INFLUENCE OF OPERATING TEMPERATURE ON THE THIN FILM SOLAR CELLS EFFICIENCY

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At present time the solar thermal collectors are used for thermal conversion, the efficiency of which reaches 70-80% due to the selective coatings application with absorption coefficient in the spectral range of sunlight to 95-98% and the reflection coefficient in the infrared range of no more than 5-7%. The current tendency in the development of the most commonly used automated systems of heat collectors with compulsory heating circulator is that the electric energy for their operation is generated by traditional silicon solar modules [1]. As far as traditionally sun modules are placed separately from solar thermal collectors, this does not lead to an efficiency increase.

The reducing the use of space for such systems may be due to the photovoltaic converters (PVC) combination with the system of heat collector. This is realized due to the use of flexible film photovoltaic converters, which can be placed on the surface of the collector plate by repeating the features of its micro relief with the effective thermal contact provision. The photovoltaic converters, for use in such systems, should effectively generate electrical energy at a working temperature of 50 to 55°C; they must also provide a solar absorption coefficient of at least 90% and have an attenuation coefficient of up to 10% in the infrared spectrum. Together with the cooling system of the heat collector, the PVC design should provide a difference between the PVC temperature and the heat carrier temperature not exceeding 5°C. When the last two conditions are fulfilled, a selective coating can be selected from the design of the solar collector, as far as its functions will be performed by the PVC.

The main optimization problem for the such a system development is to determine the level of influence of the collector working temperature on the rate of reduction of the film PVC efficiency.

The comparison of the study of the temperature dependence of efficiency for film PVC on the basis of CdTe and $CuInSe_2$ compounds produced in laboratory conditions, amorphous silicon and crystalline GaAs, which are manufactured industrially, showed that the least reduction in the efficiency with the growth of the operating temperature has device structures on the basis of base layers of cadmium telluride. With a change in temperature at 50°C, the efficiency of such devices is reduced by only 1%, and the relative rate of decrease is -0,14 rel.%/C, which is significantly less than the same for other types of PVC: GaAs -0,16 rel.%/C, amorphous silicon -0,21 rel.%/C, $CuInSe_2$ -0,36 rel.%/C.

The analytical processing and analysis of the influence of light diode characteristics on the PVC efficiency on the basis of cadmium telluride showed that the temperature stability of their efficiency is ensured by the diode current density of the cut. When the temperature rises from 20°C to 50°C, the density of the diode current of saturation increases by 50 % from $1.9 \cdot 10^9$A to $2.7 \cdot 10^9$A, which is lower than for silicon PVC, for which the diode saturation current increases by 300 %.

1. Fayaz H., Nasrin R., Rahim N.A., Hasanuzzaman M. Energy and exergy analysis of the PVT system: Effect of nanofluid flow rate // Solar Energy. – 2018. – Vol. 169. – P. 217-230.