Photovoltaic devices with InP nanolayers

MOLDOVA STATE UNIVERSITY
Research and Innovation Institute
Scientific Research Laboratory
"Physics of semiconductors and devices"
60, Alexe Mateevici str., MD 2009, Chisinau, Republic of Moldova
E-mail: andrcoval@mail.ru

A.Koval, L.Gorceac, V.Botnariuc, S.Vatavu, P.Ketrush,B.Cinic, S.Raevski, C.Rotaru

Objectives:

The aim of the present study is elaboration of photodetectors (PD) and photovoltaic cells (PVC) based on In-n^+CdS-p^o-p^+InP-(Ag+5%Zn) heterojunctions and In-n^+CdS-n^+-p^o-p^+InP-(Ag+5%Zn) homojunctions.

Solution:

- **PD- and PVC fabrication based on pInP hetero and homojunctions by using gaseous phase epitaxy in the In-PCl_3-H_2 system and by using the quasi-closed volume method.**
- **Deposition of the SiO_2/ZnO antireflective layer (80...160 nm) by using the electron beam evaporation method (300K)/ pyrolysis spray (400^{o}C).**
- **PD and PVC testing under (AM1) standard conditions.**

Results/Conclusions:

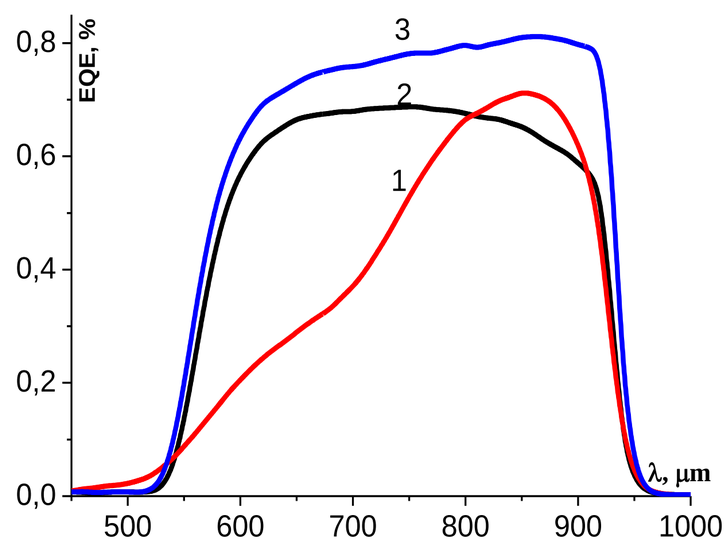
- **The dependence of the efficiency (η,%) of PVC on pInP under standard conditions (AM1) on the value of series resistance R_s was established. η_{max} of 12% was obtained for PVC having R_S=3,08 ohm·cm^2, while the R_S increase up to 17,47 ohm·cm^2 decreases the efficiency up to the value of 7,31% (see Table). Thus, one mau conclude, the need in the further optimizion of the technology of deposition of intermediate and frontal epitaxial layers of InP.**
- **The maximum external quantum efficiency of homo- and heterojunctions prepared from pInP is of 70 ... 80% (see Fig.). The absolute maximum photosensitivity is 450 ... 500μA /mW. Such junctions can be used as photodetectors in the of spectrum (500 ... 950 nm) range.**

Table

Parameters of PVC with pInP junctions with antireflective layer (1...3)

Parameters	PVC structure		
	n^+CdS-n^+-p^o-pInP	n^+CdS-p^o-p^+InP	
		PVC2	PVC3
	(1)	(2)	(3)
U_{cd},mV	786	815	819
I_{sc}, mA·cm^{-2}	12,84	18,58	16,81
FF,%	72,4	80,3	76,8
R_s, Ohm·cm^2	17,47	3,08	5,63
R_p, Ohm·cm^2	25580	6373	15394
η, %	7,31	12,00	10,74
$S_{photoactiv}$, cm^2	1,24	1,60	1,15

Fig. External quantum efficiency (EQE) spectral dependence



1 - n^+CdS-n^+-p^o-p^+InP homojunction with SiO_2 antireflective coating;
2, 3 - n^+CdS-p^o-p^+InP heterojunction with SiO_2 antireflective coating.

Advantages: **Photodetectors /PVC fabricated from InP have high resistance to the influence of corpuscular radiation: electron/proton flux with energy of 1/20 MeV and flux density of $2.10^{15}/2.10^{12}$ cm^{-2}. The parameters degradation in time of these devices is insignificant (3 ... 4% in 10 years).**