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USE OF SEMICONDUCTOR IN SOLAR PANELS

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Abstract. This article covers the theoretical and practical basis for the use of solar panels and semiconductors. Today, there is a growing interest in renewable energy sources as a result of increasing demand for energy resources, the depletion of traditional sources, and the intensification of environmental problems. Among them, solar energy is considered one of the most promising and environmentally friendly sources. Solar panels are made on the basis of semiconductor materials and convert solar radiation into electrical energy using a photoelectric effect. Studies suggest that while silicon-based solar panels are common, high-performance panels based on materials such as perovskite, gallium arsenide, and cadmium telluride have also evolved in recent years. This opens the door to new opportunities in the solar industry. At the same time, innovative approaches aimed at reducing the cost of producing solar panels, improving energy storage systems and their widespread use in various industries are also an urgent issue. The article analyzes the properties of semiconductor materials, ways to improve the efficiency of solar panels, as well as the field of practical application. The perspective and role of solar panel technologies in global energy security have also been discussed.

Keywords. Solar panels, semiconductors, photoelectric effect, silicon perovskite, energy storage, alternative energy sources, efficiency, environmental friendliness, innovative technologies.

Introduction. One of the most important global problems facing humanity today is the shortage of energy resources and Environmental Protection.

Reserves of coal, oil and natural gas used as traditional energy sources are limited, and large amounts of harmful gases are released into the atmosphere as a result of their extraction and consumption. This condition not only negatively affects the ecological environment, but is also one of the main causes of global climate change. Therefore, one of the most urgent tasks facing modern science and technology is the widespread introduction of renewable and environmentally friendly energy sources. And solar energy is one of the effective solutions to such problems. Sunlight reaches the surface of the Earth in very large quantities, and they are an inexhaustible source sufficient to meet human needs. It is estimated that the sun's rays that fall to Earth for only an hour exceed the one-year energy



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requirement of the entire world's population. This makes it clear how wide the prospects for using solar energy are solar panels occupy an important place in the effective application of solar energy in practice. Solar panels are actually made up of photoelements, which are made on the basis of semiconductor materials. Semiconductors, in terms of their physical properties, are located between conductive and dielectric materials. Their best-known examples are silicon, gallium arsenide, and cadmium telluride. Solar panels are based on the principle of the photoelectric effect. In this, under the influence of sunlight, pairs of electrons and holes are formed in the semiconductor. The movement of these electrons causes an electric current to surface, and as a result, the sun's Rays are converted into electricity. Significant advances in solar panel technology have been made in recent years. While the efficiency of early silicon panels was 10-12 percent, today their efficiency has been increased to 25-26 percent. In addition, with tandem panels, there are opportunities to achieve an efficiency of about 40 percent. Achieving such results is the result of scientific research and research on new materials. For example, perovskite-based solar panels attract attention for their low cost and high efficiency. Research is also underway on Transparent and flexible solar panels, allowing them to fit on building facades, cars, or small devices. Solar panels are distinguished not only by their environmental friendliness, but also by their economic efficiency. Their service life is 25-30 years, during which they will not only completely compensate for themselves, but also bring additional income. For this reason, solar panel based power plants are being built in many countries today. For example, countries such as China, the United States, Germany and India are leading in this area . Nevertheless, there are also problems that need to be solved in the technology of solar panels. Due to the fact that their efficiency depends on solar radiation, the chances of generating energy in cloudy weather or at night decrease sharply. Therefore, the development of energy storage technologies, in particular, the creation of inexpensive and high-capacity batteries, is one of the most important tasks. In addition, the process of manufacturing solar panels requires a large resource, which increases their cost. Nevertheless, scientific research and technological advances on a global scale are aimed at solving these problems in stages. For example, there are prospects for using recyclable materials, making the production process more environmentally friendly, and using new types of semiconductors.

Main part . The use of solar panels and semiconductors is currently one of the most relevant topics in the energy sector. The growing need for energy worldwide and the intensification of environmental problems necessitate the use of alternative energy sources. One such alternative source is solar energy. Solar panels based on the photoelectric effect are widely used in the conversion of solar energy into electricity in an efficient way. Semiconductors are used as the main material of solar panels. The most widely used Semiconductor is Silicon (Si), which differs from other materials in its low cost and efficiency. Semiconductors form pairs of electrons and holes under the influence of sunlight, which in turn provide an electric current flow. This process becomes the basis of the principle of operation of photoelements. Significant advances in solar panel technology



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have been made in recent years. For example, two-layer (tandem) solar panels, inorganic-organic hybrid panels and panels developed on the basis of perovskite materials with high efficiency began to occupy the market. In addition, the decrease in the cost of production of solar panels makes them more popular. Solar panels are considered not only environmentally friendly, but also useful in terms of economic efficiency. Their service life averages 25-30 years. However, their main disadvantage is the dependence of efficiency on the intensity of sunlight and the high cost of storage systems (batteries).

Conclusion. The use of solar panels and semiconductors is considered one of the most promising directions in solving the energetic and environmental problems facing humanity today. The ever-decreasing availability of existing energy sources on Earth, especially conventional ones such as oil, gas and coal, necessitates the rapid development of alternative energy sources, the release of harmful gases to the environment as a result of their extraction and consumption. Solar energy, on the other hand, is characterized by its Infinity, regenerative properties and environmental friendliness. Solar panels are based on semiconductor materials, the principle of their operation is explained by the photoelectric effect. This process, to put it simply, is based on the excitation of electrons and the formation of an electric current in semiconductors under the influence of sunlight. In practice, silicon is widely used, since it is considered inexpensive and effective. There is also a great prospect of a new generation of panels based on gallium arsenide, cadmium telluride and perovskite materials. Nowadays, the efficiency of solar panels is increasing worldwide. Through scientific research, up to 40% efficiency can be achieved through the use of tandem panels. This will create the possibility of converting solar energy into one of the main sources of electricity in the future. However, there are also problems in this area: for example, the production of solar panels requires a large amount of resources, the effectiveness of which depends on the availability of sunlight, and energy-saving technologies still remain expensive. Nevertheless, it is these problems that the innovative developments carried out on a global scale are aimed at eliminating. In particular, the improvement of battery technologies, the creation of transparent and flexible solar panels, the appearance of integrated panels installed on the facades of buildings are causing serious changes in the energy sector. In addition, solar panels are also used in transportation, communications, agriculture, and even the space industry. In conclusion, the use of solar panels and semiconductors is of paramount importance in ensuring the future energy security of mankind. Their widespread use is not only economically beneficial, but also serves to maintain environmental sustainability. Therefore, the continuation of scientific research, the creation of new materials and the improvement of energy-saving technologies will create a solid foundation for future energy.

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