

DSCM P88 PHOTOELECTRIC AND ELECTRICAL PROPERTIES OF HETEROJUNCTIONS ON CADMIUM TETRAPHOSPHIDE WITH ZINC OXIDE

I.G. Stamov^{1,*}, D.V. Tkachenko¹, N.N. Syrbu²

¹ Pridnestrovian State University, Tiraspol, Moldova; ² Technical University of Moldova, Chisinau, Moldova

*E-mail: istamov51@mail.ru

Active structures on anisotropic crystals with large birefringence and semiconductor properties make it possible to solve a number of problems of polarization optoelectronics and simultaneously to study the properties of the materials. The latter is especially important in the absence of comparatively simple methods for inversion of the sign of the semiconductor conductivity for the production of *n*-junctions, Schottky barriers, for example, in the case of cadmium tetraphosphide and zinc diarsenide, a change in their conductivity from hole to electron.

Cadmium tetraphosphide crystallizes in the C_{2h}^5 - $P2_1/C$ structure and is in the crystalline state an anisotropic p-type semiconductor with a charge carrier density about 10^{16} - 10^{17} cm^{-3} and a hole mobility of $600 \text{ cm}^2 / \text{Vsec}$ and the bandgap $E_g = 1.15 \text{ eV}$ [1]. Information There is very small about its optical properties and anisotropy, and there are no photovoltaic ones. This report presents the results of an investigation of the photoelectric and electrical properties of active heterojunction structures on this material with zinc oxide.

Heterojunctions (GP) of ZnO-CdP₄ were obtained by condensing vapor of zinc oxide doped with aluminum up to 3% in vacuum on chips on the cleavage planes of cadmium tetraphosphide crystals heated to a temperature of 150-200 °C.

The photocurrent spectra of GP ZnO-CdP₄ are strongly polarized because of the significant dichroism in the region of the fundamental light edge absorption. The region of photopleochroism is 112 nm. Assuming that the interband transitions in the polarization $E \parallel C$ are direct allowed ones, and in the polarization $E \perp C$ are direct forbidden, the widths of the forbidden bands from the photoelectric characteristics at room temperature are 0.924 and 0.935 eV, respectively. The voltage applied "+" to ZnO and "-" to CdP₄ leads to the increase in the photocurrent in the entire spectral region from 1300 to 360 nm. The photocurrent spectra exhibit an intense unpolarized band with a maximum at 990 nm and a characteristic dip with a minimum at a wavelength of 660 nm.

The complete complex conductivity of the surface-barrier structures is defined as $G = G + i2\pi fC$, where G is the active conductivity, and C is the capacitance. The barrier capacitance of the heterojunction varies from a maximum value equal to 1 nF/mm^2 and determined by the parameters of space-charge regions, up to geometric capacity.

In the frequency range f about 10-30 kHz the capacitance of the heterojunction remains constant, but at the large frequencies $f > 30 \text{ kHz}$ the capacitance of the ZnO-CdP₄ structure decreases with the dependence $C(f) \sim f^{-3/2}$. The Q-factor of the GJ, defined as $G / 2\pi fC$, contains a minimum at 20 kHz and a maximum at a frequency of 500 kHz.

Dependences of capacitance and conductivity on the voltage have a characteristic form for a sharp p-n structure. For the scale of $1/C^2$ in the voltage range from +0.2 to -1 V, the dependence is linear. With reverse voltages greater than 0.8 V, the conductivity increases significantly due to breakdown phenomena, presumably of a tunneling nature. Taking into account the properties of zinc oxide films obtained by this method [2], it can be assumed that the bend of the zone forming the barrier for the main charge carriers is located in CdP₄ and is 0.35 eV.

[1] Zdanowicz W., Wojakowski A. Semiconducting properties of CdP₄. *Phys.Stat.Sol.*, **16**, №2, (1966), K129-K131.

[2] V.F. Gremenok, G.A. Ilchuk, S.E. Nikitin, V.Yu. Rud, Yu.V.Rud. Obtaining and electrical properties of ZnO-Cu (In, Ga) Se₂ heterojunctions. *Semiconductors*, **39**, 2,(2005), 218-221.