

ZnO/Me Sol-Gel Film for Solar Sells and Photodetectors

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The numerous studies of thin films and nanomaterials based on ZnO obtained by various methods for use in optoelectronics, volumetric and other fields are investigated. In recent time the interest increased in the use of ZnO as material for optoelectronic devices with wide range of applications working in the visible and short-wave wavelength ranges. This material is already used in transparent thin-film transistors, photodetectors, light emitting diodes (LEDs) and laser diodes [1]. The attractive properties of zinc oxide, such as high transmittance in the visible spectral range and good electrical conductivity, are on the grounds of the stoichiometry of the film and the presence of internal crystal defects [2]. The introduction of various impurities into the crystal structure of the film leads to the change in both optical and electrical properties of the film.

The properties of ZnO:Me:RE³⁺ films synthesized by sol-gel method and ZnO:Me:RE³⁺ heterostructures on the substrate of single-crystal silicon and glass are presented. These structures are photosensitive to the IR and visible wavelength range. High photosensitivity confirms the prospects of their use in optoelectronic devices, in particular for the creation of active layers of solar cells.

Measurements of the current-voltage characteristics (VAC) on an E7-20 immittance meter at room temperature were made. The I-V measurements were carried out both in the dark and under illumination with an incandescent lamp and an IR source.

The maximum photosensitivity for the ZnO:Me:RE³⁺/Si structure appears for all films in the presence of bias voltage. The maximum sensitivity to IR radiation was observed for the ZnO:Al:Er³⁺/Si structures, and to the visible region for ZnO:Ag:Eu³⁺/Si structures. This effect can be attributed to the fact that the trivalent Eu³⁺ ions cause the luminescence in the visible range due to optical transitions, and the trivalent Er³⁺ ions in the infrared region of the spectrum.

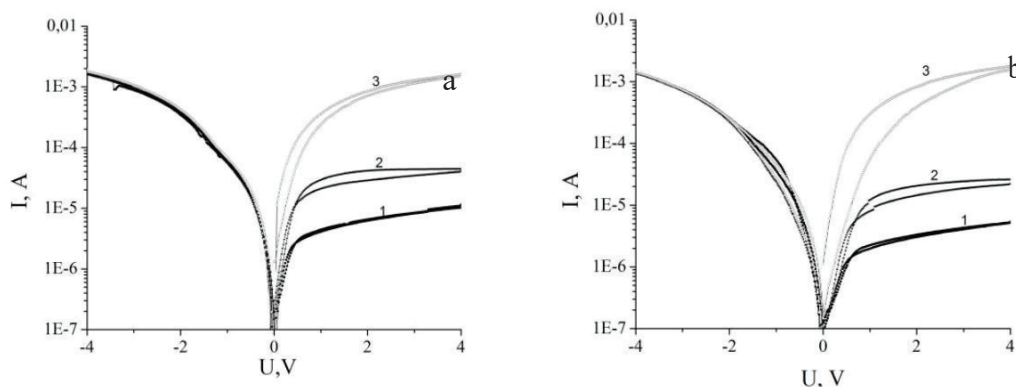


Fig. 1. Volt-ampere characteristic of ZnO: Al: Eu³⁺ (a) and ZnO: Ag: Eu³⁺ (b) films on silicon substrate. Light sources: 1- without lighting (dark), 2-IR source, 3-incandescent lamp

Keywords: sol-gel, current-voltage characteristics, transparent conductive ZnO:Me –films, hydrophobic properties, photosensitivity.

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