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- 1) We shall not consider in detail in this short exposition the probable filtering mechanism connected with the energy dependence of the creation of K^0 within its energy distribution.
- 2) In filtering the masses of K^0 for the separation of K_1^0 , by virtue of $\Gamma_1 \gg \Gamma_2$, the filtered K_2^0 will not affect the K_S^0 , and $K_S^0 = K_1^0$.
- 3) The estimates (6) and (7) are based on the usual assumption that the unstable particles are described by first-order poles.

INFRARED-CONTROLLED FIELD EMISSION FROM GERMANIUM

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In [1] we presented the results of an investigation of field emission from single-crystal Ge doped with Au. We showed that on cooling to liquid-nitrogen temperature, when the resistance of this material becomes high ($\rho \sim 10^8 - 10^9$ ohm-cm), the field-emission current is limited by the volume resistivity of the sample. The voltage-current characteristic of the emission current is of the form

$$I = A \exp\left(-\frac{V_0}{V - IR}\right), \quad (1)$$

where R is the resistance of the sample and V_0 some voltage characterizing the given sample,

and determined by the geometrical dimensions of the emitting part of the sample (point) and by the work function of its surface. The values of V_0 and R are determined directly from experiment. It was also shown in [1] that a sharp increase in the emission current occurs in the region of voltages at which the voltage-current characteristic is essentially nonlinear when the sample is illuminated and its resistance reduced thereby. The point itself turns out to have low resistance in a strong electric field even in the absence of illumination, and the effect of the illumination reduces to a redistribution of the voltage between the vacuum gap and the volume of the emitter. In the present communication we present the results of a measurement of the spectral distribution of the additional emission current due to application of infrared radiation.

Germanium samples doped with gold and compensated with antimony (n and p type) were made in the form of rods measuring $15 \times 1 \times 1$ mm, pointed on one end by electromechanical etching. The radius of the point, as measured with an electron microscope, was $0.1 - 0.5 \mu$. The samples were mounted in a nitrogen cryostat [1] with the point facing the anode; the gap was $2 - 3$ mm long. One of the faces of the sample could be illuminated with infrared from a monochromator (KS-12) modulated at 400 cps. A germanium filter was used in measurements in the $2 - 7 \mu$ range to eliminate the scattered light.

The figure shows plots of the spectral distribution of part of the emission current (per unit incident-radiation power) caused by illumination, for n- and p-type samples. It is clear from the figure that in this case it is possible to control the electron emission from the semiconductor with infrared of wavelength from 1 to 6 or 7 μ . We recall that the presently known photoemission cathodes emit electrons only under the influence of light with wavelength $\lambda < 1.5 \mu$.

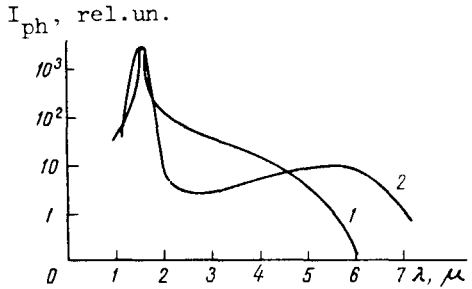
The spectral dependences of the emission, shown in the figure, practically coincide with the photoconductivity spectra of n- and p-type gold-doped germanium (see, for example, [2]).

Knowing the parameters of the semiconductor and using the voltage-current characteristic (1), it is easy to calculate the quantum yield of the described infrared cathode for the region of impurity absorption of light.

For n-type samples, for example, we have (for the case of small signals)

$$\gamma = \frac{\mu l_z N_{Au} \tau \sigma_{ph} E}{[1 + e \mu n l_y l_z \frac{E l_x}{I_0 V_0}] l_x} \quad (2)$$

Here μ is the electron mobility, N_{Au} the density of the doubly-ionized gold atoms, σ_{ph} the photoionization cross section of these atoms, τ the lifetime of the photocarriers, E the electric field intensity inside the sample, and l_x, l_y, l_z the linear dimensions of the sample (the Ox axis coincides with the current direction, and Oz with the illumination direction).



Spectral characteristic of light-controlled emission from germanium. 1 - n-type, 2 - p-type.

For standard high-resistivity samples of n-germanium doped with gold ($\rho = 10^8$ ohm-cm, μ (77°K) = 10^4 cm²/V-sec, $N_{\text{Au}} = 5 \times 10^{14}$ cm⁻³, $\tau = 2 \times 10^{-5}$ sec) at an anode-cathode voltage $V = 4 \times 10^3$ V the quantum yield for the wavelength $\lambda = 2\mu$ ($\sigma_{\text{ph}} = 1 \times 10^{-16}$ cm²) calculated by formula (2) is $\gamma = 0.12$ electron/photon. The experimentally obtained value of the quantum yield for this wavelength is $\gamma_{\text{exp}} = 0.06$ electron/photon. This corresponds to a cathode photosensitivity $\cong 2.5$ A/W.

Formula (2) discloses the operating peculiarities of this cathode: the need for an initial dark current (in the example described above this current was $I_0 = 4.5 \times 10^{-8}$ A), and the decrease in photosensitivity at large light intensity incident on the sample.

In conclusion we note that the method described here, subject to a suitable choice of semiconductor and doping impurity, can be used to construct a field-emission cathode which is sensitive to practically any region of the infrared spectrum.

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SELF-FOCUSING OF LIGHT. ROLE OF KERR EFFECT AND STRICTION

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Self-focusing of light, predicted in general form in [1] and considered in detail in [2,3], can be attributed to different physical causes (see [4] for the first information on experimental observations of the phenomenon).

According to [3], the most important may be the Kerr effect, i.e., the orientation of molecules by a high-frequency light field, and striction (change in the density of the medium).

The present note contains an analysis of the difference in the observable phenomena in these two cases. An appropriate experiment could decide which of the effects actually plays the principal role.

In the case of the Kerr effect, inasmuch as the light field has a high frequency, the effect depends not on the dipole moment of the molecule, but on the anisotropy of its polarizability, since the corresponding moment of the force is proportional to E^2 and does not reverse sign.

It follows therefore that the high-frequency Kerr effect should be large for such symmetrical molecules as p-dibromobenzene or p-dinitrobenzene.

In the case of light propagating along the z axis and linearly polarized with the electric vector directed along the x axis, the molecules become oriented (more accurately, "aligned") in the x direction.