

Influence of Localized Charge Distribution on Thin Film CdS-Cu₂S Nonideal Heterojunction Photovoltaic Properties

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The work is devoted to theoretical generalization, modeling and control of accumulation and re-read signal effect in optical sensors based on nonideal heterostructures.

The work is dedicated to the analysis of the characteristics of sensor properties and component composition of thin-film heterojunction CdS-Cu₂S. In this regard, a complex research aimed at processes modeling in the tunnel barrier layer, the study of samples chemically modified phase composition, investigation of sensor properties degradation was carried out [1].

The main results present a model that describes the kinetics of concentration of positive charge, accumulated in deep traps after photoexcitation and takes into account both thermal and tunnel holes release mechanisms. Numerical calculations of localized charge distribution changes over time, found out that this distribution in terms of dynamic equilibrium has an exponential character. Close compliance between calculated and experimentally obtained dependences was demonstrated.

The mechanisms of signal relaxation, associated with the removal processes of nonequilibrium charge from the space charge region of the image sensor on the basis of non-ideal heterojunction were investigated. The mechanism of the observed two-stage process was determined. Novel results concerning CdS-Cu₂S heterojunction surface morphology and impurities depth distribution were obtained. In particular, the question of observed variation of surface photosensitivity and components interdiffusion on heteroborder was clarified [1]. Also the comparison of samples formed by two different methodics (electrodynamical spraying and vacuum evaporation techniques) was made. X-Ray diffraction (XRD) was performed in order to detect Cu_xS compounds at CdS-Cu₂S heterojunctions.

- [1]. V. A. Borschak, V. A. Smyntyna, Ie. V. Brytavskiy, S. V. Zubritskiy, M. I. Kutalova, Ya. I. Lepikh. Microstructural features and componential analysis of thin film CdS-Cu₂S photosensing structures as element of image sensor // Photoelectronics. – 2013. – № 22. – P. 98-102.