

Physical and Chemical Properties of Solid Solutions Based on CuInSe₂-FeSe

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CuInSe₂ is a with the width of band gap (0.96 eV) relates to groups of diamond like semiconductors of A¹B^{III}C₂^{VI} type with the presence of chalcopyrite structure that is typical for them.

The great interest in CuInSe₂ and solid solutions on their basis developed among researchers nowadays is due to the fact that they are perspective materials for manufacturing of light diode solar elements and devises for nonlinear optics.

The insertion of transitional elements into the structure of CuInSe₂ can intensively influence the properties of materials, for example, change the width of band gap. However, information about the compatibility between transitional metals and CuInSe₂ given by periodic literature is insufficient [1-3]. According to literary data the structural positions of indium in chalcopyrite can easily be replaced by iron ions, and in this connection there is a strong probability of the formation of solid solutions in CuInSe₂ – FeSe.

The purpose of the present work is the synthesis of solid solutions in the (CuInSe₂)_{1-x}(FeSe)_x system, as well as composite thin-film resistors based on (CuInSe₂)_{1-x}(FeSe)_x and a polymer such as polyethylene of low pressure. Synthesis of CuInSe₂ and solid solutions on the basis of (CuInSe₂)_{1-x}(FeSe)_x was carried out as per ceramic technology with using methods introduced in work [4].

Temperature measurements of conductivity were performed in the range from 77 to 400 K. The phase transitions were determined by the method of differential thermal analysis (DTA). By the result of DTA the phase diagram of CuInSe₂-FeSe system was constructed and it is show that it belongs to eutectic type with limited solubility. Diffraction patterns of alloys from area of a-solid solutions are identical, and they crystallize in the chalcopyrite structure (spatial group 142).

The calculated values of parametres of a lattice for CuInSe₂: a=5,782 nm; c=1,1621nm correspond well with data [5]. It is established, that in composite resistors the dependence of current value (CVC) on the applied voltage has nonlinear character, i.e. CVC has the character of varistor. Researches on the electric properties have pointed out that the CuInSe₂-FeSe system possesses a semiconductor character of conductivity.

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