INFLUENCE OF ACCELERATED ELECTRON RAYS ON PHOTOELCTRIC PROPERTIES OF ALGAAS-GAAS SOLAR CELLS

R.S. MADATOV, A.M. ALLAHVERDIYEV, * G.M. SUJUDI, Y.M. MUSTAFAYEV, N.I. HUSEYNOV
Institute of Radiation Problems, Azerbaijan National Academy of Sciences
*Tabriz University of Iranian Islamic Republic

Though solar cells (SC) prepared on the basis of $A^3 B^5$ compounds and their solid solutions are used in different technical fields, the problem of their radiation resistance still remains as an urgent one. Degradation of energy parameters is observed during long-term operation of SC in radiation zone and it reduces their work time. Namely from this reason in spite of using of different methods to increase radiation resistance of raw material the problem has not found its solution. For this purpose influence of accelerated electron rays on photoelectric properties of SC prepared on the basis of AlGaAs-GaAs.

Hetero-transition was developed on the base of n-GaAs -p-GaAs -p-$Al_{0.75}Ga_{0.25}As$. Solid solution layer alloyed by zinc with 15-20mkms thickness on n-GaAs (n = 1-3 $10^{17}sm^{-3}$) substrate was blued. But the thickness of p-GaAs layer was ~1 mkm and zinc was diffused during bluing process. Surface area of the prepared sample was ~2 sm^2. The photoelectric properties were measured by solar radiation immiator (AM -1.5), but measurement of volt-ampere characteristic was conducted under direct sunbeams. Under direct sunbeams of prepared SC (P_g = 91 mVt/sm^2) I_{SC} = 20 mA/sm^2, V_{OC}=0.92 V and η =16%. The samples were irradiated by electron rays with 4.5 MeV energy in ELIT-6 device.

It has been established that at small values of tension VAC doesn't obey exponential law in straight direction. The linearity of VAC distorts at the values of tension higher that 0.4 V at the result of high resistance of base material. The values (β and j0) of diode coefficients calculated according to the curves change in the interval of 1.35-1.5 and 10^{-10}-10^{-9} A/sm^2. Time history of β and j0 shows the connection between transition mechanism of current and generation-recombination processes happening in space-charge region. During electron radiation (10^{12}-10^{16} el/sm^2) the values of β and j0 change accordingly to 1.5-2.6 and 10^{-8} -10^{7} A/sm2. And this reveals generation of charge centers on separation surface of heterotransition during radiation. Investigation of the photoelectric properties affirms this fact. So, I_{SC}/I_{SC0}=0.65, F/F_0= 0.64, V_{OC}/V_{OC0} = 0.92 (1014 el/ sm2) change insignificantly at the result of the influence of electron rays.

The results obtained conform to theoretical considerations and practical results. Increase of concentration of recombination centers in dependence with radiation dose in heterotransition boundary and mainly superficial area at the result of radiation is observed.