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ZAVOISKY PHYSICAL-TECHNICAL INSTITUTE  
TATARSTAN ACADEMY OF SCIENCES**

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RESONANCE AND ITS APPLICATION**

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**Van Vleck paramagnets – new features in comparison of LiTmF<sub>4</sub> and Li(Tm<sub>0.02</sub>Y<sub>0.98</sub>)F<sub>4</sub>: NMR study**

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Both of the Li(Tm<sub>0.02</sub>Y<sub>0.98</sub>)F<sub>4</sub> and LiTmF<sub>4</sub> 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 <sup>169</sup>Tm nucleus in diluted single crystal VVP Li(Tm<sub>0.02</sub>Y<sub>0.98</sub>)F<sub>4</sub> in comparison with our the newest obtained data of LiTmF<sub>4</sub>.

Van Vleck paramagnets LiTm<sub>0.02</sub>Y<sub>0.98</sub>F<sub>4</sub> and LiTmF<sub>4</sub> both have a tetragonal structure of scheelite (CaWO<sub>4</sub>) with a space group C<sub>4h</sub><sup>6</sup> [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<sub>0.02</sub>Y<sub>0.98</sub>F<sub>4</sub>) and LiTmF<sub>4</sub>. Angular dependence of a spin-lattice relaxation rate ( $T_1^{-1}$ ) were measured for a diluted VVP Li(Tm<sub>0.02</sub>Y<sub>0.98</sub>F<sub>4</sub>). The inhomogeneous linewidth was obtained for the Li(Tm<sub>0.02</sub>Y<sub>0.98</sub>F<sub>4</sub>) and compared with a results for concentrated VVP LiTmF<sub>4</sub>.

Temperature dependencies of  $T_1^{-1}$  and  $T_2^{-1}$  were measured for the Li(Tm<sub>0.02</sub>Y<sub>0.98</sub>F<sub>4</sub>). 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<sup>-1</sup> in approach of two-phonon Aminov-Orbach relaxation process. It is markedly different from previously known value for the concentrated LiTmF<sub>4</sub> which was 31 cm<sup>-1</sup> [3]. According to this result, we assumed different roots of correlation time in cases of diluted Li(Tm<sub>0.02</sub>Y<sub>0.98</sub>F<sub>4</sub>) and concentrated Van Vleck paramagnets LiTmF<sub>4</sub>.

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