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Modeling of an oxide solar cell based on a ZnO/Cu_2O heterojunction

A. V. Saenko, G. E. Bilyk and S. P. Malyukov

Institute of Nanotechnologies, Electronics and Equipment Engineering,
Southern Federal University
2 Shevchenko st., Taganrog, 347922, Russia
E-mail: avsaenko@sfedu.ru

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Numerical modeling of an oxide solar cell based on a ZnO/Cu_2O heterojunction has been carried out to optimize its structure and increase the efficiency of energy conversion. The influence of the shunt and series resistances, the thickness and concentration of defects in the Cu_2O and ZnO layers, as well as the surface concentration of defects at the ZnO/Cu_2O heterojunction on the photovoltaic parameters of the solar cell is studied. It is shown that the shunt and series resistances should be 2500 $\Omega \cdot cm^2$ and 3,3 $\Omega \cdot cm^2$, and the thickness of the Cu_2O and ZnO layers should be 5 μm and 20 nm, respectively. It was found that the optimal concentration of defects (copper vacancies) in the Cu_2O layer is 10^{15} cm^{-3}, the concentration of defects (oxygen vacancies) in the ZnO layer is 10^{19} cm^{-3}, and the surface concentration of defects at the interface should be as low as possible and be 10^{10} cm^{-2}. Optimization of the structure of the oxide solar cell made it possible to obtain an energy conversion efficiency of 10.25 %. The results can be used in the development and formation of oxide solar cell heterostructures.

Keywords: solar cell, oxide semiconductors, numerical modeling, layer thickness, defect concentration, efficiency.

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