EFFICIENT SILICON SOLAR CELLS FOR SPACE AND GROUND-BASED AIRCRAFT

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On the MCA "AIST 2" is planned the conduction of the experiment on the study of the outer space effects on the characteristics of experimental silicon photovoltaic cells (PVC)manufactured according to the technology developed in the Samara state University. Effective photovoltaic cells as sources of energy for aircraft are of great interest from developers of space technology, as for most of spacecraft solar panels are virtually non-alternative source of energy. Most high performance to date have nanoheterostructure PVC-based materials AIIIBV. However, despite the fact that silicon solar cells inferior to them on such an important parameter as efficiency, silicon continues to be the main material of the photo power engineering. This is due to the prevalence of raw materials and advanced technology of manufacture of the material and devices on its basis, providing a significantly lower cost silicon solar cells in comparison with analogues on the basis of materials AIIIBV. Therefore, the actual problem silicon solar cells are to increase their efficiency. Experimentally proved that silicon solar cells are not inferior in efficiency of energy conversion nanoheterostructures can be created on the basis of multilayer structures on single crystal silicon substrate in which there are materials with different bandgap Units, making it possible to reduce losses in a crystal and to exceed the theoretical limit of photovoltaic energy conversion for mono-silicon 27% [1].

In this paper photosensitive structures contained layers of nanocrystalline porous silicon, silicon carbide, fluorides of rare earth elements. In silicon nanocrystals width of the gap is determined by the quantum-size effects and can be significantly more than for three-dimensional single-crystal silicon, which allows to increase the spectral sensitivity of the FEP in the shortwave spectral range [2]. To increase the spectral sensitivity of the silicon solar cells at the far end of the spectrum allows the use of dielectric coatings of fluorides of rare earth elements (REE), thanks observed in these materials the effect of perevoploscheniya [3]. In addition, application of coatings of films oxides and fluorides REE can significantly reduce recombination losses. Application of fluoride film REE on a working surface of a silicon PV allows to increase the photocurrent more than 50% [4].

To study the photosensitivity structures were measured dependences of the photocurrent on the level of illumination of the working surface structure with white light from incandescent lamps with radiation spectrum that is closest to the sun. In Fig. 1 shows Suite-voltage characteristics of the samples photosensitive structures with porous layer in comparison with the characteristic patterns without porous layer. The figure shows that the size of the photocurrent structures with porous layer exceeds the amount of the photocurrent structures without porous layer several times with the same values of illumination.

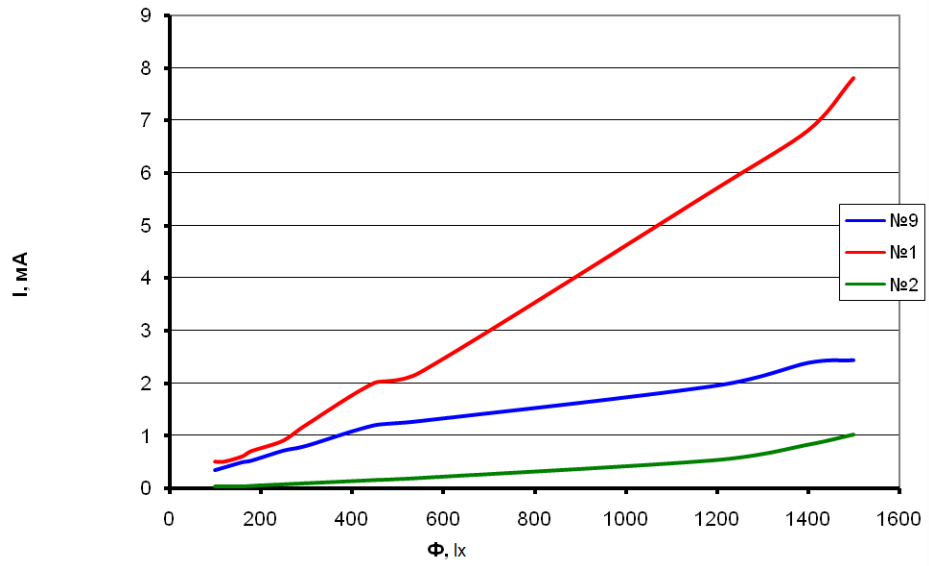

Fig. 1 Luxe-ampere characteristics of photosensitive structures: № 9 and №1 - with a porous layer, №2 - without porous layer

For a study of spectral dependencies of photosensitivity structures was carried out measurement of the photocurrent under the illumination of the working surface of the sample monochromatic light known power. Photosensitivity R was calculated as the ratio of the photocurrent Iph (ICA) to the incident radiation power P (W):

$$R = \frac{I_{ph}}{P} \tag{1}$$

In Fig. 2 shows the spectral characteristics of the samples structures without coating and with coating of fluoride dysprosium. It is seen that with a small decrease in the photosensitivity of the patterns in the shortwave spectral range application of fluoride film dysprosium significantly increases its in the longwave spectral range.

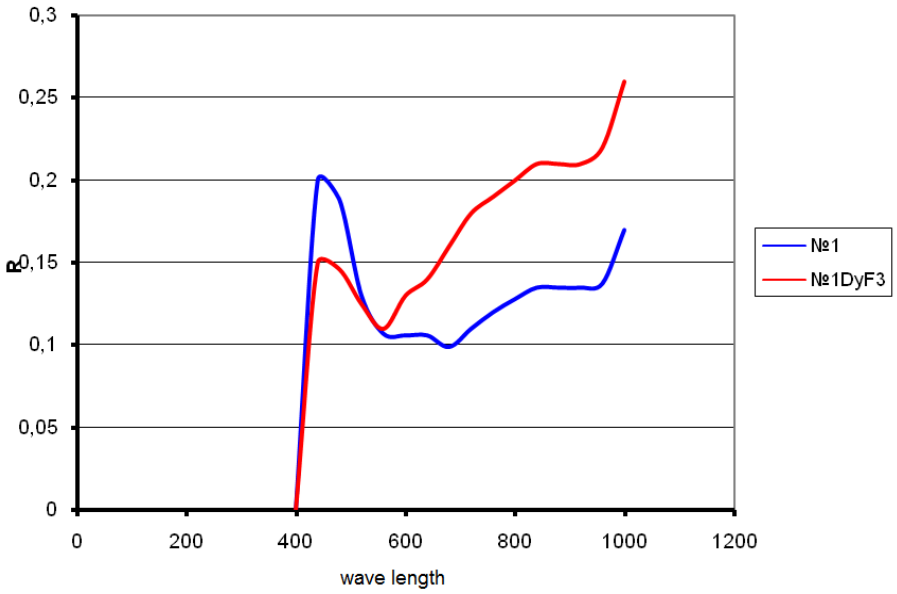

Fig. 2 Spectral characteristics of the sample with a porous layer, covered with fluoride dysprosium and without him

The above results show that the use of multilayer structures with porous layer dielectric coating of fluoride dysprosium allows you to create photosensitive structures with high photoelectric parameters that can be controlled by changing the modes of production.

Thus, we can conclude that the use in the construction of photovoltaic cells on silicon substrate layers of porous nanocrystalline silicon, promising to increase its effectiveness. At the same time, the technology of manufacturing of such structures is not much different from traditional technology of manufacturing silicon solar cells, while preserving its obvious advantages: availability of raw materials, efficiency, environmental friendliness, safety, well-developed industry

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