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Some peculiarities of spin-lattice relaxation of impurity rare-earth ions in crystals, caused by the structure defects

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Abstract

The spin-lattice relaxation times for Nd³⁺ ions in yttrium-aluminum garnets (YAG) and for Yb³⁺ ions in CaF₂ in the low-temperature range have been measured. For the first system the temperature dependence of the relaxation rate is determined to a great extent by the method of sample preparation. For samples grown by the method of the horizontally oriented crystallization the dependence is described as $T_1^{-1} = AT^n$, $n \cong 4.7$, which is an evidence of an influence of local structure disordering on the relaxation. The temperature dependence of the relaxation rate in CaF₂:Yb is also "anomalous": $T_1^{-1} = AT^{3.3}$. The results are compared with the previous data on the relaxation in similar systems, and with other cases of observation of "anomalous" temperature dependences. Different manifestations of the local crystal defects in spin-lattice relaxation are discussed. © Springer-Verlag 1998 Printed in Austria.
