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CHARACTERISTICS OF MATERIALS USED IN THE MANUFACTURE OF SOLAR CELLS

Abstract: The efficiency of QE operation depends on the various processes that occur between the upper levels of the valence field and the lower levels of the conduction field.

Key words: In photoconverters, Semiconductor materials, It wasn't right, crystal lattice, radiation spectrum.

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ХАРАКТЕРИСТИКИ МАТЕРИАЛОВ, ИСПОЛЬЗУЕМЫХ ПРИ ПРОИЗВОДСТВЕ СОЛНЕЧНЫХ БАТАРЕЙ

Аннотация: Эффективность работы КВ зависит от различных процессов, происходящих между верхними уровнями валентного поля и нижними уровнями поля проводимости.

Ключевые слова: В фотопреобразователях, Полупроводниковые материалы, Это было неправильно, кристаллическая решетка, спектр излучения.

The preparation of highly efficient solar cells depends on the properties of semiconductor materials. In fact, when the ideal efficiency of QE (for temperature Tq300 oK) is taken in relation to the change in band gap, for Earth conditions (AM 1) the maximum F.I.K band gap Eg~1.4 eV is equal to YaO' is coming. Materials that approximately satisfy this equality include solid solutions based on Si, InP, GaAs, CdTe, AlSb and A3V5, A2V6 semiconductors [1].

The efficiency of QE operation depends on the various processes that occur between the upper levels of the valence field and the lower levels of the conduction field. If the material is homogeneous, that is, its chemical composition does not change from one point to the next, then the energy of electrons above the valence region and below the conduction region is independent of coordinates [2,3]. The absorption index will have large values in EO‘s with a "correct" transition area. Because the energy received by an electron that has received energy from the outside is enough to pass through the forbidden region hy≥E_g and enter the conduction region to continue its state of motion.

On the other hand, the absorption index and the rate of its growth from energy are lower in the EOs with the "incorrect" transition field. Because it becomes difficult for the electron to move from the valence band to the conduction band under the quantum effect [4,5]. This is because the electron changes its direction and position. And this process can happen only in certain cases, in particular, due to the fact that a photon on its way meets such a valence electron in the YaO' material, during the absorption of hў energy, the atoms of the crystal lattice receive an impulse ΔK as a result of the vibrations from heat.

In photoconverters other than QE s (photoreceiving structures, photoresistors), the choice of material depends mainly on the requirements, that is, on which part of the radiation spectrum is used [6,7]. The choice of technology for obtaining semiconductor materials depends on the requirements placed on them, which mainly include the purity of the material. For example, the applied voltage of the YaO' diode in the reverse direction depends on the specific resistance of the material, and it is possible to obtain a diode with Utesq of 10-12 V in Ge with r~0.5 Ohm cm. If there are 1.5 109 Ge atoms per 100 input atoms in such a Ge material, if the number of inputs is reduced 100 times (rq 50 Ohm cm), a diode with a Utesq equal to 500 V can be obtained. Therefore, materials are divided into three categories in terms of the purity of materials used in technical devices based on semiconductors. Class A includes materials with A1 - 99.9% purity and A11 - 99.99% purity, which can be determined by simple classical chemical analysis [8]. Class V is divided into V3 and V6. Such substances are called particularly pure and ultra-pure (10-3-10-6% precision inputs). The next cleanest category is S7-S10, with a purity level of 10-7-10-10% [9].

Choosing a method of growing semiconductor materials depends on studying their physical and chemical properties. If the melting temperature of the substance is high, chemical activity and vapor pressure are high, it is very difficult to grow crystals of such substances. It is desirable to grow them from vapor phase or solutions at low growth rates. It is necessary to accurately measure the temperature of the growing process, control the distribution of substances, maintain the pressure of the components in the gas state at a constant level, and precisely control the operation of the mechanical parts of the machine [10]. There are many methods of cultivation, the main of which include the following.

1. Growth from pure substances and supersaturated solutions with doped inputs.

2. Growing from solutions.

3. Vapor phase growth.

There are 2 ways to grow crystals from a stoichiometric liquid phase. Crucible and non-crucible growing methods. This method is divided into several views. Including the directed crystallization method, "horizontal" and "vertical" Bridgeman method, field melting method and Chokhralsky method [11].

The basis of these methods is directed heat transfer. An example of this is the Chokhralsky method in.

A characteristic feature of vertical furnaces is that the “crystallization” front cannot be observed. Another drawback is that the growing crystal is in constant contact with the walls of the crucible. In order to obtain single crystals of the required size, the crystallization boundary should be convex during the entire technological process. The use of these methods is also relatively limited due to the limitation of suitable materials for the crucible. One of the main materials suitable for a crucible is quartz. In quartz crucibles used to grow silicon and gallium arsenide crystals, the solution is usually contaminated with oxygen [12]. For example, in the process of growing a single crystal of silicon, oxygen can enter silicon with a concentration of up to 10^{17} cm^{-3}. In the process of growing a single crystal of gallium arsenide, silicon can enter it along with oxygen from quartz. We can see methods without a crucible in the example of the Varneyle method and field cultivation without a crucible. A silicon sample in the form of a polycrystalline solid cylinder is fixed in a vertical position on a common axis cooling mandrel. In a small slotted container attached to the upper stock, the powder of the growing material is placed. Stocks can be rotated at a constant speed or moved relatively close to each other. A molten area is created in a narrow (bounded) part of the silicon with the help of a heat source. The molten sphere is held under the influence of surface tension forces. That is, the weight of the molten sphere is kept under the influence of surface tension forces. The diameter of the growing crystal depends on the critical length of the sphere and the material properties, i.e. (G/d)1/2 (G is the surface tension between the liquid-solid body, d is the specific gravity of the dissolved substance). High-frequency inductive heating, electron-beam or radiation methods can be used as a heat source. This method is relatively universal and can be used to grow semiconductor compounds with any melting temperature and high vapor pressure. In the process of growing in this method, the solvent in the preparation of the solution can be from a neutral substance (a substance that is not part of the growing material) or from substances that are part of the compound. The choice of solvent is important in the process of crystal growth. If the semiconductor material itself is used as a solvent, then in order to obtain the desired material: it is necessary to clean the base material from impurity impurities and introduce one or two impurity compounds with a certain concentration into the crystal lattice during crystal growth [13].

If another material is used as a solvent in the production of a semiconductor material, first it is dissolved in this material and then the crystallization process is carried out. In this case, all available inputs are redistributed in the solution and in the growing crystal.

The solubility of any substance in a solid body is determined by the composition of the solid body and which phases it is in equilibrium with, the state of the solid body, liquid, gas and the minimum state of free energy of the system as a whole. Since the free energy depends on the state of the system, the change in temperature disturbs the equilibrium and the composition of the existing phases also changes. If the solvent itself is present, then the growth process proceeds at a constant temperature, and the composition of the solid depends on the concentration and nature of the inputs [14]. If the solvent is from another substance, then since the crystallization process of the main substance takes place at different temperatures, its composition depends on the temperature and changes proportionally to it. The process of distribution of inputs is one of the determining properties in the process of semiconductor crystallization, and it is determined by the Schroeder equation based on the theory of ideal solutions.

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