The Use of Semi-Insulating Crystals Cd (Zn) Te: in Detectors for Ionizing Radiation

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Semi-insulating crystals of Cd(Zn) Te with weak n-type conductivity, doped with indium during growth, which can be used for the manufacture of detectors of ionizing radiation were investigated in Shottky photodiodes design.

Crystals were grown through a solution-melt tellurium at 800°C by the zone melting method. Polycrystalline blank placed in quartz ampoule that moved through the heater zone at a speed of 2 mm per day. Synthesis of polycrystalline piece performed at 1150°C. Crystal plates 5×5 mm^2 and a thickness of 0,8-2,0 mm cut from different parts of the ingot. To investigate the electrical properties of crystals the ohmic contacts were made by thermal spraying of indium in a vacuum. Thus the structure created In / Cd (Zn) Te / In.

The current- voltage characteristics (CVC) demonstrated two specific areas: linear $I \sim V$ and quadratic $I \sim V^2$. The voltage V_o was determined at the point of intersection of the continuation of ohmic and quadratic dependences of current on voltage. It was found differences in the magnitude of the resistivity determined from linear plots of CVC for crystals cut from different parts of the ingot: ~ (3-6) $\times 10^{10}$ Om×cm for the middle and (1-2)$\times 10^{10}$ Om×cm for the end of the ingot at 293 K and different temperature dependence of voltage V_o. This behavior of the CVC we explain within the model of space charge limited currents (SCLC). Based on the joint study of the temperature dependence of ohmic current areas of CVC and SCLC for crystals Cd (Zn) Te doped indium during growth, we defined that impurity energy level, responsible for the dark conductivity, has the donor nature. The observed features of the electrical properties of the crystals from the analysis of the statistics of electrons and holes from the electroneutrality equation explains the specifics of compensatory processes of semiconductor material. The method of determining the ionization energy, the degree and nature of compensation deeper level, responsible for the dark conductivity of the material proposed. Relationship between the degree of compensation deeper level of semiconductor crystals with detecting properties of structures fabricated on them were investigate. Established that for close values of material resistivity detective properties are better for structures made from crystals in which dark conductivity caused by poorly compensated deep level.