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Research Article

TECHNOLOGY FOR OBTAINING INORGANIC AND ORGANIC SEMICONDUCTOR COMPOUNDS FOR SOLAR CELLS

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ABSTRACT

This article presents the synthesis of semiconductor polymer materials and their use in photovoltaic technology, the study of one of the promising semiconductors, polyaniline, titanium dioxide deposited on one side on a transparent special glass plate and impregnated with a dye, solar cells obtained based on dyes that are sensitive to sunlight and the power generated by them, the values of voltage and current were measured.

KEYWORDS

Semiconductor, solar cells, polyaniline, dyes sensitive to sunlight.

INTRODUCTION

Solar energy is one of the renewable alternative energy sources. As the world's demand for energy increases year on year, so do the energy challenges [1].

The first problem facing the economic development of all countries of the world is the efficient use of solar energy. Since solar energy is an abundant and completely free alternative raw

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material. It is important to create cheap and promising solar cells based on organic semiconductor materials [2-4].

This will be the basis for the large-scale use of solar energy and the supply of cheap electricity [5-9].

Semiconductor polymers are organic compounds that do not contain metal atoms, but their level of electrical conductivity overlaps the conduction region of inorganic semiconductors and reaches the limits of the conductivity of metals [6-11]. Since the properties of semiconductor polymers are similar to those of inorganic semiconductors, they are called "smart" polymers. In recent years, the Nobel Prize in Chemistry has been awarded for research in the field of semiconductor polymers, and the production of solar cells based on polymer materials by synthesizing these semiconductor polymer materials and studying their photochemical properties leads to the rapid development of the entire electrical industry [12-16].

Experimental part

At present, there is a growing interest in research on the synthesis of semiconductor polymer materials and their use in photovoltaic technology. Especially polyaniline, polythiophene, polypyrrole, polyacetylene, etc. Polyaniline is considered one of the most promising semiconductors, due to the ease of synthesis, the low cost of the initial monomer and the possibility of replacing them, the polymer is produced depending on the acidity of the medium, the degree of oxidation of the polymer backbone, physicochemical properties and structure particles.

Synthesis of inorganic and organic dyes for solar cells based on dyes sensitive to sunlight, formation of a microlayer coated with new semiconductor oxides TiO2 or ZnO, selection of a special transparent glass with one conductive side, preparation of solutions of iodine in potassium iodide as an electrolyte, scientific research was also carried out in areas such as improving the photochemical stability and complete energy conversion, i.e., the efficiency of solar cells based on photosensitive dyes that convert visible and infrared rays into electrical energy.

The principle of operation of solar cells based on dyes that are sensitive to sunlight can be compared with artificial photosynthesis, since in this case sunlight (photon) is absorbed by the dye absorbed into the material of the semiconductor microlayer and moves electrons, and the place of electrons is transferred by electrolyte solutions with a calculated oxidative - recovery potential. Sunlight Sensitive Dye Solar Cells are a technology used to generate electricity in wide light, indoor and outdoor environments, allowing the user to convert artificial and natural light into electricity to power a wide range of electronic devices.

The basic operating cycle of solar cells based on sunlight-sensitive dyes can be briefly described as follows with photochemical reactions: After absorbing light, the dye donates electrons to the TiO2 semiconductor coating, a dye devoid of electrons takes electrons from a solution of iodine in potassium iodide. A solution of iodine in potassium iodide, i.e. the iodine ion, having donated its electrons to the colouring matter, restores electrons through the cathode. Here S- colourant, hv- a beam of light, TiO_2- semiconductor oxide layer.

photoanode: $S + hv \rightarrow S^*$ – absorption of light by paint;

paint: $S^* \rightarrow S^+ + e^-$ (TiO_2) – electron loss;

$2S^+ + 3I^- \rightarrow 2S + I_3^-$ – recover lost electron;

cathode: $I_3^- + 2e^-(\Gamma) \rightarrow 3I^-$ – recovery of a lost electrolyte electrolyte; $I_3^- + 2e^-(TiO_2) \rightarrow 3I^- + TiO_2$ – recovery of a lost electrolyte electrolyte;

comprehensive view of the process: $e^-(\Gamma) + hv \rightarrow e^-(TiO_2)$.

Results and Discussion

Check with a multimeter DT 9205A which side of a transparent glass plate is transparent. Take one of the glass plates with the conductive side marked, rinse it thoroughly with a solution of ethyl alcohol, and then wipe it with a clean, dry cloth. One of the two glass plates is transferred to the conductive side and coated with a pre-prepared titanium dioxide paste to form a microlayer Figure 1. As a result, it is dried in an oven at appropriate temperatures from one hour to three hours. The purpose of drying is to increase the porosity of the titanium dioxide-coated photoactive coating by losing water and moisture and to achieve greater absorption of dye solutions.

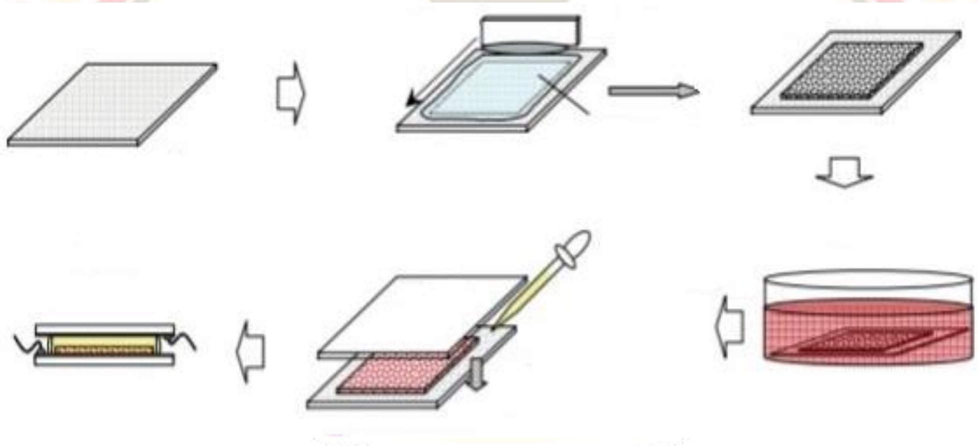

Figure 1. Titanium dioxide is deposited on one side of a transparent special glass plate and immersed in dye

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Figure 2. Measurement of the voltage and current values of solar cells based on photosensitive dyes and the power they produce

The other side of the cleaned special transparent glass plate was treated with pure graphite and covered with a micro-layer of paint. Both glass plates were sealed with plastic film to leave free space on one side. In the next process, a glass plate taken from an oven was immersed in a container with a dye solution. The dye absorbed into the pores of a coating consisting of titanium dioxide deposited on a glass plate was immersed in the solution until the substance was saturated.

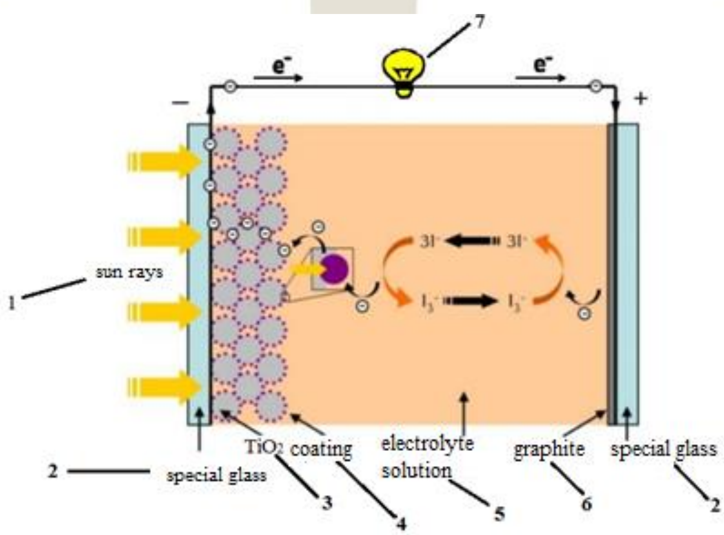

Figure 3. A general technological scheme of a solar cell based on dyes that are sensitive to sunlight has been assembled

1- sun rays entering the system, 2- single-sided transparent conductor, special glass, 3- titanium dioxide coating 4- colouring matter sensitive to sunlight, 5- electrolyte solution 6- photoanodic coating consisting of graphite, 7- accumulative power.

In the next step, the glass plate coated with titanium dioxide removed from the solution was washed with ethyl alcohol and wiped with a clean cotton cloth, the second glass plate coated with graphite and the glass plate wetted are connected together on top of each other, the part that remains open and clean is shown and fixed with each other by forming a contact, and measuring work are carried out.

CONCLUSION

The photochemical reactions of the main working cycle of solar cells based on light-sensitive dyes are described, titanium dioxide was coated on one side of a transparent special glass plate and impregnated with dye, Experiments were carried out to measure the voltage and current values of solar cells obtained based on photosensitive dyes, and the power generated by them, the assembled general technological scheme of a solar cell operating on the basis of light-sensitive dyes were developed.

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