

Electrical properties of nanoporous photo adsorbers based on $\text{CuSn}(\text{S},\text{Se})_2$ under conditions of varying moisture and lighting

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Nanostructured materials based on $\text{CuSn}(\text{S},\text{Se})_2$ are of interest in the context of renewable energy. They are effective photoadsorbers [1], and in addition, they have a high structural susceptibility to moisture adsorption. Thanks to the use of nanostructured photo adsorbers, it becomes possible to create a hybrid system that combines the properties of both phototransformers and converters of energy absorption of water molecules into an electric form.

The purpose of this work is to investigate the electrical properties of direct current materials in conditions of different humidity. Crystals of the composition $\text{Cu}_2\text{CdGe}_{100-x}\text{Sn}_x\text{Se}_4$ were used as the investigated objects, where $x = 10, 20, 30, 40, 50, 60, 70, 80, 90$.

Fig. 1. Dependence of the electrical conductivity of $\text{Cu}_2\text{CdGe}_{100-x}\text{Sn}_x\text{Se}_4$ samples on humidity.

As can be seen (Fig. 1), there is a tendency to decrease the electrical conductivity of the $\text{Cu}_2\text{CdGe}_{100-x}\text{Sn}_x\text{Se}_4$ system with an increase in tin concentration ($x\%$). The maximum value (0.0546 Ohm^{-1}) was recorded for two samples $x=10$ and $x=20$ at atmospheric humidity values of 26% and 75%, respectively. It was found that the optimal humidity, where the greatest electrical conductivity is observed for most samples, is 75%.

It was found that the studied compounds of the composition $\text{Cu}_2\text{CdGe}_{100-x}\text{Sn}_x\text{Se}_4$ ($x=10-90$) at relatively high concentrations of dopant in atmospheric humidity conditions of at least 75% have a sufficient level of electrical conductivity and can potentially be used as a functional medium for a combined chemo- and photo-converter for alternative energy sources.

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[1] Xie H. et al. Impact of Sn (S, Se) secondary phases in $\text{Cu}_2\text{ZnSn}(\text{S}, \text{Se})_4$ solar cells: a chemical route for their selective removal and absorber surface passivation //ACS applied materials & interfaces. –2014. –T. 6. –№. 15. –C. 12744-12751.

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