Quadrupole and magnetic mechanisms of ^{209}Bi spin-lattice relaxation in $Bi_4Ge_3O_{12}$

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9.7 cm

$Bi_4Ge_3O_{12}$ belongs to the class of complex Bi-oxides (α-Bi_2O_3, Bi_3O_4Br) which exhibits unusual magnetic properties. Thus, local ordered magnetic fields of about 30 G were revealed in the $Bi_4Ge_3O_{12}$ single crystal by ^{209}Bi NQR experiments (JMMM 224(2001)249). To elucidate the nature of the relaxation mechanism the nuclear spin-lattice relaxation was studied in the $Bi_4Ge_3O_{12}$ single crystal by ^{209}Bi NQR spin-echo technique. The recovery curves were measured for all ^{209}Bi NQR transitions of nuclear spin I=9/2 in a large temperature range 10 - 230 K. The experimental relaxation curves were described by the single effective spin-lattice relaxation time T_1^*. The temperature dependence of $1/T_1^*$ was close to T^n law with n=2.4 - 2.7. Theoretical treatment was given for the nuclear spin-lattice relaxation in the multi-level system for the case of single-axial crystalline electric field. Both quadrupole and magnetic mechanisms of relaxation were taken into account. To separate the quadrupole and magnetic contributions an idea of Rega (J. Phys.: Condens. Matter 3(1991) 1871) was used. To extract the temperature dependences of parameters W_1, W_2 and W_M the fitting procedure for calculated and experimental relaxation times was used. High accuracy measurements of the recovery curves enable us to conclude that the magnetic mechanism contributes noticeably to the spin-lattice relaxation in $Bi_4Ge_3O_{12}$ at T≤50 K.

13.4 cm

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