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ABOUT MAKING AND PROBLEMS OF APPLICATION FOR CADMIUM SULFIDE IN ENERGY

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The results of analysis for obtaining and major technological characteristics of solar cells on cadmium sulfide basis as to the opinion of it's using in solar energetic are considered. The most popular methods for production of solar cells on cadmium sulfide basis in modern productions are considered. The estimation of perspectives of using of cadmium sulfide in solar energetic is given.

Key words: cadmium sulfide, production, p-n transition, value of band gap, coefficient of efficiency, solar element

Since in 1954 a photoeffect was educed in the structure of CdS-Cu_2S [1], intensive researches for possibility of creation of sun elements are began on the basis of the noted system. The detailed review over of works which executed in this to 1973 is brought in the article [2], the review of later researches is given in works [3,4].

The most perspective method of decline of cost for sun elements is creation of thin-film elements. Main efforts in this area are sent on research-and-development sun elements on the basis of getero system CdS-Cu_2S, as their making can be in a considerable measure automated [5].

It should be noted that coefficient of efficiency of sun elements on the basis of CdS-Cu_2S is subzero enough: does not exceed 8 %; in theory them coefficient of efficiency it is possible to promote to 15 % [6].

For determination of different methods of improvement of elements the calculations of density of current which flows through the limit of division of j_{L0} depending on different parameters were executed.

An important parameter in these calculations is an coefficient of absorption α_d, which can change depending on the method of material making, as a result looked variation of the measured values of coefficient absorption in wide limits.

In area of lengths for waves, less than wave-length, which conforms the width of forbidden zone of CdS ($\lambda < 0{,}51$ mcm) 15-20 % photons are placed from their general quantity in the spectrum of sun radiation. It should be noted that the curve of spectral susceptibility of element with a reflection surface during work in the frontal mode has a slop, when a wave-length presents 0.51 mcm which conforms the width of forbidden zone of CdS. For elements with the very skim layer Cu_2S appearance of slop for lengths of waves, less than $\lambda = 0.51$ mcm, it is also related to illumination of carriers in CdS. Existence of this slop testifies that for most elements during work at the frontal mode there is a reflection of light from a umbra surface.

Size of diffusive length L for electrons in the layer of Cu_2S it is possible to estimate by means of dependence of integral current of short circuit from the thickness of the noted layer. Density of current, that look in the real elements, and

also the values of thickness which a maximal current conforms it is show that $L > 0{,}3$ mcm.

Results of calculations of current of polycrystalline sun elements with planar geometry during work at the back mode elements have a higher susceptibility. As during making of elements on the limits of granules the layer Cu_2S appears the method of immersion, then a necessity is correction results, got for a planar model; for elements with a nonplanar structure higher currents are expected.

It is foreseen that the increase of Cu_2S near the limits of granules takes place with considerably greater speed, than in the center of granule. A size d is attitude of general volume Cu_2S to the area of element with planar geometry and it is determined by an electrochemical or chemical method. It is experimentally set that between the size of d and sometimes immersion t exists linear dependence.

In the brought calculation data over it is did not take into account influence of superficial recombination speed of which is evened S, and drift field, by intensity of F_1. According to the executed estimations [6], for good elements recombination on an interface diminishes the current of short circuit less than on 10 %, while the drift field can increase j_{L0} intensity of F_1 approximately on 10 %.

Other important parameter of sun element is successive resistance of R_S. When successive resistance is determined by the parameters of layer of Cu_2S, it depends from the concentration of carriers and thickness of layer (inversely proportional to product of pd). For the optimized elements $L/d > 2$, thus L is straight proportional p-1/2. Using correlation of $R_S < R_{S0}$ jointly with limitations $L/d > 2$ and $d > d_0$ (what is needed for effective absorption of photons), it is possible to define the area of values of thickness of layer Cu_2S and concentrations of carriers which provide necessary properties of elements.

Conclusions. The executed researches allowed really to estimate theoretical possibilities of improvement of descriptions of sun elements on the basis of structure CdS-Cu_2S. Calculations executed for elements with the best descriptions, coming from the bottom limit of losses. That the value of coefficient of efficiency exceeded 10 % it is necessary substantially to increase voltage of open-circuit. On condition that parameters of grate and electronic cognation of both materials, in particular, width of forbidden zone conform each other, it is possible to get $V_{o.c.} = 0{,}8$ V. Such voltage of open-circuit in combination with the higher value of current of short circuit will allow to get coefficient of efficiency of sun elements approximately 15 %. If to eliminate the effect of increase of surface of escape and increase duty cycle, then it is possible yet more to promote the top limit of coefficient of efficiency elements.

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