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CONTINUOUS DEVELOPMENT OF NEW MODELS OF PHOTOELECTRIC MATERIALS LED TO THE APPEARANCE OF A LARGE NUMBER OF SOLAR PANELS.

Baratova Gulnoza Tashmukhamadovna
Senior Lecturer of the Department
of Energy and Applied Sciences,
Yeoju Technical Institute in Tashkent

Annotation. The principal structure of modern three-cascade InGaP / InGaAs / Ge with an indication of the functional purpose of the layers and their main characteristics is given. The mechanism of degradation of the electrical parameters of such photoconverters under the influence of cosmic radiation is explained and the possibility of minimizing this negative effect is shown. Energy is the material foundation of survival and economic development, but as the world economy expands, the development of high speeds, energy shortages, environmental pollution, environmental degradation and other problems are gradually deepening, energy supply and demand become more visible.
Key words: solar cells, photovoltaic converters.
Аннотация : Структура современных трехкаскадных InGaP / InGaAs / Ge с указанием функционального назначения слоёв, механизм деградации электрических параметров таких фотопреобразователей под действием космической радиации и показана возможность минимизации данного негативного эффекта. Энергетика является материальной основой выживания и экономического развития, но как мировая экономика продолжает, развитие высокоскоростных, нехватка энергии, загрязнение окружающей среды, экологической деградации и другие проблемы постепенно углубляется, энергоснабжение и спрос становится более заметным.
Ключевые слова: солнечные элементы, фотоэлектрические преобразователи.

Introduction

Nowadays, there is a great interest in the use of renewable (alternative) energy sources: solar, wind, geothermal, etc. In terms of the level of renewable energy supplied to the Earth, the Sun is the most powerful of the known sources. Therefore, the development of devices using solar energy is one of the most important areas of investigation.

The use of photovoltaic converters for the production of electricity makes it possible to comprehensively solve the issues of energy supply, environmental protection, and saving fossil energy sources. Their combined use with various power electronics devices in grid-connected power supply systems enables multifunctional systems.

PV got its name from the process of converting light (photons) energy into electrical energy (voltage) called the PV effect. The PV effect was discovered in 1954 when scientists at Bell Telephone discovered that silicon (this element is the basis of ordinary sand) creates electrical energy when it is illuminated by sunlight. Soon solar cells were used to power the electronic equipment of space satellites and small electronic devices such as calculators and wristwatches. Today, thousands of people power their homes and offices from individual solar PV systems. The main semiconductor materials that are used to produce 99% of photovoltaic cells in today's global market are:

1. **Monocrystalline silicon -** Grown in the form of large crystals by the method of Professor Czochralski. Further, silicon cylindrical ones are cut into very thin discs 0.2-0.4 mm thick and subjected to specialized chemical processing. Almost ready cells are turned, polished, covered with a protective coating and metallized. One can make a solar battery with own hands- photovoltaic cells are bought in the store, and the rest of the monoblock parts can be made independently from scrap materials.

2. **Polycrystalline silicon** - Produced in metallurgy by a cheaper method of directional crystallization. After the silicon raw material has melted, it is slowly cooled, which leads to the formation of “needle-like” multidirectional crystals. In operation, such a surface is slightly worse than a single crystal at ideal illumination, but more effective in other cases.

3. **Amorphous silicon** – this is what solar cells of this type are made of. The basis of batteries of this type is hydrogenated silicon with a high coefficient of radiation absorption. Modern models combine several layers enriched with germanium and carbon. This eliminates the main disadvantage of a-Si panels - rapid cell degradation. Solar cells, consisting of two semiconductors with different bandgap widths, are able to demonstrate high efficiency compared to individual cells, since tandem cells make more complete use of the solar spectrum. In particular, conventional silicon solar cells efficiently convert the infrared portion of the solar spectrum to electrical energy, while perovskite compounds can efficiently convert the visible portion of the spectrum, increasing the efficiency of the tandem.

Continuous development of new models of photoelectric materials led to the appearance of a large number of solar panels. They include:

1. silicon, including mono and polycrystalline,
2. amophobic species from telluride kadmium semi-conductor panels from selenium, indium
3. gallium and copper (CIGS)
4. polymer models.

Table 1

Mono	17-22 %
Poly	12-18 %
Amorphous	5-6 %
Based on cadmium telluride	10-12 %
Polymer based	5-6 %

By mechanical properties they are distinguished into the following categories:

- hard
- flexible (thin-film)
- one and two-sided panels.

All varieties demonstrate high performance - they practically do not require maintenance, only needing to clean the working surface from dust, which impairs the reception of solar energy by photocells.

Silicon

Silicon solar panels are the most common of all types. The technology of their production is well-worked, the producers of the batch were able to achieve the maximum efficiency of production and recurrence of the results. All types of solar panels used in solar panels are divided into three main groups:

- Monocrystalline
- Polyester
- Amorphous

The technology of their production is noticeably different; in general, only the base material of the manufacture remains. They also differ in efficiency, in terms of use.

Monocrystalline

Among all existing developments, the most effective are mono-ceramic silicon panels. Despite the rather high price, they are demanded and are the preferred option for the user. The peculiarity of these photoelectric elements is that they are a thin silicon crystal. Growth technology consists of lowering the correct, small size reference crystal into the silicon melt. This small sample becomes the basis for the growth of a large crystal, which, when it reaches the desired size, is sawn into thin plates.

Polycrystalline

Polycrystalline cells are designed to speed up and reduce the cost of the manufacturing process. Growing a crystal is a long and expensive process, which negatively affects the cost price. Polycrystalline panels are made from castings obtained after pouring molten silicon into molds. The solidified mass is cut into thin plates, which become the basis for the panels. Their efficiency is 12-18%, the price is about 20% lower. Externally, polycrystalline panels are easily distinguished by their blue flowers and the absence of any additional elements.

What organic solar panels are made of.

3rd generation organic based panels are being actively researched today. The third generation of solar cells also belongs to thin-film technologies, but they are devoid of the usual concept of a p-n junction, and hence the use of semiconductors. Currently, this generation includes a variety of technologies such as perovskite solar cells and others. Most of the technologies are based on the use of organic polymer materials.

The advantage of third generation photocells is low cost and ease of manufacture. The main obstacle to popularization is low efficiency, which does not exceed 7%. Currently, the market share of the third generation of cells does not exceed 0.5%. The following important features are characteristic of organic polymers:
1) simplicity and low cost of creation;
2) no problems with disposal;
3) unlimited scope of application;
4) the possibility of manufacturing in a transparent form.

Structurally, they contain a thin glass substrate and a sprayed conductive "paint". It is based on nanocrystalline "cathode" and "anode", as well as a non-aggressive electrolyte such as titanium dioxide. Ease of use consists in the possibility of obtaining any color shades and application to any surface with an ultra-thin layer.

Conclusion

The further increase in the use of photovoltaic plants contributes to the overall development of the industry. The use of photovoltaic converters for the production of electricity makes it possible to comprehensively solve the issues of energy supply, environmental protection, and saving fossil energy sources.

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