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METHODS OF IMPROVING THE EFFICIENCY OF SOLAR CELLS BY CHANGING THEIR STRUCTURE

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A B S T R A C T

This article analyzes the improvement of the optical properties of solar cells and the new type of pyramidal solar cell and its construction solutions. The fact that the rays of the sun falling on the surface of the element depend on the geometric dimensions and recommendations for improving the refractive index by changing them are given.

K E Y W O R D S

pyramidal solar cell, refractive index, photoenergy, light absorption, construction.

In the future, the use of renewable energy sources is undoubtedly necessary to ensure energy, environmental, and economic security, as well as for the sustainable development of the energy sector. A prerequisite for preserving natural resources and protecting the environment for future generations is the adoption of renewable and alternative energy sources. The use of solar energy is environmentally friendly compared to conventional fuels, so recently, solar energy has been converted into electricity. the need for devices has increased significantly. Examples of such devices are photovoltaic cells. Various types of photovoltaic devices have already been developed, but their efficiency still needs to be improved, and therefore, creating methods to improve their efficiency is a priority for many researchers.

Today, silicon-based, perovskite, organic and other types of solar cells are being produced. Among them, the most common one is silicon-based. Because it is the most common element on earth after oxygen, and the production technology is also cheap. However, the useful work coefficient is close to 20% in production, and theoretically close to 30% in laboratory conditions. It is also very expensive in terms of cost.

The useful efficiency of solar cells depends on the nature and structure of the semiconductor material used for it, the quality of the ohmic contact, the resistance of the materials, how much of the incident light flux returns from the surface and how much of it passes through the semiconductor without being absorbed, the formed electron-holes depends on how much is allocated to the p-n junction region.

The incidence, refraction and return of light rays on the surface of two media can be analyzed by the nature of the polarization of the electromagnetic wave after falling on the surface, the refraction and return of the polarized light. Taking into account the above points, we have proposed a new

pyramidal solar element. The pyramid-shaped textures formed on the surface of this structure by various technological methods are analyzed based on two or more times of refraction of the light falling on the surface of two media. Due to the increase in the number of refractions, the flow of refracted rays into the semiconductor medium increases.

We will consider which absorption has the greatest contribution in the process of absorption and in which cases it can be fully demonstrated. The absorption of light depends on the types of absorption, phonon absorption, excition absorption through the input atoms of the main absorption mechanism, assuming that photoenergy is used to change the energy states of electrons and atoms:

Solar elements with this design are very different from other designs in terms of their appearance and structure. Because we can determine how many times the incident light is refracted depending on the angle at the base of the resulting pyramids. Through this, you can find out exactly what pyramids should cover the solar element.

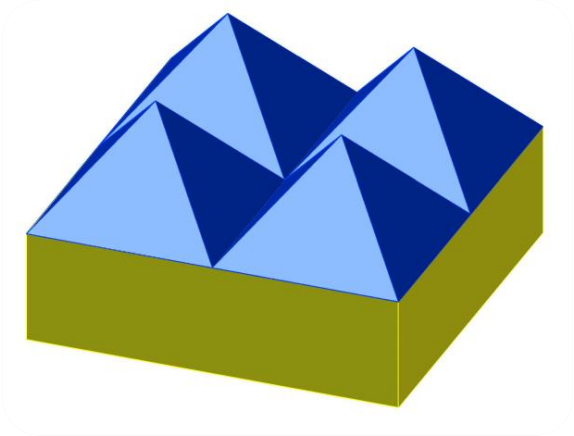

Figure 1. general view of the pyramidal solar element.

In these pyramidal solar elements, the height of their shape and the angle of their base are the most important parameters. So, if it is considered that the angle at the base of the pyramids should be in the range of 64.3<a<80, then we can say that our pyramid will look like this.

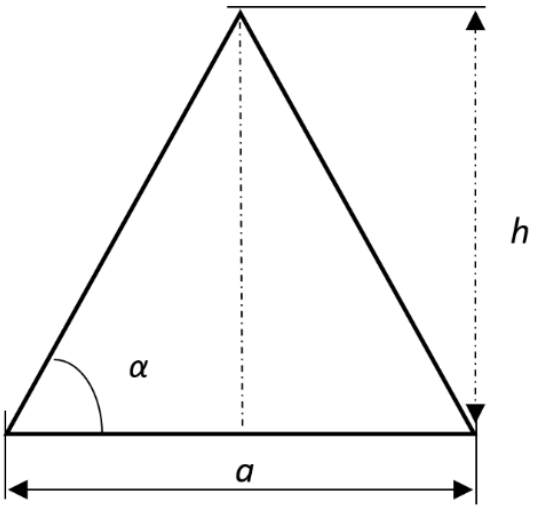

Figure 2. Side view of the pyramidal solar cell.

Here a is the angle at the base of the pyramid, h is the height of the pyramid, and d is the width of the base of the pyramid. By changing these parameters, the refractive index of the light falling on the pyramid can be improved.

It can be seen from the drawing that the reflectance, absorption and transmission parameters of the silicon plate with a pyramid-shaped texture were determined. These optical parameters depend on the pyramid parameters of the absorption index. The absorption index of the silicon wafer is strongly influenced by the angle and height of the pyramid. In addition, the intensity of light falling on the surface is equal to the sum of reflected from the surface, absorbed by the crystal, and transmitted through the crystal.

The properties of the material are usually referred to as the reflection coefficient, absorption coefficient, and transmission coefficient. Based on the Bouguer-Lambert law, the intensity of light incident on the crystal surface is absorbed by the crystal, and its amount decreases exponentially with the crystal thickness. In general, the physical meaning of the absorption coefficient is that atoms meet photons is to change one's energy state. Therefore, the greater the concentration of atoms and the larger the surface of atoms meeting with photons, he greater the probability of absorption of photons.

If light is imagined to be refracted four times between the pyramids, the relationships between each refraction angle and the angle at the base of the pyramid can be described as

$$a_1 = a$$

$$a_2 = 3a - \pi$$

$$a_3 = 5a - 2\pi$$

$$a_4 = 3\pi - 7a$$

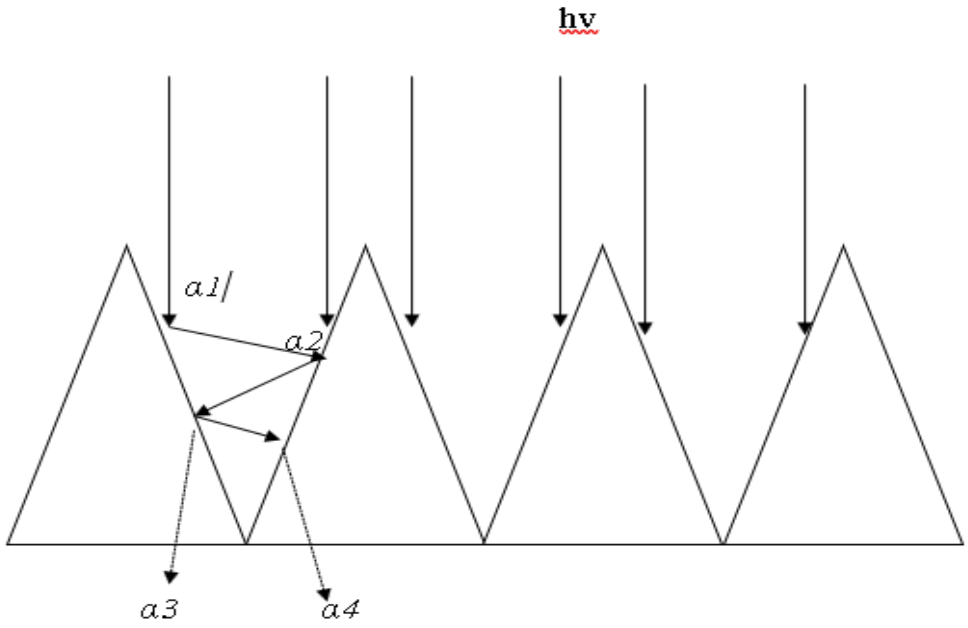

Figure 3. Scattering of light falling on pyramidal solar elements.

So, in order to improve the optical properties of the pyramidal solar cell, we can create solar cells with a modern appearance that are more efficient than traditional solar cells by calculating the amount of light falling on them in different sizes. In addition, another advantage of this type of new construction is that it saves a lot of space. If we use a pyramid structure instead of a 2m square panel, we can place a solar cell that is about 3 meters square, which in turn means more energy.

LIST OF REFERENCES

1. Lutfiddin Omanovich Olimov, Utkirbek Akramjonovich Axmadaliyev Solar and wind energy opportunities in uzbekistan, Collection of articles of the VI International Scientific and Practical Conference, Held on November 20, 2021 in Penza
2. I.I. Anarboyev L.O. Olimov. Electrophysical Properties of Two Structured Polycrystal Silicon. International journal of multidisciplinary research and analysis. 4 (11) 2021, PP. 1678-1681 www.ijmra.in DOI: 10.47191/ijmra/v4-i11-30, Impact Factor: 6.072
3. F.L. Omonboev L.O. Olimov, B.M. Abdurakhmanov. The Influence of Alkali Metal Atoms on the Electrical Conductivity of Granular Silicon. 7 (12) 2020, PP.7-10 https://www.arcjournals.org/international-journal-of-advanced-research-in-physical-science/volume-7-issue-12/
4. L.O. Olimov, BM Abdurakhmanov, FL Omonoboev, AH Yusupov. Influence of alkali metal atoms on the photoelectric properties of polycrystalline silicon solar cells. Journal of physics and surface engineering. 1 (3) 2016, RR. 263-267
6. R Aliev, L.O Olimov, Eh Mukhtarov. The effective design of photoelectric generator. 15.11.2011, PP.25-28. Modern problems of physical semiconductors - 2011.