PPLICATION OF PHOTOVOLTAIC EFFECTS TO ENERGY-SAVING MATERIALS COMPONENTS OF THE STRUCTURE AND SOLAR CELLS

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Abstract: This paper explores the use of photovoltaic effects in the design and development of energy efficient materials and storage cell components. The authors explore how photovoltaic technology can be incorporated into building materials and energy storage devices to improve their efficiency and sustainability. The article discusses the various applications of photovoltaic effects, including generating electricity from sunlight, capturing and storing energy, and contributing to the overall reduction of energy consumption. The conclusions presented in this paper provide valuable insights into the practical application of photovoltaic technology in the construction and energy storage industries, which have important implications for environmental protection and sustainable development.

Key words: photovoltaic, potential, photoelectric, nanomaterials, utility power system, distributed generation

Currently, more than 75% of electricity is generated by burning mineral and organic fuels. However, the energy industry is already faced with a situation of depletion of its traditional raw material base. One of the reasons for this was the limited availability of fossil energy resources. In addition, oil, gas and coal are also the most valuable raw materials for the intensively developing chemical industry. Maintain high The pace of energy development through the use of only traditional fossil energy sources is becoming increasingly difficult [1-5].

In addition, the combustion of fuel in thermal power plants, as well as in residential heating systems (boiler installations) leads to significant environmental pollution. When burning solid and liquid fuels or natural gas, sulfuric anhydride, nitrogen oxides, and fluoride compounds enter the atmosphere. required energy sources**.**

When it comes to energy based on renewable energy sources (alternative energy), the first thing that comes to mind is solar energy. This is not surprising: the integral flux of solar radiation entering the Earth's atmosphere is about 2.1017 W.

While the total installed capacity of all power plants in the world does not exceed 3.10 12W, i.e. almost 100 thousand less [6-9].

Th present article is devoted to the study of solar elements properties of the most reliable and fi nancially beneficial converting process of solar energy into electric energy based on semiconductor silicon. Silicon is the biggest longitude diffusion than CaAs, so it is shown that current carriers are generated more by sunlight.

During the exploitation of this solar elements defects lessen the the life of secondary carries of electric energy and as a result of it it disseminates the optical sensitivity of solar centers in amount of products [10-13].

The sun is a huge, inexhaustible, absolutely safe source of energy, equally owned by everyone and accessible to everyone. The bet on solar energy should be considered not only as a win-win, but in the long term and as a non-alternative choice for humanity. The transformation of solar energy into electrical energy is carried out using semiconductor photocells. These devices appear today to be fully mature in scientific and technological terms in order to be considered as the technical basis for large-scale solar power of the future.

However, the widespread introduction of solar energy is possible only with a significant reduction in the cost of electricity obtained by converting the energy of solar radiation. For the economic efficiency of photoconversion using solar modules in ground conditions, cheap devices that provide light collection and energy converters with a high efficiency [14].

For the successful production of highly efficient solar cells, along with the use of modern manufacturing methods, a deep understanding of the processes occurring in the cells is necessary. By establishing a correspondence between the characteristics of the elements and the main structural, electronic and optical properties of the semiconductor layers, it is possible to accurately determine the influence of each of them on the parameters of the p-n junction and identify ways to increase the efficiency of the device. generation of solar energy. Application of photovoltaic effects to energy-saving materialscomponents of the structure and solar cells [15-17].

The photovoltvoltaik effect is the generation of voltage and electric current in a material upon exposure to light. It is a physical phenomenon.

The photovoltaic effect is closely related to the photoelectric effect. For both phenomena, light is absorbed, causing excitation of an electron or other charge carrier to a higher-energy state. The main distinction is that the term photoelectric effect is now usually used when the electron is ejected out of the material (usually into a vacuum) and photovoltaic effect used when the excited charge carrier is still contained within the material. In either case, an electric potential (or voltage) is produced by the separation of charges, and the light has to have a sufficient energy to overcome the potential barrier for excitation. The physical essence of the difference is usually that photoelectric emission separates the charges by ballistic conduction and photovoltaic emission separates them by diffusion, but some "hot carrier" photovoltaic devices concepts blur this distinction [18-19].

The photovoltaic effect occurs in solar cells. These solar cells are composed of two different types of semiconductors - a p-type and an n-type - that are joined together to create a p-n junction. To read the background on what these semiconductors are and what the junction is, click here . By joining these two types of semiconductors, an electric filed is formed in the region of the junction as electrons move to the positive p-side and holes move to the negative n-side. This field causes negatively charged particles to move in one direction and positively charged particles in the other direction.

Light is composed of photons , which are simply small bundles of electromagnetic radiation or energy. These photons can be absorbed by a photovoltaic cell - the type of cell that composes solar panels. When light of a suitable wavelength is incident on these cells, energy from the photon is transferred to an atom of the semiconducting material in the p-n junction. Specifically, the energy is transferred to the electrons in the material. This causes the electrons to jump to a higher energy state known as the conduction band . This leaves behind a "hole" in the valence band that the electron jumped up from. This movement of the electron as a result of added energy creates two charge carriers, an electron-hole pair [20-22].

Environmental concerns and climate change have put pressure on utility power system managers to look for alternative sources of energy. Recent research advances and developments in exploiting renewable energy sources for improving power system operations have seen encouraging results. Distributed generation (DG) is a method of generating electricity from multiple renewable energy sources that are very near to load demands. DGs interconnected to utility power systems have multiple advantages such as increased system reliability, reduced peak power requirement, improved power quality, requisite supply of reactive power, and environmentally clean energy. The renewable energy resources used for generation of electricity are solar, thermal, photovoltaic (PV), wind farms, hydro, biofuels, wave, tidal, ocean, and geothermal sources. However, PV systems have been considered a better renewable energy source for electricity generation, because of the abundant long-time availability of free solar energy at the earth's crust. PV generation is based on the PV effect, which is a process with PV cells that uses solar light photons to strike on the doped semiconductor silicon to produce electricity.

The photovoltaic effect is a process of converting light, i.e., photons, into electricity. Solar cells or photovoltaic (PV) cells are electronic devices where sunlight is directly converted into electricity due to the photovoltaic effect. A photovoltaic system is an array of solar modules that comprise a number of solar cells that generate electrical power. Multiple modules, as shown in the photovoltaic hierarchy in Fig. 5.1, are wired together to form an array to obtain more electricity [23-25].

Photovoltaic (PV) effect is a process by which PV cell converts the absorbed sunlight energy into electricity. PV system operates with zero carbon-dioxide emissions which has benefits for environmental safety. The photon energy absorbed by nanomaterials is transferred to the electrons in the atoms. Fig. 41.1.1 shows the pictorial representation of the working of a PV cell. When two differing p–n semiconductor layer are brought into contact, an electric potential is created between n- and p-type semiconductor layers. Electrons wander across the junction and jump to the p-type semiconductor leaving behind a static positive charge. Simultaneously the holes wander across the junction leaving behind a static negative charge. These free electrons and holes join up and disappear. At a certain level, a depletion zone is created at the p–n junction where there are no more chances of any charge carrier migration [26-28].

These separated static positive and negative charges create an electric field across the depletion zone. This built in electric field provides the force or voltage needed to drive the current through an external circuit. When the photon energy from the sun is absorbed by the semiconductor layer it is transferred to the electrons of the material. The electrons get sufficient energy to move to the conduction band which in-turn leaves a “hole” in the valence band. Valence electrons escape from the normal positions in the atoms of semiconductor material and become a part of electric flow or current. This voltage causes electrons to move toward the negative end and holes toward the positive direction. When there is a sufficient amount of sun energy, i.e., when the absorbed photon energy is greater than the bandgap energy of the materials used in the PV cell, the atoms collide and free electrons start to migrate, creating the current of electricity.

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