THE MAIN PARAMETERS OF THE SOLAR CELL

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After the global energy crisis in the 70s of the last century, the development of unconventional and renewable energy began. Currently, the total capacity of operating power plants based on renewable energy sources is about 600 GW, which is almost twice the capacity of all operating nuclear power plants in the world. [1].

On the territory of the Central Asian region, the priority areas of research in the field of solar energy are:

1. Improvement of solar power plants (SPP), allowing to generate electrical and thermal power on an energetically significant scale without negative impact on the ecological environment [2];
2. Experimental research and practical application of solar parabolic cylindrical power plants [3];
3. Developments for the widespread use of heat pipes as a heat sink for solar parabolic cylindrical installations [4];
4. Research to improve the efficiency of photoelectric conversion (solar flux, ambient temperature, wind speed, optimal system load matching) [5];
5. Development and improvement of existing hybrid structures for air, water cooling, heat removal from panels, with forced cooling [6].

In the automated systems for measuring the energy indicators of the above solar systems, certain structures and algorithms are formed, which consist of the following main parts:
object of research - solar energy system;
sensor;
secondary, microprocessor device;
actuating mechanism;
experimental data logger.

The measuring system of experimental data consists of functionally combined measures, measuring instruments, measuring transducers, computers, other hardware and software modules installed to measure one or more energy quantities. The main task of measuring systems is to generate measuring information signals in a form most convenient for automatic processing and control, transmission and use in registration systems [7, 8].

In Figure 1.1, you can see a solar cell circuit based on a *p-n*-junction. The current I is taken by the load R, which shunts based on the *p-n*-junction. Parallel to the *p-n*-junction, there is a current generator with a current strength I_{ph}, which describes the excitation of nonequilibrium carriers by solar radiation [9].

The current-voltage characteristic can be described by the expression:

$$I = I_s\left(\exp\left(\frac{eV}{kT}\right)-1\right)-I_{ph} \qquad (1.1)$$

The value of the photocurrent I_{ph} is determined by the number of excess charge carriers created by light and reaching the *p-n*-junction:

$$I_{ph} = I_{ph}S = \left(\frac{e\gamma\beta SI_r}{h\nu}\right) \qquad (1.2)$$

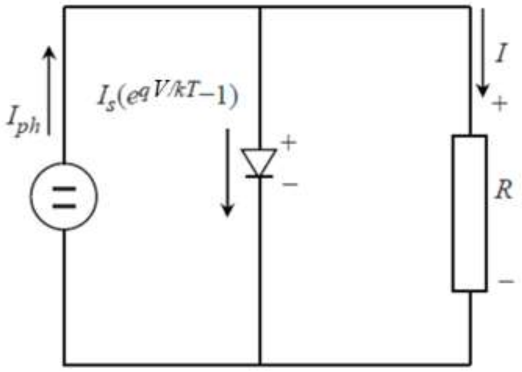

Figure 1. Equivalent circuit of a solar cell

where, I_{ph} is the photocurrent density; S is the area of the p-n-junction; γ is the proportion of non-recombined pairs of charge carriers that have come to the p-n-junction; β is the quantum yield; I_r is the radiation intensity.

From (1.2) one can obtain a graph of the current-voltage characteristic (CVC) of a p-n-junction under illumination. Figure 1.2 shows that the CVC can be obtained by moving the dark characteristic down along the current axis by the value I_{ph} [9].

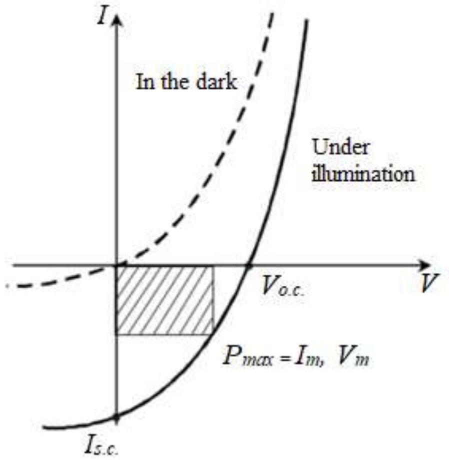

Figure 2 – Current-voltage characteristics of a photocell based on p-n-junction

It can be seen that the CVC equation is valid when the photosensitive element is illuminated with light of any spectral composition, only the value of the photocurrent I_{ph} changes [9-10].

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