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Chemical bath deposition of sulfide tin(II) films with sodium thiosulfate

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Abstract

Thin films of a semiconductor compound of tin monosulphide SnS in view of high values of coefficient of optical absorption in visible and near infrared area of a range is of interest to optoelectronics. Due to the development of photovoltaic thin-film SnS technologies, having width of the forbidden zone for direct transitions 1.37 эВ, it is extremely promising as this value is near optimal for effective transformation of sunlight to electric energy on one-transitional solar elements. It suggests that when using SnS as the absorbing layer in photo-electric converters the efficiency to 24% theoretically can be reached. Thanks to a possibility of synthesis of films of sulfide of tin in low-temperature conditions in water environments and prevalence of tin in the nature, interest is caused to him. In this regard development of conditions of purposeful synthesis of SnS. In work the calculation method of forecasting of boundary conditions of formation of the solid phase of SnS developed by authors and approved on a number of chalcogenide of metals is used. The concentration areas of formation of sulfide of tin(II) are established for reactionary system «$SnCl_2$ – $Na_3C_6H_5O_7$ – $Na_2S_2O_3$» by the analysis of ionic balances at a temperature of 298 K taking into account the prevailing complex forms of tin. Calculation is show that the weakly acidic area (pH = 3÷4) is favorable for receiving sulfide of tin (II) and excludes formation of $Sn(OH)_2$. On the basis of the received results with use of the $Na_2S_2O_3$, $SnCl_2$, $Na_3C_6H_5O_7$ by hydrochemical deposition at T = 353 K were received mirror layers of SnS of gray color with good adhesion to a sitall substrate with thickness depending on conditions of carrying out process from 50 to 300 nm. By the energy dispersive analysis it is shown that the content of tin and sulfur in them is 50.43±1.0 and 49.57±1.0 ат. % respectively, i.e. the synthesized SnS films exhibit pronounced stoichiometry. Films are formed from plate with sizes ~50×100 nm.

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