SEMICONDUCTOR – ELECTROLYTE JUNCTION AT THE n-GaAs (n-InP)/Na_2SiO_3 SOLUTION INTERFACE

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Abstract.–The photoelectrochemical properties of the electrolyte-semiconductor interface in the chains formed by carbon auxiliary electrode-electrolyte-n-GaAs or n-InP semiconductors have been investigated. Besides bulk n-GaAs crystals also nanoporous n-GaAs material was used as photoelectrode. Current-voltage characteristics in the darkness and under illumination and spectral distribution of the photosensitivity were studied. The values of the photopotential reach 1V in the case of n-InP photoelectrode and 0,8V and 0,4V in the case of nanoporouse and bulk n-GaAs photoelectrode, respectively.

1. INTRODUCTION

Usually the photovoltaic cells are based on the p-n junction in different semiconductor materials. Although the basis of solar energy conversion is considered to be the same, photoelectrochemical devices are characterised by a semiconductor-electrolyte interface which resembles the solid state p-n junction. In that sense photoelectrochemical cells (PEC) could be examined in the same way as photovoltaic devices [1], [2].

Different semiconductor materials and electrolyte based redox couples were used for the fabrication of PEC [3]. Solar energy conversion efficiencies more than 10% have been obtained, but the greatest shortcoming of the PEC is the degradation of the interface photoelectrical parameters due to the corrosion of the photoelectrode at the semiconductor-electrolyte inter-face, limiting the efficiency and effective lifetime of these devices. In this sense the goal of the actual work is the selection of a new type of electrolyte, which does not corrode the photoelectrode. From our point of view such electrolyte may be a colloidal aqueous solution of Na_2SiO_3. As photoelectrode we have chosen the n-GaAs (n-InP) which are semiconductor materials with the band gap the closest to the maximum of the solar energy spectrum. Since the photoelectrochemical processes depend on the interface surface we have utilised nanoporous nGaAs besides bulk n-GaAs crystals.

2. EXPERIMENTAL

The investigation of the electrical and photoelectric properties of electrochemical chain metal - carbon - colloidal aqueous solution of Na_2SiO_3 – n-GaAs photoelectrode - metal was carried out in an organic glass cell with walls of 1mm thickness, described in [4], [5]. n-GaAS wafers with the thickness of 0,5 mm, with the electron concentration $n = 10^{18}cm^{-3}$ at 300K were used as photoelectrode. The photoelectrode was stuck to the external part of the cell wall, while the contact with the electrolyte was provided

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