It is markedly different from previously known value for the concentrated $LiTmF_4$ which was 31 cm^{-1} [3]. According to this result, we assumed different roots of correlation time in cases of diluted $Li(Tm_{0.02}Y_{0.98}F_4)$ and concentrated Van Vleck paramagnets $LiTmF_4$.

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