PR-40

INFLUENCE OF DOPING CHROMIUM ON ELECTROPHYSICAL PROPERTIES OF CHEMICALLY DEPOSITED PbS FILMS

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Abstract. Most researchers show great interest in studying the doping of thin films with transition elements. One of the most common materials for alloying is lead sulfide PbS. Lead sulfide is a semiconductor material of the $A^{IV}B^{VI}$ group, which has found wide application in many fields of science and technology. Information about the photoconductivity of nanostructured thin-film lead sulfide doped with chromium is given by the researchers. [1]. It was of interest to study the photoelectric properties of iodine and chromium-doped PbS films with a grain size of more than 100 nm, excluding the dimensional effect.

Thin films of PbS were synthesized by chemical deposition from aqueous solutions containing $Pb(CH_3COO)_2$, $Na_3C_6H_5O_7$, NH_4OH, NH_4I и $(NH_2)_2CS$. Doping of PbS films was carried out by Cr^{3+} during synthesis by introducing into the reactor at a salt $CrCl_3$ when they are deposited for 1.5 hours. All films were deposited on preliminarily degreased glass substrates in a «TS-TB-10» liquid thermostat at 353 K.

The photoelectric characteristics (dark resistance Rd, volt sensitivity Us) of PbS (I,Cr) films were measured on an installation K.54.410 with a 573 K blackbody radiation source at a radiation modulation frequency of 800 Hz and an irradiance of $1 \cdot 10^{-4}$ W/cm^2. An increase in the concentration of $CrCl_3$ in the reaction mixture from 0.002 to 0.008 mol/l leads to an increase in the volt sensitivity from 50 to 150 μV and a simultaneous decrease in the dark resistance of PbS(I,Cr) films from 16 to ~2.6 MΩ, i.e. by 6.2 times (Figure 1). This is probably due to the inclusion of a dopant metal in the surface layer of the investigated semiconductor compound in analytically undetectable concentrations, which enhances the acceptor state.

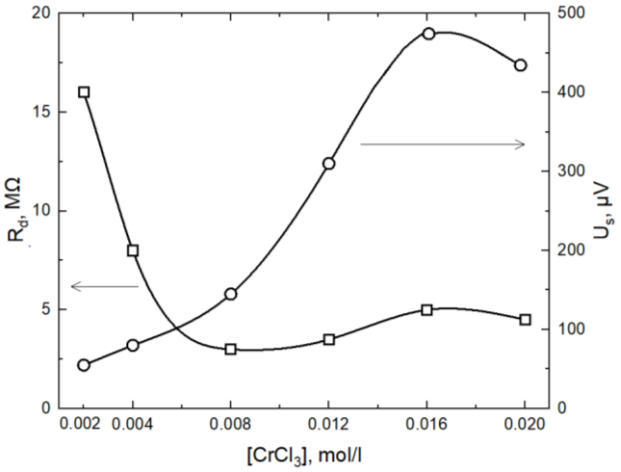

Figure 1 – Changing the dark resistance R_d and volt sensitivity U_S of elements (5×5) mm^2 based on films PbS (I,Cr) from the concentration of $CrCl_3$ in the reaction bath.

References

1. Ahmed M., Mohamed Rabia, Mohamed Shaban. The structure and photoelectrochemical activity of Cr-doped PbS thin films grown by chemical bath deposition. RSC Adv. 2020. № 10. pp. 14458–14470.