STUDYING THE PROPERTIES OF CASSITERITE-BASED AND SILICON OPTICAL LAYER PHOTOCELLS

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Abstract:
The article describes the methods of studying the properties of cassiterite-based and silicon optical layer photocells.

Keywords: cassiterite, photocell, optical layer, photogeneration, silicon, heterojunction, homojunction, light absorption coefficient, light reflection coefficient.

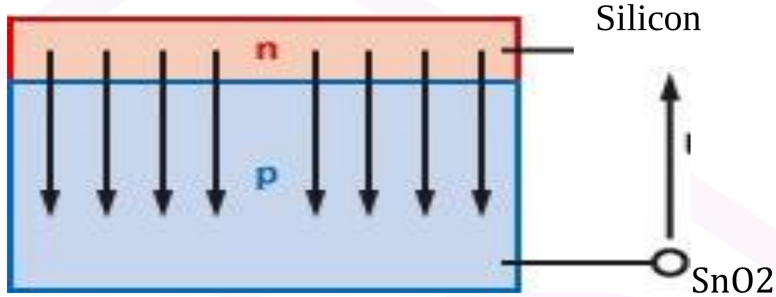
Energy plays an important role in the life of society. It makes it possible to multiply the possibilities of meeting various regional needs. The development of human civilization is closely related to the amount and types of energy that is used all the time. However, today's development of the national and world economy is causing excessive use of energy resources and, depending on it, their volume is decreasing. Therefore, generating electricity easily, conveniently, cheaply and, most importantly, without harming the environment is one of our main needs. It is known that the generous Sun has been shining its light on the Earth for billions of years. Sunlight is energy. People have learned to turn it into electricity. For this, he created special semiconductor devices - photocells. Together they form solar cells. The amount of solar energy transmitted to the Earth is approximately 20 times more than the amount of energy currently produced in the world. Today, many scientific works and researches are being conducted all over the world regarding the wide use of renewable electricity sources and their efficiency improvement. Among such issues, increasing the efficiency of photovoltaic cells to a high level is the main task facing most researches. We would like to make the following suggestions for the creation of photocells with such tasks in front of us.
Photocells are electrical devices that generate electric current (photocurrent) or photoelectromotive force by absorbing light falling on it. Semiconductor photocells are used to convert solar energy directly into electricity in solar cells and photoelectric generators. Cassiterite (SnO_2) is used as the main element of

solar cells that we would like to offer. This substance is considered the most important ore of tin and its most common compound, tinstone is insoluble in water and hydrochloric acid, it also has a specific gravity and is weather resistant. We took cassiterite with a thickness of the main layer of 120 μm.

Environment-air

D_{SnO2}=60 nm

D_{Si}=120μm



Photocells use materials with different chemical composition for the base and top. The basis of the photovoltaic cell we offer is cassiterite. The optical layer is used to increase the light absorption properties of semiconductors. The thickness of the optical layer is nm (nanometer). We emphasize that the photogeneration process of the tested photocell will be high as the optical layer of the proposed photocell consists of silicon. The photogeneration process is the formation of electron and hole pairs. Electrons and holes act as charge carriers in the photocell. A heterogeneity occurs between cassiterite and silicon. Electric transitions based on semiconductor materials with equal band gap widths, that is, chemically the same semiconductor materials, are called homojunctions, and transitions based on semiconductors with different band gap values are called heterojunctions.

Since silicon and cassiterite are elements with different forbidden band widths, heterojunction occurs between them. In this case, silicon is coated on the upper layer of cassiterite with a size of 60 nm.

If the surface of the photocells is made in the form of pyramids in order to ensure that all the light coming from the sun is consumed in the process of current formation in the photocell, the light falling on the pyramid is refracted 4 times hitting the sides of the pyramid, and each time a certain part of the light is absorbed, the falling light is almost not reflected. In this case, it is desirable that the pyramids are equilateral and the angle between the base and the side is

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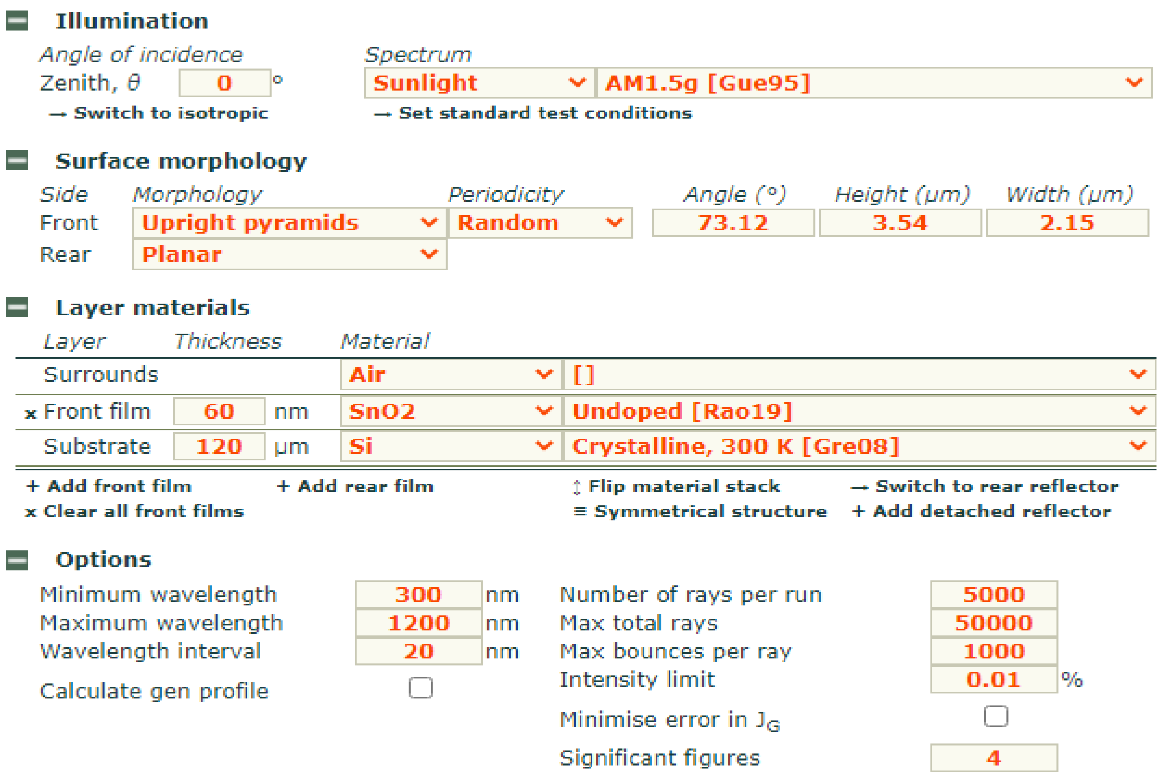
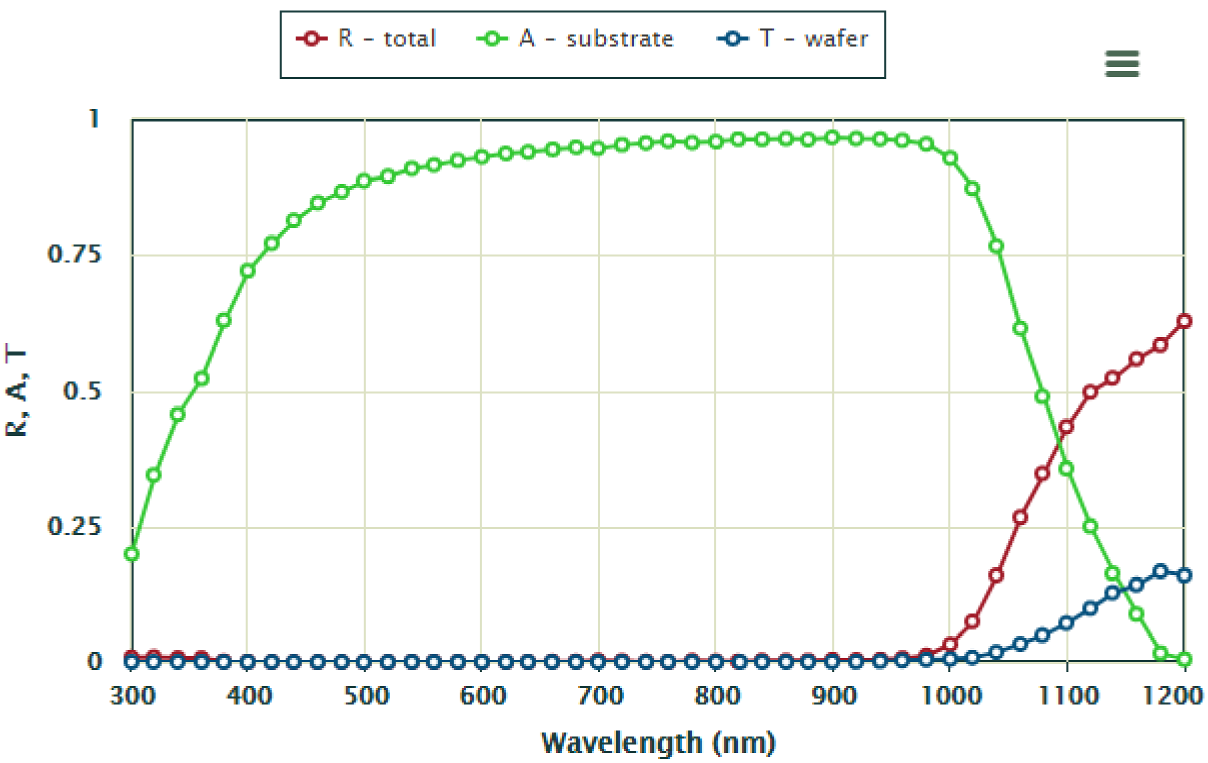
73.120. That's how we come close to the intended goal and increase the useful work coefficient to a certain level.





Here:

- R- is the reflection coefficient
- A- is light absorption coefficient
- T- is light transmission coefficient

The parameters entered using the above suggestions have been verified in the PV LIGHT HOUSE program, which is currently designed with an in-depth study of the properties of solar cells. As can be seen from the graph, the light absorption coefficient of the photocell reaches its maximum value when the wavelength is in the range of 600�1000 nm, and the light reflection coefficient shows a very low value. The fact that the photogeneration process is 99.21% indicates that this photocell is more efficient than the original ones.

As can be seen from the graph, a semiconductor solar cell with a Cassiterite base and an optical layer of Silicon can be superior to the currently used solar cells with high safety and efficiency.

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