LIMITATION OF THE HALL MOBILITY IN INHOMOGENEOUS CdHgTe CRYSTALS

O. I. Vlasenko, Z. K. Vlasenko, S. V. Svechnikov, D. T. Tarashchenko[1]

Institute of Semiconductor Physics, Nat. Acad. Sci. of Ukraine *(45, Nauky Prosp., Kyiv 03028, Ukraine)*,
[1]Institute of Physivs, Nat. Acad. Sci. of Ukraine *(46, Nauky Prosp., Kyiv 03028, Ukraine)*

S u m m a r y

The work is devoted to ascertaining a role of bulk inhomogeneities in the formation of the Hall mobility μ_H and its temperature dependence in $Cd_xHg_{1-x}Te$ *n*-type crystals where $x \approx 0.2$ and the carrier concentration is equal to $n_0 \approx 2 \cdot 10^{14} \div 10^{16}$,‡$^{-3}$. With this aim, the dependences $\mu_H(T)$ for the prefect and imperfect crystals were compared to each other. The revaled variations were analyzed taking into account additional experimental data, that helped to determine the presence, and, whenever possible, type of inhomogeneities (magneto-field dependences of cross magnetoresistance, spectral and kinetic characteristics of photoconduction, the results of structural investigations and chemical analysis, etc.). The comparison of the results of these examinations revealed mechanisms of influence of spatial inhomogeneities in a composition and the level of doping on the Hall mobility and formation of its temperature dependence. In particular, we have established that, in the ranges of intrinsic and impurity conductivities, $\mu_H(T)$ dependences are distorted due to inhomogeneities in the composition and the level of compensation (or doping) of material, which results in various character of $\mu_H(T)$ dependences in these temperature ranges. The presence of fluctuations of a composition, that are small by their amplitude, or the compensation level leads to the appearance of energy barriers for activation of the carrier mobility, ΔE_μ, that differs in the temperature ranges of intrinsic and impurity conductivities. It results in the respective alterations of spole angles in the $\mu_H(T)$ dependences. The calculated values of ΔE_μ lay within (1$^-$ 15) meV. The presence of wide-gap or overcompensated (impassable for electrons) areas large by their amplitude and geometric sizes leads to a change of the effective volume of a crystal and a parallel shift of $\mu_H(T)$ dependences towards smaller values of μ_H. This shift is mainly determined by the factor of a volume part *A* of such inclusions. We analyzed the resons that lead to the appearance of dependences ΔE_μ and *A* on temperature when changing the temperature ranges of intrinsic and impurity conductivity and inside these ranges. The presence of large concentrations of fine-dispersed inhomogeneities can result in the appearance of an additional channel for scattering of carriers by these inhomogeneities. Ising the statistical data on the μ_H value at 77 K in crystals with various concentrations of charge carries, we revealed an essential contribution of inhomogeneities by a level of doping in limiting μ_H in crystals with concentrations $n_0 < 10^{14} \div 10^{15}$ cm^{-3}.