RESEARCH LABORATORY MODEL OF EFFICIENCY CONVERSION OPTICAL RADIATION TO ELECTRICITY

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Experimental study of optical radiation conversion efficiency of different light sources in electricity on the proposed academic laboratory bench using photovoltaic.

Photovoltaic cells, experiment, performance, stand.

Development of materials, technologies and equipment for manufacturing photovoltaic modules is actual and prospective activities of modern global organizations. However, along with the mass production of industrial designs, manufacturers do not pay enough attention to the development of affordable specialized equipment for education and training can serve photovoltaic system. Develops and produces educational and laboratory benches research and scientific and industrial institutions. Cost stands to perform one type of research was from 5,022.00 to 12,553.00 USD. [1] As of 2012 Currently existing educational market stands, for example a typical set of training equipment "Sun fotoэlektrycheskaya system" [2], is expensive (according to the manufacturer's website approximately 42,180.00 USD. As of February 2014) and is readily available for the purchase of educational institutions. List of laboratory work that can be performed on the stand is traditional and is reduced to the study of photovoltaic module and study of autonomous photovoltaic system consisting of: rechargeable battery, charge controller and variable load.

In terms of minimum manning stands to create educational laboratories using its own logistical base for the development of research methods is an urgent task.

The purpose of research - to develop a laboratory stand photovoltaic module to study and conduct research of efficiency of conversion of optical radiation of different light sources in electricity.

Materials and methods of research. Studies were conducted using photovoltaic module lamp with different types of lamps and the ability to change the position of the optical system, digital voltmeter and ammeter, pyranometer and variable load.

Experimental studies carried out by the developed program guidelines.

Results. For research conversion efficiency of light emission of different light sources in electricity proposed scheme laboratory stand.

According electric concept assembled laboratory stand, the appearance of which is shown in Fig. 2, containing 1 - photoelectric converter brand Luxeon PT-020 (with power, current at maximum power, short-circuit current, the voltage at open contact material - monocrystalline silicon); 2 - FLUXE 18B multimeter with DC voltage measurement accuracy of ± 0,5% of the data; 3 - multimeter VC-9804A with DC measurement accuracy ± 0,8% of the data; 4 - pyranometer SP-216 with an error of measurement ± 0,5%; 5 - lamps (bulbs - 100W, infrared - 100 W fluorescent - 130 W UV - 130 W); 6 - resistor; line.

To achieve accurate results, a study should be carried out in the absence of a foreign sources of light on the surface of the photoelectric converter, it will avoid the error results from natural light. Thus lighting phototransducer ensured only by the lamp fixture. Ambient temperature during the experiments equal to 24 0C.

The first stage of photovoltaic research is to determine the dependence of electromotive force photovoltaic flux density of radiation (E = f (W)). During the experiment photovoltaic electrical load missing. Light source is set to direct radiation to the surface phototransducer (zero mark on the limb stand) at a height of 30 cm. Set the voltmeter generated electromotive force (E, B) and according phototransducer hits pyranometer - irradiance (W, W / m2) in phototransducer center and four extreme points of its surface. Calculated average of the flux density radiation. Then made similar measurements at oblique incidence of radiation on the surface of photovoltaic turning the module at an angle of 10, 20, 30, 40 and 50 degrees. The calculation results are shown as a graphical dependence.

The second phase of research on the laboratory bench to determine the dependence of power load acting in the electrical circuit (P = f (R)). Light source is set to direct radiation to the surface of the photoelectric converter. To change the load resistance in the electrical circuit used rheostat. The results of the experiment are shown in Fig. 4, where 1 - experiment with an incandescent lamp 100 W; 2 - experiment with infrared lamp 100 W; 3 - Experiments with fluorescent lamp 130 W; 4 - Experiments with ultraviolet lamp 130 watts.

The calculation of the efficiency of photovoltaic done by dividing the generated power phototransducer (RF = UI, W) on radiated power (PB = WS, W), ie, where W, W / m2 - irradiance sources of artificial lighting; S = 0,18072 m2 - surface area phototransducer brand Luxeon PT-020. The results of calculation of efficiency phototransducer when hit by radiation of different types of lamps in its area shown in Fig. 5.

Thus, for the development of laboratory and educational booth used 1800.00 USD. for all the equipment including measuring devices (multimeter in calculating the value FLUXE 18 B replaced by VC-9804A), which is significantly less than the cost of sales of existing stands. In addition to lower cost possible through the use of stationary measuring devices.

Concusions

As a result of experimental studies using laboratory-training stand, the following conclusions:

1. To increase the efficiency of energy conversion is possible through the use of light sources with high flux density light.

2. To achieve maximum conversion efficiency flux density radiation into electrical energy photoelectric converter should be placed perpendicular to the rays of light emission.

3. In laboratory experiments better use lamps incandesce-tion of different power with higher density of radiation compared to fluorescent or UV.