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FEATURES OF LUMINOUS CONDUCTIVITY IN THE CRYSTALS TREATED IN A CORONA DISCHARGE

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The technology of semiconductor crystal processing in the corona discharge has been developed. It was established that as a result of this exposure, the samples acquire alternating spectral sensitivity.

The observed phenomenon is explained by the emergence of a saddle of the potential barrier in the element surface region the unusual properties which can allow the creation of a new type device.

It is known that the properties of semiconductor crystals can vary within wide limits depending on the quantity and quality of the formed defects. It must have an effect on the contact of the semiconductor sample.

In the present work we consider the problem about the behavior of the originally ohmic contact to the semiconductor at the appearance in its space charge region of charged unevenly distributed electron traps. Despite the urgency of this problem, in the literature it is almost not lit.

The introduction of the trapping centers in the crystal contact layer can dramatically change this region energy structure. In particular, in the case of electronic traps, the formation of the locking barrier is possible. This significantly changed the conditions of current transfer and hasspecific effects, similar in nature to the negative photoconductivity.

To analyze this situation it is necessary to eliminate the dependencies that describes the kind of arising barrier in the conduction band, as in the dark and in the light. As well as depending of the parameters of this barrier, its width, height, the maximum coordinate, the wall slopes – on the properties of trap – theirs energy depth, initial concentration and distribution in the sample depth.

The aim of this work is to show that the charged unevenly distributed of electron traps are able to form a locking barrier in ohmic contact space charge region. Its parameters are associated uniquely with the parameters of the traps and thus can manage technologically. In this case thank to the resulting barrier the sensor based on semiconductor crystal acquires new properties, including anomalous.

The change of photoconductivity, caused by the processing of cadmium chalcogenides monocrystal samples in the gas discharge was studied by authors [1-3]. The technology of this treatment is as follows. The element was placed in a vacuum

1. The effect of traps on the barrier structure

If the contact is formed for high-resistance semiconductor, due to the considerable differences of transmissibility prectically all the space charge region (SCR) is in its contact layer.

Let's in such a semiconductor were introduced electron traps N_t, which concentration decreases from the surface deep into the volume according to the law

$$N_t = N_{t0} e^{-\frac{x}{\ell_0}} \qquad (3)$$

where N_{t0} - the concentration on a geometric surface, and l_0 - a characteristic length that indicates how far the number of traps decreases in e times.

The activation energy of the traps (E_C–E_t). Then, just at the contact (region I Fig.1), traps are below the Fermi level. Such traps are filled with electrons regardless of the free charge concentration . On the surface their distance from the Fermi energy and, consequently, the filling will be at its maximum. Therefore, at point x=0 the appearance of such trap concentration of free electrons and the energy distribution do not change. Still they are described by formulas (1) and (2).

As can be seen from Fig.1, the greater is the depth of the traps (E_C–E_t), the wider is the region 1, enriched by electrons, as for large coordinate x traps are below the Fermi level and in the region of the Fermi level.

And, as will be further shown, the greater the initial concentration of traps N_{t0}, the steeper the dependence $\frac{dE}{dx}$ goes up. Both of these factors, acting together, should provide greater height of the formed barrier.

On the contrary, in the depth of the volume at $x > L_1$ the aquarance of electronic trap conditions will change significantly. The traps are partially filled and are able to capture an additional charge. The concentration of free charge, initially account n_0 (curve 1 Fig.1a) should decrease, which is accompanied by increase in the distance from the bottom of the conduction band up to the Fermi level.

Let's consider the impurities N_t edge of the front of spreading (region III of Fig.1a). The concentration of traps in the region $x = L_1$ is small, so in general it remains electroneutral. The part of free charge goes to the traps. The equation of electroneutrality in this case looks like:

$$N_d^+ = n_0 e^{-\frac{E(x)}{kT}} + N_{t0} e^{-\frac{x}{\ell_0}} \qquad (4)$$

Given the fact that numerically the of ionized donors concentration N_d^+ is equal to n_0 and using the decay exponent in the range from (4) obtain

$$n_0 \frac{E(x)}{kT} = N_{t0} e^{-\frac{x}{\ell_0}}.$$

From which

$$E_3(x)\Big|_{x \to L_2} = \frac{N_{t0}}{n_0} kT e^{-\frac{x}{\ell_0}} \qquad (5)$$

Decreasing of the x coordinate to the surface side, the value of the energy of the conduction band edge increases, although only slightly. If all the free charge n_0 will move to traps, then $(E–E_c) \sim kT$ (on the border of areas II and III).

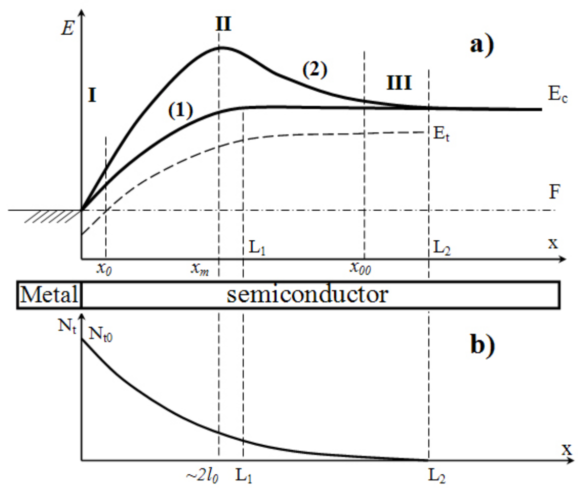

Fig. 1. (a) - structure of the SCR of ohmic contact to the high resistance semiconductor: (1) - the initial state; (2) – after the introduction of the traps; (b) - the distribution of the electron traps concentration in depth of the sample

The studied processes on the edges of the SCR are sufficient for predicting the energy distribution changes. If in the volume depth the energy curve $E_c(x)$ is directed upward, and on contact with the metal comes to the same point where it was without taking into account the traps, the overall profile of the SCR should be bell-shaped (curve 2 Fig.1a). And its width is controlled only by these traps penetration depth determined by technological factors in the crystal processing.

1. The energy distribution in the crystal near-contact layers with traps for electrons

The profile of the barrier in region I of Fig.1a can be determined by using the Poisson equation

$$\frac{d^2E_1}{dx^2} = \frac{4\pi e^2}{\varepsilon}\rho(x) = \frac{4\pi e^2}{\varepsilon}\left[N_d^+ - N_t(x) - n(x)\right] \qquad (6)$$

where E – the energy, a $N_d^+ = n_0 << n_k$. Using expressions (2) and (3) formula (6) takes the form

$$\frac{d^2E_1}{dx^2} = \frac{4\pi e^2}{\varepsilon}\left[-N_{t0}e^{-\frac{x}{\ell_0}} - n_k\left(\frac{a}{a+x}\right)^2\right]. \quad (7)$$

Note that negative values of the second derivative indicate the convexity of the function E_1 in the region I.

After integrating

$$E_1(x) = \frac{4\pi e^2}{\varepsilon}\left[-\ell_0^{\ 2}N_{t0}e^{-\frac{x}{\ell_0}} + n_k a^2 \ln|a+x| + C_1 x + C_2\right]. \quad (8)$$

The values of the constants C_1 and C_2 can be determined from comparison with the distribution (1) for a pure semiconductor.

When using for contact of metals with possibly small work function the value of the jump at the boundary of $\Delta E(0) \rightarrow 0$. In this case, when x=0 $(E_C – F)=0$ and $n_k \approx N_c = 10^{19}cm^{-3}$. According to [4] value of cadmium concentration on the surface ~ $10^{21}cm^{-3}$. Taking this quantity for 0.1÷1% of the total values we obtain that on the surface $N_{t0} \leq n_k$.

Considering also the calculations described in paragraph 1, regarding the filling of the traps without the free charge concentration changing, would be fair:

$$\frac{dE}{dx}\Big|_{x=0} = \frac{dE_1}{dx}\Big|_{x=0}$$ or from (7) and (1)

$$\frac{2kT}{a+x} = \frac{4\pi e^2}{\varepsilon}\left[\ell_0 N_{t0}\, e^{-\frac{x}{\ell_0}} + \frac{n_k a^2}{a+x} + C_1\right]$$,where as

x=0 is obtained $$C_1 = \frac{2kT}{a}\frac{\varepsilon}{4\pi e^2} - \ell_0 N_{t0} - n_k a \,. \quad (9)$$

The value of the constant C_2 in (8) can be found from the condition $E_1(0) = 0$. From this it follows

$$C_2 = \ell_0^{\ 2}N_{t0} - n_k a^2\, \mathrm{h}\ a\,. \quad (10)$$

Finally (8) with (9) and (10) becomes:

$$E_1(x) = \frac{4\pi e^2}{\varepsilon}\left[\ell_0^{\ 2}N_{t0}\left(1 - e^{-\frac{x}{\ell_0}}\right) + n_k a^2 \ln\frac{a+x}{a} + \left(\frac{2kT}{a}\frac{\varepsilon}{4\pi e^2} - \ell_0 N_{t0} - n_k a\right)x\right]. \quad (11)$$

The resulting expression is too cumbersome for further analysis. Therefore, we believe that the value l_0 in the traps distribution is large enough, and the point of linkage with the function $E_2(x)$ (i.e. the width of region I) lies in the coordinate that is smaller than the screening radius a. Then expanding in a number of the exponent and the logarithm of (11) will obtain the expression:

$$E_1(x) = \frac{2kT}{a}x \quad (12)$$

which, as expected, not influenced by the parameters l_0 and traps N_{t0}. In the surface layer the distribution of the energy barrier represented by almost a straight line with a slope *2kT/a*. In this graph $E_1(x)$ lies above the curve 1 Fig. 1a. This means that from the beginning with the coordinate increasing the concentration of free charge decreases faster than the concentration of traps.

2. The barrier structure in depleted layer

In the central part of the barrier (region II Fig. 1) free charge virtually absent and the concentration of electrons on traps significantly exceeds the number of ionized donors, since for these distances x number of traps is still quite large. Then $n_t(x) >$ N_d^+; $n(x)$. In this case, the charge density

$$\rho(x) = -en_t(x) = -eN_t(x)f(x)\,,$$

where $f(x)$ - the probability of filling traps Fermi – Dirac

$$f(x) = e^{-\frac{(E-E_t)-(E-F)}{kT}} = e^{-\frac{E-E_t}{kT}} \cdot e^{-\frac{E-F}{kT}}$$

In this expression, the first exponent associated with the activation energy of the traps, with the coordinate does not change, and the rate of the second exponent depends on x.

Finally, the Poisson equation has a view

$$\frac{d^2E_2(x)}{dx^2} = -Ae^{-\frac{x}{\ell_0}}e^{\frac{E_2}{kT}} \quad (13)$$

where

$$A = \frac{4\pi e^2}{\varepsilon}N_{t0}e^{\frac{E_c - E_t}{kT}}\,. \quad (14)$$

It is seen that in this region the second derivative is negative. The curve is concave. Using the substitution have

$$Z = -\left(\frac{x}{\ell_0} + \frac{E_2}{kT}\right) \qquad (15)$$

Or

$$\frac{d^2 z}{d\,x^2} = \frac{A}{kT} e^Z \,. \qquad (16)$$

$$\frac{1}{2} d\left(\frac{dz}{dx}\right)^2 = \frac{A}{kT} e^Z dz \,.$$

Where after integration

$$\left(\frac{dz}{dx}\right)^2 = 2\frac{A}{kT} e^Z + C_1 \qquad (17)$$

The value of C_1 can be obtained at the position of the maximum, where $\frac{dE}{dx} = 0$. Then

$$\tilde{N}_1 = \left(\frac{1}{\ell_0}\right)^2 - 2\frac{\grave{A}}{kT} \mathring{a}^{-\frac{x_{\max}}{\ell_0}} \cdot \mathring{a}^{-\frac{E_{\max}}{kT}} \qquad (18)$$

On the rising curve where x<x max and E< E max is true (see 15)

$$C_1 << 2\frac{A}{kT} e^Z$$

For strong enough barriers on the drop-down of the value of x and x_{max} that have the same order, and $E < E_{max}$. Therefore, this condition remains valid here. In general formula (17) takes the form

$$\left(\frac{dz}{dx}\right)^2 = 2\frac{A}{kT} e^Z \,.$$

From where

$$\frac{dz}{dx} = \pm\sqrt{\frac{2A}{kT}} e^{\frac{Z}{2}} \,. \qquad (19)$$

In accordance with (11) on the ascending part of the curve the derivative is negative. On falling apart for all $\frac{dE}{dx} < \frac{kT}{\ell_0}$ (i.e. slow decay), it also remains in force. Then in (19) should leave the sign «–». Where after integration is determined

$$-2e^{-\frac{Z}{2}} = -\sqrt{\frac{2A}{kT}} x - C_2 \,. \qquad (20)$$

Substituting (10) into (16) and simplifying the expression, it turns out

$$E_2(x) = -kT\frac{x}{\ell_0} + 2kT\ln\left(\sqrt{\frac{A}{2kT}} x + C_2\right). \qquad (21)$$

2. **Detalization of the explicit form of the energy distribution function**

From the equality of the derivatives at the point of stitching x_0 is obtained

$$\frac{2kT}{a} = -\frac{kT}{\ell_0} + \frac{2kT\sqrt{\frac{A}{2kT}}}{x_0\sqrt{\frac{A}{2kT}} + C_2} \,,$$

From where for large l_0, when $\frac{1}{2\ell_0} < \frac{1}{a}$

$$x_0\sqrt{\frac{A}{2kT}} + C_2 = a\sqrt{\frac{A}{2kT}} \qquad (22)$$

Then the value

$$x_0 = a - \frac{C_2}{\sqrt{\frac{A}{2kT}}} \,. \qquad (23)$$

After substitution into the expression $E_1(x_0) = E_2(x_0)$ we can find:

$$\frac{2kT}{a}\left(a - \frac{C_2}{\sqrt{\frac{A}{2kT}}}\right) = -\frac{kT}{\ell_0}\left(a - \frac{C_2}{\sqrt{\frac{A}{2kT}}}\right) + 2kT\ln\left(a\sqrt{\frac{A}{2kT}}\right) \qquad (24)$$

In the second term on the right in (24) takes into account the dependence (22). Reducing $2kT$ and bringing like, it turns to $2\ell_0 > a$

$$\left[1 - \ln\left(a\sqrt{\frac{A}{2kT}}\right)\right] \cdot a \cdot \sqrt{\frac{A}{2kT}} = C_2 \,. \qquad (25)$$

If the growing part of the barrier sufficiently sharp, then the value x_0 in (23) is not large compared to a. In this case, from a comparison of (23) and (25) follows $\ln\left(a\sqrt{\frac{A}{2kT}}\right) < 1$, and finally

$$C_2 = a\sqrt{\frac{A}{2kT}}$$

$$E_2(x) = -\frac{kT}{\ell_0} x + 2kT\ln\left[\sqrt{\frac{A}{2kT}}\left(x + a\right)\right] \qquad (26)$$

As can be seen from (26) in the maximum when

$$\frac{dE_2}{dx}=-\frac{kT}{\ell_0}+\frac{2kT}{x_m+}=0$$

$$x_m=2\ell_0-a\approx 2\ell_0 . \qquad (27)$$

The width of increasing side of the barrier and, consequently, the field strength is controlled by the parameters of the distribution of traps $2l_0$. Substituting (27) in (26) is determined by the value of the function E_2 in maximum:

$$E_{2\max}\cong -2kT+2kT\ln\sqrt{\frac{A}{2kT}}\left(2\ell_0\right) . \qquad (28)$$

The more the $2l_0$, the higher the barrier.

The dependence on the initial concentration of traps N_{t0} and their activation energy (E_C–E_t) is dened by the value $A=\frac{4\pi e^2}{\varepsilon}N_{t0}e^{\frac{E_c-E_t}{kT}}$. From (28) it follows that with increasing of these parameters, the barrier height also increases linearly in proportion to (E_C – E_t) and logarithmically proportional to N_{t0}.

The total width of the SCR can be determined when $E_2(x)=0$:

$$\frac{L_2}{2\ell_0}=\ln\left(\sqrt{\frac{A}{2kT}}L_2\right). \qquad (29)$$

It is considered that for this task the traps diffuse on L_1 and already at the maximum coordinate is $x_{max} > a$. Equation (29) does not allow to explicitly obtain the dependence of $L_2(l_0, A)$, but allows to reveal tendencies of this dependence by using methods borrowed from the theory of numbers.

Consider (29) in the form

$$\frac{L_2}{2\ell_0}-\ln L_2=\ln\sqrt{\frac{A}{2kT}} . \qquad (30)$$

The type of traps is not changed (i.e., fixed A), but at the expense of technological methods increasing l_0. In this case, since the right part does not change, and the denominator of the first term increases, the value of L_2 should increase, although not proportionally. If L_2 is not changed, the left side of (30) is also decreased. This follows from

$$\frac{d\left(\frac{L_2}{2\ell_0}-\ln L_2\right)}{dL_2}=\frac{1}{2\ell_0}\downarrow-\frac{1}{L_2}\uparrow<0$$

Conversely, l_0=const, and the value of A increases. Then the left side in (30) should increase. Since the logarithmic function $y = \ln L_2$ slower linear change $y=\frac{L_2}{2\ell_0}$, in general, L_2 increases. With increasing concentration of the traps on the surface of the N_{t0} and their activation energy (E_C–E_t) of the SCR width increases.

Note that for this conclusion it is important simultaneous increase in both parameters. Fundamentally, it is possible when there are few deeper traps [$exp\left(\frac{E_c-E_t}{kT}\right)$ more] on the geometric surface (less N_{t0}). Since the value of N_{t0} is controlled technologically, this competition can be avoided.

3. **Energy profile of the barrier in the bulk of semiconductor**

After stitching at point x_0 the function $E_2(x)$ in the depth of the volume has also been found associated with the surface condition (see 6).

The standard procedure for suturing in the depth of the scope of functions $E_2(x)$ and $E(x)$ leads to a too complicated system of equations that can be solved only by numerical methods.

Therefore, it was applied workaround [5]. The value of the function at the maximum at $x=x_m$ is equal to

$$\frac{dE_2(x_m)}{dx}=-\frac{kT}{\ell_0}+\frac{2kT\sqrt{\frac{A}{2kT}}}{\sqrt{\frac{A}{2kT}}x_{00}+C_2}=0$$

From that

$$\sqrt{\frac{A}{2kT}}x_m+C_2=2\ell_0\sqrt{\frac{A}{2kT}}$$

and $C_2=\sqrt{\frac{A}{2kT}}\left(2\ell_0-x_m\right).$

This is after substitution in $E_2(x)$ gives

$$E_2(x)=-\frac{kT}{\ell_0}x+2kT\ln\left[\sqrt{\frac{A}{2kT}}\left(x+2\ell_0-x_m\right)\right] \qquad (31)$$

and in maximum ($x=x_m$)

It is seen that the closer to the boundary the barrier forms (x_m decreases), the higher it is. With increasing concentration of traps N_{t0} and their depth (E_C – E_t) (i.e., increases) the barrier also increases. This coincides with the previously obtained.

At the point of stitching the barrier function $E_2(x)$ with the function in the quasi-neutral region $E \approx kT$. Therefore, we can assume that x_{00} determines the overall width of the SCR: $x_{00} = L_2$. It turns out:

$$2\ln\left[\sqrt{\frac{A}{2kT}}\left(L_2+2\ell_0-x_m\right)\right]=\frac{L_2}{\ell_0}+1,$$

and $L_2>>l_0$ and therefore $\frac{L_2}{\ell_0}>>1$. (32)

Then

$$L_2+2\ell_0-x_m=\frac{e^{\frac{L_2}{2\ell_0}}}{\sqrt{\frac{A}{kT}}}$$

or

$$L_2\approx 2\ell_0\ln\left(2\ell_0\sqrt{\frac{A}{2kT}}\right).$$

The width of the space charge region increases with increasing $2l_0$, which also coincides with the previously obtained.

The technology of sample doping

In [2], a method of creating electron traps on the semiconductor surface due to the processing gas discharge is described. The advantages of this technique are associated with the presence of an electric field during technological operations. By varying the magnitude and direction of this field it is possible to control the process of introduction of defects and profile of their distribution.

In [6] indicates significant migration of the impurity ions in wide band gap semiconductors in the fields of order 10^5 V/m.

In addition to creating electronic traps and managed process of introducing them into the volume of semiconductor sensor, the proposed method of treatment in a corona discharge contributes to the formation of donor on the surface of the sample [3]. The same electric field which promotes the outflow of these traps, accumulates donors in the surface layers, increasing their conductivity. Thus, it becomes possible to make processing of crystals with pre-applied contacts and in the same cycle to make measurements without the presence of air in the chamber.

The sample was a rectangular plate of monocrystal cadmium sulfide with a thickness of ~ The width of the space charge region increases with increasing 2l0, which also coincides with the previously obtained.

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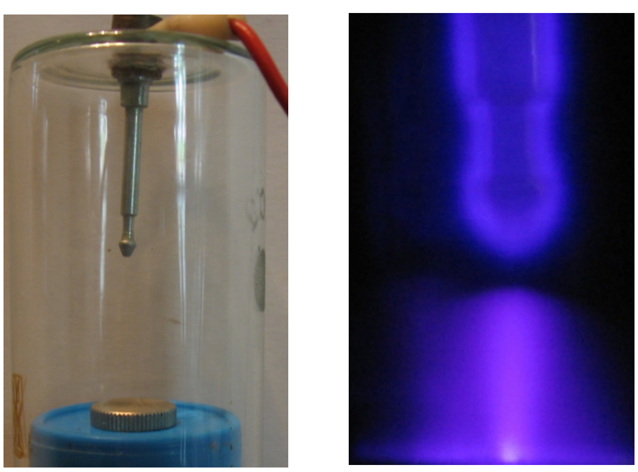
The sample was a rectangular plate of monocrystal cadmium sulfide with a thickness of ~ 1,5 mm and an area of the front surface of about one square centimeter. The crystal was placed in a vacuum chamber, which created a vacuum of the order of 10-2÷10-3 mm. Hg.

Stable symmetric discharge (Fig. 2.b) managed to create [7] when the cathode end was attached to the conical form. When an insufficient degree of vacuum in a chamber, the discharge passed into the avalanche and was twisting, and in the working field of high voltage the twisting moment was almost independent of the field. All the following results are obtained after processing in the mode of glow discharge.

The best results are obtained when the gap width is 8-12 mm. We attribute this to the fact that with the insufficient value of the period expiring on the electron has not gained enough energy to create defects in the structure of the investigated crystal.

The high voltage of the order of 4-5 kV was created by high-voltage rectifier. In this case, the contrast described earlier (see [1-3]) is to use DC voltage for processing.

For processing in a gas discharge were selected samples, which have symmetrical linear graphs like the VAC in the dark and in the light. Has been used quite photosensitive crystals. In both cases – and in the dark and when illuminated – after the manufacturing process, the overall resistance of the crystal increased. After the appearance of these traps initially low resistivity space-charge region of the ohmic contact due to formation of the barrier significantly increases its resistance. The base resistance in the dark was ~ $5 \cdot 10^4$ Ohm, in the light - $(2\div3)10^4$ Ohm. Insignificant difference of the obtained values leads to the conclusion that the resulting width of the barrier is determined only by the penetration depth of the traps. Far from the surface of the crystal layers of the traps is very small and therefore they are already filled in in the dark. The light does not change their fill and, therefore, the width of the SCR, and with it the resistance.



a) b)

Fig. 2. The design of the arrester (a) and processing of the samples the vacuum in the gas discharge (b)

When illumination by strongly absorbed light carriers are generated in the surface layers of the sensor and must move along the surface by the applied field. Processing in a gas discharge contributes, according to [1,2], the formation on the surface additional donor centers. In this case the surface conductivity increases, and the impact of recombination is weakened.

In the spectral range 540-600 nm by the impact of a gas discharge, we observed a slight increase of the photocurrent. This indicates the predicted occurrence as a result of processing of crystals of deep trap levels.

Conditions of formation barrier in our structures are also seen in the dependence of the curve shape of the spectral distribution of the photocurrent polarity from the applied voltage. For conventional barriers with increasing applied forward bias, the barrier height and width decrease. The field strength in the SCR barrier, as the ratio of these quantities varies little. When changing the polarity of the applied field on the opposite of both these parameters – the height and width are simultaneously increased, but their ratio is again significant changes does not undergo.

In our case it is not. The resulting width of the barrier is determined only by the penetration depth of the traps and does not depend on the applied voltage. An external electric field in this case reduces the height of the barrier and distorts its symmetry (see Fig.1). The side of the potential barrier, the field strength at which is opposite to external, is reduced to a greater extent. Because it is one-sided coverage, short-wave and long-wave part of the curve the spect

Experimentally proved to be correct to investigate the spectral distribution of the emerging photo – EMF. Such an approach allows not to take into account the nuances of the formation of the photocurrent – recombination in the inner regions of the crystal, the influence of the resistances of its parts, etc. But instead to identify the main – effect of the emerging traps in the surface layers of the sample due to the processing in a gas discharge and donor levels on its geometric surface.

Without the participation of the external field on the samples processed in a gas discharge, for the longitudinal conductivity, we observed the unusual origin and distribution of EMF in the excitation light of different wavelengths. A curve is represented in Fig. 3

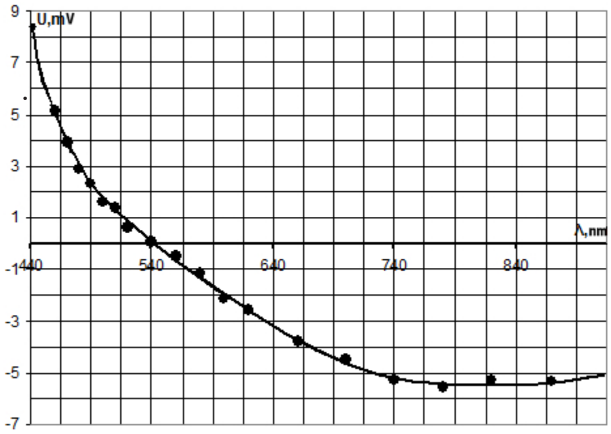


Fig. 3.The spectral distribution of the photo EMF for crystals, processed in a gas discharge

In our case, we found that the magnitude of photo-EMF under white light of 100 Lux was less than that in monochromatic light. This is due to the unusual form of a graph Fig.3. Shortwave and longwave contributions do not add up as usual in the white light, and subtracted.

This happens due to the unusual kind of barrier. Typically, SCR is either a growing part from the surface deep into the crystal (ohmic contact) or falling (gate contact). In our case presented both of the slope of the barrier (Fig.1). It shifted in the whole volume of the crystal from the surface. In this regard, when illuminated from the side of a contact on the surface of the sample, first, the absorption occurs in the increasing part of the barrier to short wavelength light with strong absorption. Photoexcited electrons by the field barrier are returned to the contact on the illuminated surface, where they increase the negative potential relatively to the lower contact to the sample. In Fig.3 we adopted this value for the positive part of the curve (area 440-540 nm).

As can be seen from the figure, with increasing the excitation wavelength, the contribution of this component decreases. This is because of that for larger wavelength the absorption coefficient decreases, and part of the photons reaches the deeper layers of the crystal, where the falling part of the barrier is. In this case, the field strength causes the non-equilibrium electrons move in the opposite direction. It is obvious that for a wave length of 540 nm, when in Fig.3, there is a curve crossing the x-axis, both processes balance each other and the resulting potential difference is equal to zero.

With further increase in wavelength, more photons are absorbed by the falling part of the barrier (Fig.1). Field barrier primarily directs the electrons into the sample, a negative potential of lower contact increases.

For sufficiently large wavelengths ~ 800 nm or more, the signal Fig.3 stabilizes, remaining negative. This indicates the predominant light absorption in the right side of the barrier (Fig.1). In addition, the photons can penetrate deep enough into the crystal and be absorbed outside the SCR contact without making any contribution to the signal formation Fig. 3.

The limit of the change curve Fig.3 is a conventional spectral distribution of photo reply.

Used processing methods cause changes in this schedule with some ratio of temperature, light, tension, the used field and the duration of the treatment. In our case the best results we have obtained with 15 min treatment with 8 mm distance to the needle on which it was 4000 V. Then the schedule gets abnormal appearance with maximally large negative values.

If too large saturation of the traps during processing in a gas discharge, their concentration gradient is insignificant, and the spectral distribution returns to its original state. This is the same crystal, which just increased the resistance due to the presence of traps.

Thus, the proposed technology of sensors, in full accordance with the developed model allows to obtain sensors with abnormal spectral sensitivity. The view according to Fig. 3 makes it possible to use them as receptors in a certain, prescribed in the course of technological processing, the wavelength of the radiation. Moreover, since at this point the value of the signal is zero, this sensor will be completely insensitive to any noise and interference, including artificially supplied.

In addition, since the light from different spectral regions the sign of the EMF and therefore the current is reversed, this property can be used to create optical devices of new generation.

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FEATURES LUMINOUS CONDUCTIVITY IN THE CRYSTALS TREATED IN A CORONA DISCHARGE

Abstract

The technology of processing of semiconductor crystals is developed in the corona discharge. It is established that as a result of this exposure, the samples acquire alternating spectral sensitivity.

The observed phenomenon is explained by the emergence of a saddle of the potential barrier in the surface region of the element, the unusual properties which can allow the creation of a new type of device.

Key words: LUMINOUS CONDUCTIVITY, THE CRYSTALS, CORONA DISCHARGE

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ОСОБЕННОСТИ СВЕТОВОЙ ПРОВОДИМОСТИ В КРИСТАЛЛАХ, ОБРАБОТАННЫХ В КОРОННОМ РАЗРЯДЕ

Резюме

Разработана технология обработки полупроводниковых кристаллов в коронном разряде. Установлено, что в результате этого воздействия образцы приобретают знакопеременную спектральную чувствительность. Наблюдаемые явления объяснены возникновением двухскатного потенциального барьера в приповерхностной области элемента, необычные свойства которого могут позволить создание прибора нового типа.

Ключевые слова: Кристаллы, коронный разряд , световая проводимость,

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ОСОБЛИВОСТІ СВІТЛОВОЇ ПРОВІДНОСТІ В КРИСТАЛАХ, ОБРОБЛЕНИХ У КОРОННОМУ РОЗРЯДІ

Резюме

Розроблено технологію обробки напівпровідникових кристалів у коронному розряді. Встановлено, що в результаті цього впливу зразки набувають знакоперемінну спектральну чутливість. Явища, що спостерігаються, пояснені виникненням двосхилого потенційного бар'єра в приповерхній області елемента, незвичайні властивості якого можуть дозволити створення приладу нового типу.

Ключові слова: кристали, коронний розряд, світлова провідність