DETERMINATION OF DEFORMATION POTENTIAL CONSTANT Ξ_d IN n-Ge

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The values of deformation potential constants obtained in experimental way are used both at calculation of energy shifts of corresponding extrema at elastic deformations and at calculation of probabilities of transition at scattering on lattice acoustic oscillations which determine the value of current carriers mobility and peculiarities of anisotropic phenomena at such scattering.

The offered paper presents the results of experimental research of n-Ge crystals with current carriers output concentration $n=3\cdot10^{14}$ cm^{-3} and deep energy level of gold $E_C-0.2$ eV. With temperature lowering in case of n-Ge with deep energy level $E_C-0.2$ eV of gold there develops a trend to the decrease of intrinsic resistance with pressure increase at transition through the peak of dependency $\rho=\rho(X)$. The explanation of this effect lies in the fact that piezoresistance for the given case is coused by the action of two mechanisms: 1) deformation redistribution of current carriers among lowering valley and three rising ones along the energy scale, which leads to the decrease of current carriers mobility and to the increase of $\rho=\rho(X)$; 2) the decrease of value of energy gap between the energy level $E_C-0.2$ eV and the bottom of conduction band owing to which the concentration of current carriers in the conduction band increases and, correspondingly, the decreases function $\rho=\rho(X)$. For minima of L_1 type which will be lower ones in n-Ge conduction band at deformation along the axes of the greatest tensosensitivity:

$$\Delta E_C=(\Xi_d+\frac{1}{3}\Xi_u)Sp\varepsilon+\frac{2}{3}\Xi_u(\varepsilon_{12}+\varepsilon_{13}+\varepsilon_{23}). \qquad (1)$$

The contribution of the small term $(\Xi_d+\frac{1}{3}\Xi_u)Sp\varepsilon$ caused by the volume change at uniaxial deformation is difficult to estimate because of the lack of reliable data concerning the value Ξ_d, which called forth our desire to determine the given potential constant for n-Ge.

The value of energy gap change between deep level $E_C-0.2$ eV and the bottom of n-Ge conduction band in calculation for each 10^3 kG/cm^2 determined by our method exposed to be equal to $(5.8\pm0.1)\cdot10^{-3}$ eV and the value of deformation potential constant – $\Xi_d=(-6.2\pm0.3)$ eV.