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Volt-Ampere characteristic of the filling coefficient of the solar elements is the dependence of the nonideal coefficient

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Annotation: In this work, a new expression with a simple view to the saturation coefficient of the solar elements has come out. It is shown that the results of the calculation from this expression can be deduced from the results obtained from the experiment. From this formula, it is calculated that the fill coefficient of the solar elements is tied to the nonideal coefficient of the photo VAX, this parameter can be attributed to the nonideal coefficient of the photo VAX at the point at which the short-circuit current density is determined, it is seen that the effective power is linear to connect the nonideal coefficient.

Keywords: solar element, filling coefficient, useful working coefficient, temperature, effective power, short circuit current density, photo VAX ni coefficient of nonideality.

One of the important scientific problems that is urgent to be solved in the last years in the field of physics of semiconductor devices is an indicator of increasing the efficiency of semiconductor QE. In order to increase the efficiency of QE, it is necessary, first of all, to study the quality of r-p-transition, which is the basis of the structures, and the dependence of physical indicators assessing such quality on the nonideal coefficient of the volt-Ampere characteristic (VAX) under illuminated conditions. The study, focusing on the main output parameters of semiconductor photoelements and their nonidealistic coefficients of Vax in various coherent expressions, and relying on experimental data, is one of the urgent tasks. To date, to develop specific targeted scientific research on the creation of high-performance energy sources on the basis of semiconductor materials in the world, including simple and accurate expression of the main output characteristics of semiconductor photoelements; to determine the laws of dependence on their nonidealistic coefficient; optimization of the process of effective separation of photogenerated charge carriers in r-p-transition on the basis of theoretical and practical data is one of the important tasks.

It is known that one of the parameters determining the effective conversion of solar energy into electricity is the saturation coefficient of the solar elements. And the quality of QE is determined by the nonideal coefficient of the photovoltaic Ampere characteristic.

Therefore, the study of the dependence of the p' noideality coefficient on the filling coefficient is one of the actual tasks of this direction.

As you know, the filling coefficient of QE is expressed using the following formula.

$$ff = \frac{P_{эф}}{P_{\max}} = \frac{j_{эф}U_{эф}}{j_{кз}U_{xx}} \qquad (1)$$

Here $j_{эф}$ – effective value of current strength density, $U_{эф}$ – effective voltage, $j_{кт}$ - short circuit current density, $U_{си}$ – salt processing voltage QE.

For the dependence of the density of saturated Vine on temperature, the following equation is obtained:

$$j_0 = j_{00}\exp\left[\frac{q\varphi}{k}\left(\frac{1}{T_0} - \frac{1}{T}\right)\right], \qquad (2)$$

Here is the density of the saturation current at j_{00}-T_0=300 K, The Q-electron charge, the potential barrier height of φ - QE, the constant of k - Bolsman.

Based on the conducted experiments, taking into account the temperature dependence of the salt processing voltage, when by extrapolation is equal to T≈0K in the empirical method $U_{cu} \approx \varphi_0$ the condition is fulfilled.

For Salt processing voltage, the following expression is obtained: $U_{cu} = (U_{cu0} - \varphi_0)\frac{T}{T_0} + \varphi$, (3)

Here $U_{0cи}$ - $T_0=300\ K$ salt performance voltage in, φ_0 - $T=0\ K$ the potential barrier height of QE in.

It is known that the potential barrier height of the ideal solar elements is determined by the fact that the width of the Forbidden Zone is tied to the Eg.

$$\varphi_0 \approx \frac{E_g}{q} . \qquad (4)$$

The potential barrier height of φ – QE is the connection of this parameter to the temperature is the same as the connection of the Forbidden Zone of semiconductors to the temperature:

$$\varphi = \varphi_0 - \gamma T . \qquad (5)$$

Here φ_0 - T=0 K QE potential barrier height at, γ - amorphous semiconductor ban zone is the temperature coefficient of the energy width.

Its value is for semiconductors $\gamma \approx \left(5 \cdot 10^{-4} - 10^{-5}\right)$ ev / K is located in the range.

QE's photo VAX

$$j_{\phi} = j_0\left[\exp(\frac{qU}{n' kT}) - 1\right] - j_{кз} \qquad (6)$$

$U=U_{cu}$ when equal to $j_{\phi}=0$ from the equation, the short-circuit current density is expressed as follows:

$$j_{кз} = j_0\left[\exp(\frac{qU_{cu}}{n'_1 kT}) - 1\right] \qquad (7)$$

Here n'_1- nonideal coefficient of Vax at the point at which the short-circuit current is detected.

(2) and(3) by putting the equations (7) into the expression, it is possible to obtain the expression of the short-circuit current density connecting to the temperature:

$$j_{кз} = j_{00}\exp\left[\frac{q\varphi}{k}(\frac{1}{T_0} - \frac{1}{T})\right]\left[\exp\left[\frac{q\varphi}{n'_1 kT_0}(\frac{U_{0xx}}{\varphi} - 1 + \frac{T_0}{T})\right] - 1\right]. \qquad (8)$$

The short-circuit current density QE has shown a strong correlation to the photo VAX nonideal coefficient and has satisfied the results of the experiment. The results of this research work indicate that in high and low temperatures, the width of the zone where the workpiece is prohibited, a small QE should be prepared.

It is known that the effective power of QE is determined by multiplying the effective values of the voltage and current emitted from QE:

$P_{эф} = j_{эф} U_{эф}$. (9)

This is seen from the formula to come up with a formula that determines the density of the effective power of QE, $j_{эф}$ – effective current strength and $U_{эф}$ – it is necessary to determine the expression of effective voltage.

For effective voltage to QE's FIK detection method, the following expression was obtained:

$$U_{эф} = \frac{n'_2 kT}{q}\ln\frac{j_{кз}}{j_0}\frac{n'_2 kT}{qU_{xx}} \qquad (10)$$

Here n'_2 – vax nonideal coefficient at the point at which effective power is detected.

When the output voltage of QE is equal to the effective voltage, the effective current density of QE is determined by the following equation:

$$j_{эф} = j_0\left(\exp\left(\frac{qU_{эф}}{n'_2\,kT}\right)-1\right) - j_{кз}\,. \qquad (11)$$

(11) if we substitute the U_{ef} equation in the expression for the effective current density, we will have the following equation:

$$j_{эф} = j_{кз}\left(\frac{n'_2\,kT}{qU_{xx}} - 1 - \frac{j_0}{j_{кз}}\right) \qquad (12)$$

When calculating and analyzing the experimental results, it was shown that the effective voltage does not depend on the nonideal coefficient of QE. Therefore, effective voltage comes in the following form:

$$U_{эф} = \frac{kT}{q}\ln\frac{j_{кз}}{j_0}\frac{kT}{qU_{xx}} \qquad (13)$$

and for effective power, the following equation is obtained: $P_{эф} = j_{эф}U_{эф} = j_{кз}\left(\frac{n'_2\,kT}{qU_{xx}} - 1 - \frac{j_0}{j_{кз}}\right)\frac{kT}{q}\ln\frac{j_{кз}}{j_0}\frac{kT}{qU_{xx}}$

(14)

given that the short-circuit current (j_{qt}) and the saturation current(j_0), the density is negative (14), the expression comes in the following form: $P_{эф} = \frac{kTj_{кз}}{q}\left(1 + \frac{j_0}{j_{кз}} - \frac{n'_2\,kT}{qU_{xx}}\right)\ln\frac{j_{кз}}{j_0}\frac{kT}{qU_{xx}}$. (15)

It can be seen that QE's effective capacity is n '$_2$ i n'$_1$ dependent, similarly, as long as QE's short circuit current density is n'$_1$ dependent.

(15) when we put the equation (1) into the formula, we form the following equation for the filling coefficient:

$$ff = \frac{kT}{qU_{xx}}\left(1 + \frac{j_0}{j_{кз}} - \frac{n'_2\,kT}{qU_{xx}}\right)\ln\frac{j_{кз}}{j_0}\frac{kT}{qU_{xx}} \qquad (16)$$

Using this formula, it is possible to investigate the relationship of QE filling coefficient to VAX nonideal coefficient.

It can be seen that the filling coefficient does not depend on n'$_1$, but the density of the short-circuit current depends on n'$_1$. Therefore, the filling coefficient depends on the VAX nonideal coefficient of ff QE at the point at which the short-circuit current is detected.

1- figure shows the connection of the VAX nonideal coefficient at the point at which the short-circuit current density is determined to the QE filling coefficient. This bond is at a strong level and an increase in the nonideal coefficient of QE from 1 to 3,8 leads to a decrease in the filling coefficient from 0,796 to 0,128. The results of the calculation were obtained for the following values.T_0=273*K*, T=300 *K*, j_0=3,5$*10^{-10}$*A/см²*, U_{cu}=0,63 *B*,

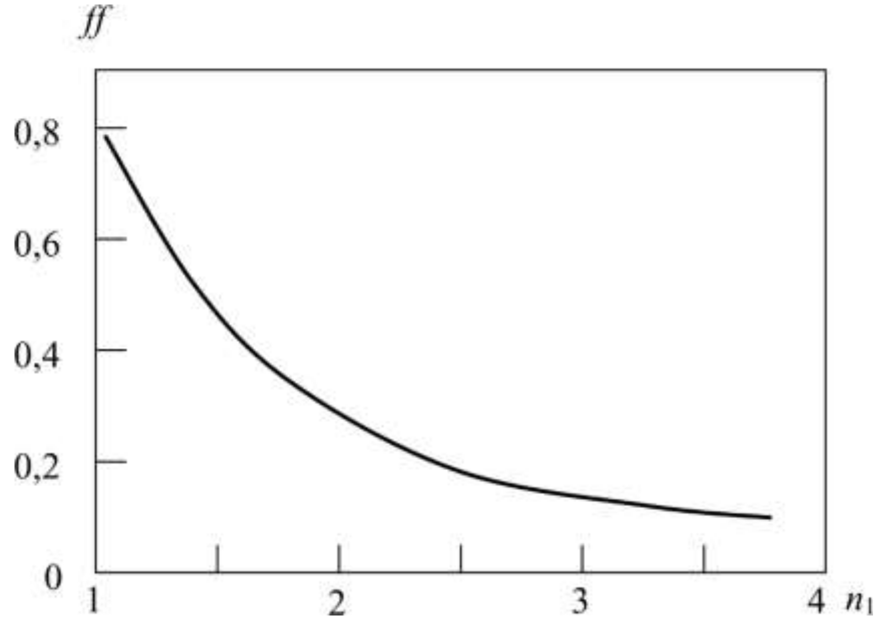


Figure-1.effect of the VAX nonideal coefficient on the filling coefficient of the QE at the point at which the short-circuit current is detected. The results of the calculation are determined for the following values: T_0=273*K*, *T*=300 *K*, j_0=3,5∗10^{-10}*А/см*^{2}, U_{cu}=0,63 *В*, φ_0=1,23 *В*, γ=2∗10^{-4} *В/К* и n_2'=2,5.

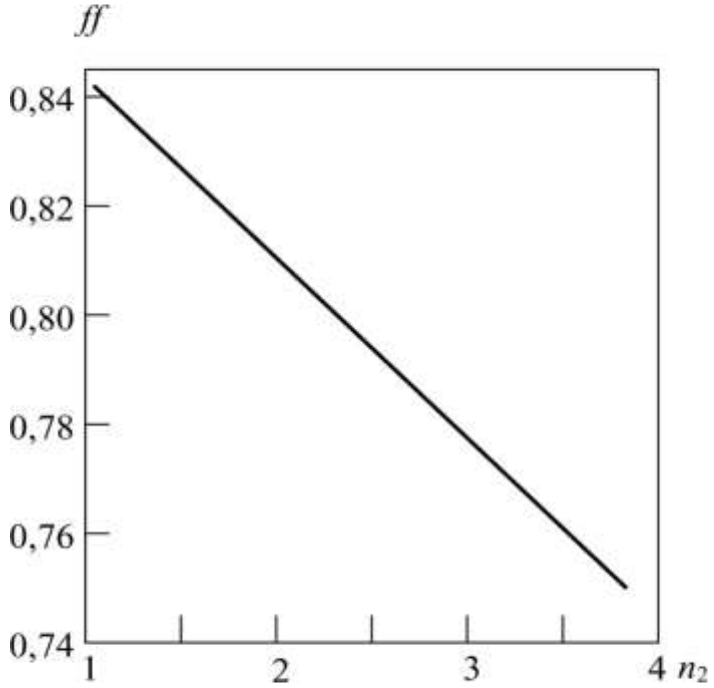
φ_0=1,23 *В* и γ=2∗10^{-4} *В/К* и n_2'=2,5. From this it can be seen that this dependence is at a strong level, since the filling coefficient is almost 2 times reduced.

Figure 2 shows the relationship of QE filling coefficient to VAX nonideal coefficient at the point at which effective power is detected. This link has a linear function. An increase in the nonideal coefficient of QE from 1 to 3,8 leads to a decrease in the filling coefficient from 0,842 to 0,751.

The results of the calculation were obtained for the following values.

T_0=273*K*, *T*=300 *K*, j_0=3,5∗10^{-10}*А/см*^{2}, U_{cu}=0,63 *В*, φ_0=1,23 *В* и γ=2∗10^{-4} *В/К* и n_1'=1,0028.

In this research work, the formula for determining the filling coefficient is presented. Using this formula, theoretically, the correlation of the filling coefficient to the nonideal coefficient has been investigated.



Effect of 2- photo VAX nonideal coefficient on image QE filling coefficient at point where effective power is detected. The results of the calculation are determined for the following values: T_0=273*K*, *T*=300 *K*, j_0=3,5∗10^{-10}*А/см*^{2}, U_{cu}=0,63 *В*, φ_0=1,23 *В*, γ=2∗10^{-4} *В/К* ва n_1'=1,0028.

The results of the calculation show that the increase in the coefficient of nonideality at the point at which the short-circuit current density is determined leads to a sharp decrease in the filling coefficient of QE. This in turn leads to a sharp reduction in QE fik.

As a result of the studies, the dependence of the VAX noideal coefficient on the point at which effective power is determined, on the filling coefficient, is subject to a straight-line function and does not have a strong effect on the QE fik.

From the results obtained, the following conclusions are drawn: any increase in the VAX nonideal coefficient of QE leads to a decrease in effective power. This leads to a decrease in blood.

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