APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

S/089/60/009/005/010/020
B006/B070

9.4300 (3203, 1043, 1143)
26.2532

AUTHORS: Konovalenko, B. M., Ryvkin, S. M., Yaroshetskiy, I. D., Bogomazov, L. P.

TITLE: An Apparatus for Studying the Effect of Gamma Radiation on Semiconductor Materials

PERIODICAL: Atomnaya energiya, 1960, Vol. 9, No. 5, pp. 408 - 409

TEXT: In the present "Letter to the Editor", a cobalt apparatus for the study of the effect of gamma radiation on the electrical properties of semiconductors is described. The apparatus was developed in 1958 by the Fiziko-tekhnicheskiy institut AN SSSR (Institute of Physics and Technology of the AS USSR). The principal use of the apparatus is in the production of defects that are constant in time. To obtain enough defects, fluxes of 10^{11} $cm^{-2}sec^{-1}$ are required. Fig.1 gives a schematic representation of the apparatus; Fig.2 shows the experimental chamber. Both are described in detail. The dose rate was measured at different points of the chamber, and some of the results are given in a Table. The highest dose rate of 128 r/sec was found at the center of

An Apparatus for Studying the Effect of Gamma Radiation on Semiconductor Materials

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B006/B070

the chamber floor; 10 mm above the floor it was only 72 r/sec; 20 mm above, 43 r/sec, and 40 mm above, 22 r/sec (all values refer to the center of the chamber). There were no disturbances during the experiment, the work was satisfactory in all respects. L. V. Maslova is thanked for help in measuring the field of gamma radiation. There are 2 figures, 1 table, and 2 Soviet references.

SUBMITTED: April 6, 1960

Fig.1

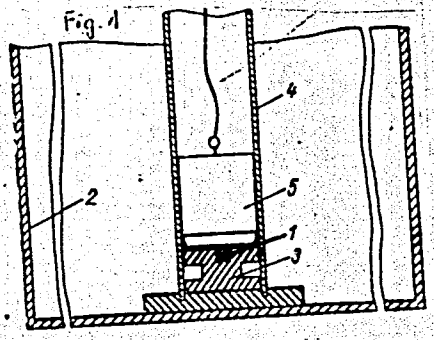

Fig.1

Legend to Fig.1: Scheme of the apparatus: 1 - Co^{60} standard source; activity: 400 g-equ.Ra; 2 - iron tank, 2.9 m high, filled completely with water. Base: 2.5 × 0.6 m^2; wall thickness: 5 mm; 4 - copper tube 125 mm wide on the inside; 5 - chamber with the sample.

Fig-2

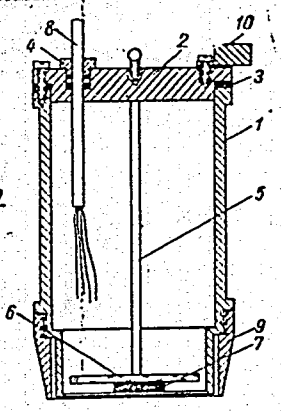

Fig. 2

Legend to Fig.2:
Scheme of the sample chamber. 1 - measuring vessel; 2 - cover; 3 - rubber ring; 4 - hermetically closable opening through which a cable (8) is introduced for the measurement of the electrical parameters of the irradiated samples; 5 - two supports; 6 - holder for the sample (7) made of asbestos cement; 9 - conical insert; 10 - guide box.

RYVKIN, S. M.

"Impurity Photoconductivity Kinetics,"

report to be submitted for the Intl. Conference on Photoconductivity, IUPAP, Cornell University, Ithaca, N. Y., 21-24 Aug 1961.

Leningrad Physico-Tech. Inst.

S/120/61/000/002/012/042
E210/E594

9.6150 (and 2705)
24.6810

AUTHORS: Vitovskiy, N. A., Maleyev, P. I., Matveyev, O.A., Ryvkin, S.M. and Tarkhin, D. V.

TITLE: Silicon N-P Counters of Heavy Charged Particles Operating Without an External Power Supply

PERIODICAL: Pribory i tekhnika eksperimenta, 1961, No.2, pp.82-83

TEXT: Fused silicon diodes having an n-p junction area of about 1 mm^2 have been studied in order to determine their counting properties when operated as short-circuited rectifiers. The saturation current in the counters studied was not over 0.1 μA; the leakage resistance was several megohms. Under such conditions, short-circuit current rectification can be realized by using a 250 kilohm load. In counters irradiated with α-particles under the above conditions and tested at room temperature, pulse amplitudes reached 2-3 mV with practically no noise. This performance equals that of counters operating as photodiodes, but the noise in the latter case increases rapidly with increasing cut-off voltage. In both cases (operating as rectifiers or photodiodes) pulse rise time varies from 1 to 5 μsec. The decay time is determined by the R-C of the circuit. This is shown in the oscillograms, Fig.1. In

Silicon N-P Counters of ...

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Fig.1a the duration of the markers is 1 μsec. Fig.1б - leading edge of the pulse; marker duration 0.2 μsec. Trigger delay 0.5 μsec. With decreasing temperature the pulse amplitude and duration remain unchanged. Silicon n-p counters are regarded as highly promising since even at room temperature they can operate as photovoltaic cells without an external power supply.
Comments made during the proof-reading: The here described counters show considerable variance in the amplitudes of the pulses during the counting of monochromatic particles, i.e. they are not suitable for spectrometry. At present, the laboratory of the authors manufactures surface-barrier silicon counters which are suitable for spectrometry (amplitude resolution less than 1% for α-particles with energies of 5.5 MeV). The considerations presented in the paper are in principle applicable also for such spectrometric n-p counters. There are 1 figure and 3 Soviet references.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN SSSR (Physico-technical Institute AS USSR)

SUBMITTED: February 20, 1960

Card ~~2/3~~ 2/2

BERKOVSKIY, F.M.; RYVKIN, S.M.; STROKAN, N.B.

Influence of adhesion levels on the relaxation of current through the p—n junction. Fiz. tver. tela 3 no.1:230-235 Ja '61. (MIRA 14:3)

1. Leningradskiy fiziko-tekhnicheskiy institut AN SSSR imeni akad. A.F.Ioffe.

(Transistors)

S/181/61/003/001/036/042
B102/B204

9.4160 (1137, 1395)
9.4177

AUTHORS: Ryvkin, S. M., Paritskiy, L. G., Khansevarov, R. Yu., and Yaroshetskiy, I. D.

TITLE: Investigation of the kinetics of impurity photoconductivity for the purpose of determining the parameters of local levels

PERIODICAL: Fizika tverdogo tela, v. 3, no. 1, 1961, 252-266

TEXT: An investigation of impurity photoconductivity is not only of interest in principle, but is also of practical importance for studying the local electron states in the forbidden band and especially of its interaction with exciting radiation. Apart from an earlier paper by the authors, relaxation processes of impurity photoconductivity have hitherto not been investigated in detail; this was, however, the aim of the present voluminous paper. The authors set themselves the task of investigating theoretically the most important cases of photocurrent relaxation during excitation in the impurity region. The rules governing the kinetics of impurity photoconductivity have certain peculiar features as is shown

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here, due to which impurity photoconductivity relaxation differs essentially from that of intrinsic photoconductivity. An exact analysis of these rules shows that an experimental investigation of the kinetics of impurity photoconductivity may serve the purpose of determining various parameters of impurity centers as, e.g., the photon capture cross section, the trapping cross section for free carriers, as well as the energy position of the impurity level in the forbidden band, the concentration of centers and the degree of their completion. In part 1 of this paper, the most important rules of the kinetics of impurity photoconductivity in the excitation of carriers for one type of local centers are dealt with. This is done on the basis of an example of a semiconductor, in whose forbidden band there is a sort of local level with concentration M; these levels are assumed to be in the upper half of the band, so that they are in heat exchange with the conduction band. This semiconductor is irradiated with monochromatic light of such a wavelength that only electrons pass from the local levels onto the conduction band, and that monopolar impurity photoconductivity occurs. The equation of motion (13) $d\Delta n/dt = (m_o - \Delta n)qJ - \gamma \Delta n(N_{cM}+M-m_o+n_o+\Delta n)$

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Investigation of the kinetics of...

is set up, where q is the capture cross section of an electron on the M-level for a photon; $m = m_0 - \Delta m$ is the electron concentration on the level M; γ is the recombination coefficient; J is the light intensity; $n = n_0 + \Delta n$ is the electron concentration in the conduction band; n_0 is the dark concentration of the electrons; N_{cM} is the effective state density in the conduction band; and $\Delta m = \Delta n$. The solution in the case of excitation by square light pulses is, for the case of growth (switching on of light), given by

$$\Delta n_{\text{св.}} = A \operatorname{th}(\gamma A t + B) - C, \qquad (1.6)$$

где

$$A = \sqrt{C^2 + m_0 \frac{qJ}{\gamma}}; \quad B = \frac{1}{2} \ln\left(1 + \frac{2C}{\Delta n_{\text{св.}}}\right);$$

$$C = \frac{1}{2}\left(N_{cM} + M - m_0 + n_0 + \frac{qJ}{\gamma}\right),$$

and for switching off

Investigation of the kinetics of...

different conditions and for different special cases, and expressions are derived for the relaxation times. The dependence of relaxation times on light intensity is investigated, and explicit formulas are derived, for q. In part 2 of this paper, the effect of a constant exposure in the impurity region upon the kinetics of impurity photoconductivity is investigated. (1.3) acquires the form

$$\frac{d\Delta n}{dt} = (m_0 - n_{J_0}) q\Delta J - \gamma\Delta n \times$$
$$\times \left(N_{eff} + M - m_0 + n_0 + 2n_{J_0} + \Delta n + \frac{qJ_0}{\gamma} + \frac{q\Delta J}{\gamma}\right). \quad (2.1)$$

where J_0 is the intensity of constant exposure, ΔJ the amplitude of the square light pulse, and n_{J_0} the steady carrier concentration in the conduction band. The solutions (growth, drop, steady) have the form

$\Delta n_H = \Delta n_{st}\left[1-\exp(-t/\tau_H)\right]$; $\Delta n_c = \Delta n_{st}\exp(-t/\tau_c)$; and

Investigation of the kinetics of...

where β is the quantum yield of the intrinsic effect, k the absorption coefficient in the intrinsic region, whose solution for switching in long-wave light is given by

$$\Delta n = \frac{qm_0\Delta f\left(\frac{1}{\tau_N'} + q\Delta f + r_1\right)\left(\frac{1}{\tau_N} + q\Delta f + r_2\right)}{\frac{1}{\tau_M}\left(\frac{1}{\tau_N} + q\Delta f\right)(r_1 - r_2)}\left[\exp(r_1 t) - \exp(r_2 t)\right], \qquad (3.9)$$

где

$$r_{1,2} = -\frac{1}{2}\left(\frac{1}{\tau} + \frac{1}{\tau_N} + \frac{1}{\tau_M} + q\Delta f\right) \pm$$

$$\pm\sqrt{\frac{1}{4}\left(\frac{1}{\tau} + \frac{1}{\tau_N} + \frac{1}{\tau_M} + q\Delta f\right)^2 - \left(\frac{1}{\tau_N'} + \frac{q\Delta f}{\tau_M}\right)}.$$

and for switching off long-wave light by

Card 7/8

VITOVSKIY, N.A.; MASHOVETS, T.V.; RYVKIN, S.M.; SONDAYEVSKIY, V.P.

Energy spectrum of defects arising in Ge under the effect of gamma radiation. Fiz. tver. tela 3 no. 3:998-1001 Mr '61. (MIRA 14:5)

(Crystals—Defects) (Germanium) (Gamma rays)

S/181/61/003/004/030/030
B102/B209

24,7700 (1035, 1143, 1469)

AUTHORS: Dobrego, V. P., Rogachev, A. A., Ryvkin, S. M., and Yaroshetskiy, I. D.

TITLE: Low-temperature breakdown in germanium in connection with radiative defects

PERIODICAL: Fizika tverdogo tela, v. 3, no. 4, 1961, 1298-1300

TEXT: In germanium doped with elements of the third or fifth group, the current may suddenly rise at helium temperatures when the field applied exceeds a certain critical value. This effect is known as low-temperature breakdown. The following is the mechanism of this effect: At these temperatures, the majority of carriers causing impurity conduction is localized at impurity centers, and resistivity is high. When a field is applied, the free carriers are accelerated and, at a certain field strength, their energy is high enough to cause impact ionization of the filled impurity centers. The low-temperature breakdown in Ge or Si due to donor or acceptor impurities has been investigated repeatedly. The present paper is a report on studies of this effect which is caused by radiative defects; such defects have been

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B102/B209

Low-temperature ...

produced by irradiating the semiconductor with gamma quanta or fast neutrons. First, the energy levels of the radiative defects are discussed; Fig. 1 shows the level scheme for gamma-irradiated (a) and fast-neutron irradiated (b) germanium. The two shallow levels of the radiative defects are only 0.02 and 0.01 ev, respectively, off the valency band; at helium temperatures, they are occupied by electrons only partly or not at all. In neutron-irradiated Ge specimens, the 0.01-ev level was found to be free from electrons at helium temperatures. In chemically impure specimens, the presence of donor centers offered a certain compensation, and the level was partly occupied by electrons. Volt-ampere characteristics of such specimens were taken by means of a "characteriograph." They were analogous to those obtained by B. Vul, E. Zavaritskaya, and V. Chuyenkov for the low-temperature breakdown due to impurity centers. Altogether, three specimens were examined: gamma-irradiated 1-γ had a concentration of shallow radiation levels of $N_a = 7.10^{13}cm^{-3}$ and a hole concentration on them of $p_a = 1.10^{13}cm^{-3}$; 1-n and 2-n were n-type specimens having a resistivity of 2 ohm·cm; after neutron irradiation they were p-type. n-type and p-type specimens having a resistivity of 3 and 12 ohm·cm, respectively, were measured for comparison. The

Low-temperature ...

values of the critical field strength (1) and of the breakdown field strength (2) for these two specimens are listed in columns (3) and (4) of the table. The authors thank T. V.Mashovets and N. A. Vitovskiy for having prepared the gamma-irradiated specimens, as well as S. R. Novikov and R. F. Konoplevaya for the neutron-irradiated specimens. There are 2 figures, 1 table, and 11 references: 5 Soviet-bloc and 6 non-Soviet-bloc. The most recent reference to an English-language publication reads as follows: McWhorter, R. Rediker, Proc. IRE, 47, 1207, 1959.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. akad. A. F. Ioffe AN SSSR Leningrad (Institute of Physics and Technology imeni Academician A. F. Ioffe AS USSR Leningrad)

SUBMITTED: December 20, 1960

	1-г	1-в	2-в	контрольный, n-типа (3)	контрольный, p-типа (4)
③ $E_{кр.}$, в/см	14	110	12	9.5	7.5
② $E_{а}$, в/см	44	110	15	10.2	9

Card 3/4

S/181/61/003/004/030/030
B102/B209

Low-temperature ...

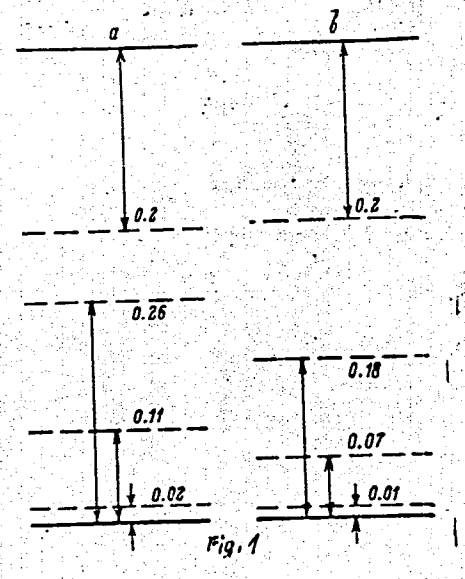

Fig. 1

Card 4/4

S/181/61/003/005/039/042
B111/B202

9,4160

AUTHORS: Paritskiy, L. G., Rogachev, A. A., and Ryvkin, S. M.

TITLE: Kinetics of photocells with an "external" photoelectric effect from a metal into a semiconductor

PERIODICAL: Fizika tverdogo tela, v. 3, no. 5, 1961, 1613-1616

TEXT: The paper by R. Williams and R. Bube (Appl. Phys., 36, No. 6, 1960) gives a series of proofs for the existence of an "external" photoelectric effect taking place from a metal into a semiconductor in photocells consisting of a Cu-coated low-resistance CdS crystal. Earlier measurements made by the author showed a low inertia in such photocells. The studies of the kinetics of the photocells are similar to those of photocells with n-p junctions which were dealt with in Ref. 3 (S. M. Ryvkin, ZhTF, XXVII,8, 1676, 1957) and Ref. 4 (S. M. Ryvkin, N. B. Strokan, L. L. Makovskiy, ZhTF, XXVIII, 9, 1958) for, actually, a metal connected with an n-type semiconductor replaces a p-type semiconductor. In this case those electrons which have absorbed a photon and whose energy exceeds the barrier height play the part of the unbalanced minority carriers in the metal. On the same

conditions as in Ref. 3 a value of $\sim 10^{-12}$ sec was obtained for the time in which a photoelectron passes the region of space charge. In the following, the authors demonstrate that the relaxation time of a photocell τ_j depends on the charging resistance in the following way: with $R_H \gg R_{BH}$ (R_H = charging resistance, R_{BH} = external differential resistance of a photocell) τ_j is independent of R_H and equal to $R_{BH}C$ (C = capacitance between the layer of space charge and support); with small R_H and if $R_T \ll R_{BH}$ (R_T = resistance of the semiconductor) τ_j depends linearly on R_H. Photocells Cu - CdS with a resistivity CdS being ≈ 1 ohm.cm were measured. The Cu-layer was electrolytically applied from a Cu_2SO_4 solution by N. F. Prikot, student of the LGU (Leningrad State University). τ_j was measured by the method of phase compensation of light which was sinusoidally modulated by a frequency of 1 Mc. 240 and 260 were obtained for the capacitance of the space charge. The capacitance of the support was 60 pf. 1 kohm and 440

Kinetics of ...

ohms were obtained for for R_{BH}. Photocells of this type can be used as photosensitive receivers with low inertia for the red and infrared range of the spectrum; also the range of sensitivity can be varied according to the metal and the semiconductor employed. The authors thank F. M. Berkovskiy for measuring the time constants. There are 2 figures and 5 references: 4 Soviet-bloc and 1 non-Soviet-bloc.

ASSOCIATION: Fiziko-tekhnicheskiy institut imeni A. F. Ioffe AN SSSR Leningrad (Institute of Physics and Technology imeni A. F. Ioffe AS USSR Leningrad)

SUBMITTED: November 26, 1960

Card 3/3

27276

94.7700 (1035, 1138)
26.1512

S/181/61/003/008/006/034
B102/B201

AUTHORS: Paritskiy, L. G. and Ryvkin, S. M.

TITLE: Study of "nonlinear" processes of relaxation of photoconductivity in the presence of adhesion levels

PERIODICAL: Fizika tverdogo tela, v. 3, no. 8, 1961, 2245 - 2258

TEXT: The investigations described here in great detail were conducted for the purpose of calculating the relaxation of monopolar photoconductivity with any ("nonlinear") filling of adhesion levels. The relaxation curves are shown in this case to display characteristic sections or points, by which the level parameters can be calculated. Earlier already, Ryvkin had studied the effect of carrier trapping by adhesion levels upon the relaxation of monopolar photoconductivity in the "linear" case (adhesion levels are little filled during the relaxation process, and the carrier lifetime is constant). By way of experiments, the authors have discovered an intense α-adhesion on the relaxation curves of CdS single crystals (FTT, II, 3, 1960). The study is here continued by first observing theoretically the kinetics of monopolar photoconductivity at any degree of excitation (considerable

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Study of "nonlinear" processes of...

filling of adhesion levels). The effect of a high filling degree of adhesion levels upon the existence of a nonlinearly ascending section in the photoconductivity curve is examined in Chapter 1 of the present paper on the basis of the band scheme (Fig. 1). The forbidden band contains the recombination centers S, to which the fact is to be ascribed that the electron lifetime τ_n in the conduction band is large compared with the hole lifetime τ_p in the valence band, so that photoconduction is purely n-type. In addition, the forbidden band includes adhesion levels of concentration M; multiple adhesion on them should be possible. The photoelectron concentration (n) in the conduction band grows in the initial stage of relaxation ($t \ll \tau_n$) following the law

$$n = \beta k J 0^2 \gamma M \left(1 - e^{-\frac{t}{\theta}}\right) + \frac{1}{2}\beta k J (\tau_n - t)\left[\pm\sqrt{1 + \frac{4N_{eff}t}{\beta k J (\tau_n - t)}} - 1\right]; \quad (9)$$

Card 2/B5

Study of "nonlinear" processes of...

where β denotes the quantum yield of the inner photoelectric effect, k is the light absorption coefficient, J is the light intensity, γ is the trapping factor of electrons from the c-band onto the M levels, $\theta = 1/\gamma(M+N_{cM})$, $N_{cM} = N_c \exp(-\Delta E_M/kT)$, N_c is the effective state density in the c-band, ΔE_M the energy of M levels, calculated from the bottom of the conduction band; $\theta \ll (M+N_{cM})/\beta kJ$. Fig. 2 shows n(t) in case of "nonlinear" filling of the adhesion levels. The greater the light intensity, the smoother will be the course of the n(t) curves, i. e., the larger the first linear sections, the farther they will be shifted to the right. Chapter 2 deals with the effect of adhesion levels upon the general character of the relaxation curves of photoconductivity. This is done for the case of τ_n = const and in the presence of an intense multiple adhesion. An S-shaped ascent of photoconductivity can be observed in this case. An experimental study was made of the photoconductivity curves on CdS single crystals that were strongly alloyed with silver; the experimental arrangement shown in Fig. 6 was used for the purpose. Square light pulses were used (front 2 sec) that were produced by means of a disk M rotating

Study of "nonlinear" processes of...

in the pre-vacuum chamber. The experimental curves showed a good agreement with theory. A method for the optical longwave sounding of local levels is discussed in chapter 4. The method is essentially based on what follows: the intensity of carrier generation, g, can be determined from the initial inclination of the curve of the growth of impurity conductivity, and is proportional to the concentration of carriers occupying a given level: $g = mqJ$; m is the carrier concentration on a given level, q the photon capture cross section, and J the intensity of the longwave light. Since qJ is easily determinable, the m can be determined from the measurement of g. If a semiconductor is irradiated with a longwave light pulse having a shorter duration than the time of growth of impurity photoconductivity, $m = c\Delta i_\phi$, will be valid, where i_ϕ is the amplitude value of the photocurrent pulse induced by the light pulse and c is an experimental constant which, inter alia, depends on the form of the light pulse. For the case of a linear filling of adhesion levels, Fig. 12 presents the curves of the optical sounding of adhesion levels during the relaxation of photoconductivity. Oscillograms obtained experimentally are in agreement with them. By optical sounding, n, m, dn/dt, and dm/dt can be determined at any instant. In case of nonlinear relaxation processes, determinations are made

Study of "nonlinear" processes of...

analogously. Yu. A. Zibuts and A. A. Purtskhvanidze are thanked for their assistance. M. I. Boyko and V. Ye. Lashkarev are mentioned. There are 13 figures and 17 references: 9 Soviet-bloc and 8 non-Soviet-bloc.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR Leningrad (Institute of Physics and Technology imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: February 4, 1961

Fig. 1: Scheme of electron transition

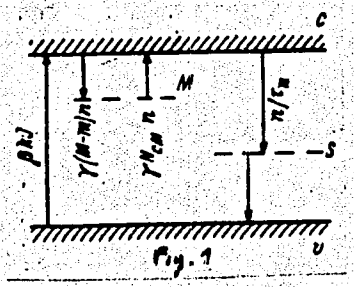

Fig. 1

27295

S/181/61/003/008/025/034
B109/B202

9.4177
26.2420

AUTHORS: Arkad'yeva, Ye. N., Kasymova, R. S., Ryvkin, S. M.

TITLE: Kinetics of the induced defect photoconductivity in telluric cadmium

PERIODICAL: Fizika tverdogo tela, v. 3, no. 8, 1961, 2417-2426

TEXT: The authors describe the energy band schemes and the determination of its various energy levels for monocrystalline CdTe. The effect of induced defect photoconductivity occurs according to the energy band scheme shown in Fig. 7. Upon illumination by infrared light the electrons on M are promoted to the conduction band c from which they either 1) return to M or 2) go to S (n-type). Case 2) plays an important part when the infrared light is switched on. In the course of time its effect is, however, weakened (the photocurrent decreases). If the hole concentration in M increases and in S decreases to such a degree that case 1) becomes more probable than case 2), then the photocurrent does no longer decrease and the quasisteady state is attained. The exact positions of the individual levels of the energy band schemes are determined by measuring the properties of the

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APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

Kinetics of the induced defect ...

conductivity of n- and p-type CdTe in this special state. The measurements are made according to Ye. N. Arkad'yeva, L. G. Paritskiy, S. M. Ryvkin (Ref. 1: FTT, II, 6, 1161, 1960) and S. M. Ryvkin, L. G. Paritskiy, R. Yu. Khansevarov, I. D. Yaroshetskiy (Ref. 3: FTT, III, 252, 1961) via the photon capture cross section q of the level M. The Fermi level is measured by determining the temperature dependence of the logarithm of the specimen conductivity which is practically a straight line. It follows from the slope of this straight line that the p-type has approximately 0.33 ev from below, and the n-type approximately 0.38 ev from above. To determine the energy level which is the principal cause of induced photoconductivity, the authors measure the spectral behavior of induced defect photoconductivity (maxima for p- and n-type approximately 1.8 μ red boundary for p-type approximately 4.3 μ, for n-type approximately 3.5 μ) as well as the dependence of the increase- and decrease-time constants on induced defect photoconductivity. From these values the quantity q is determined according to Ref. 3. Thus, the values 0.30 ev are obtained for the p-type from below, and 0.33 ev for the n-type from above. The complete energy band scheme is shown in Fig. 7 (a S,s donor level, n-type; 6 S,s acceptor level, p-type). There are 8 figures, 1 table, and 5 references: 3 Soviet

Card 2/3

Kinetics of the induced defect ...

and 2 non-Soviet.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR Leningrad (Institute of Physics and Technology imeni A. F. Ioffe AS USSR Leningrad)

SUBMITTED: February 11, 1961 (initially), March 24, 1961 (after revision)

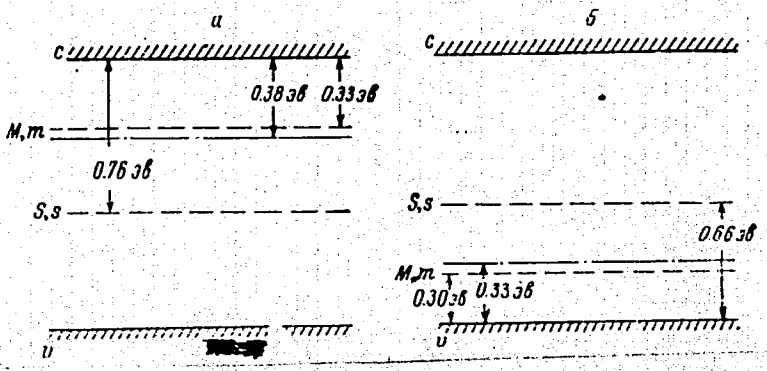

Fig. 7

Card 3/3

27298

S/181/61/003/008/028/034
B109/B202

9,4178

AUTHORS: Grinberg, A. A., Ryvkin, S. M.

TITLE: Unipolar nonsteady photomagnetic effect

PERIODICAL: Fizika tverdogo tela, v. 3, no. 8, 1961, 2470-2474

TEXT: While under steady conditions the ordinary photomagnetic effect (Kikoin-Noskov) occurs only in the case of bipolar photoconductivity of a semiconductor, a photomagnetic effect (PME) may occur also in a unipolar semiconductor under nonsteady conditions. At the moment of illumination a diffusion current of unbalanced charge carriers is formed because the charges do not have sufficient time to form a counterfield. The noncompensated diffusion current of the unbalanced charge carriers is deflected in the magnetic field thus causing the PME voltage. After the illumination is switched off a voltage of reverse polarity occurs (Fig. 1) due to "suction" of the volume charges. Quantitative estimation: The authors proceed from the formula

Card 1/4

Unipolar onsteady photomagnetic effect

$$\mathbf{j}=\varphi\left\{\mathbf{j}^*-\frac{\tilde{\mu}H}{c}[\mathbf{j}^*\mathbf{k}]\right\}+(1-\varphi)(\mathbf{j}^*\mathbf{k})\mathbf{k},$$

где $\mathbf{j}^*=e\mu n_0\mathbf{E}+eD\,\mathrm{grad}\,\Delta n$; $\varphi=\sqrt{\frac{e}{m^*\mu}\left(\frac{\tau_p}{1+\left(\frac{e\tau_p}{m^*c}H\right)^2}\right)}$; τ_p — время релакса- (1)

given by A. A. Grinberg (Ref. 1: FTT, II, 836, 1960) (τ_p relaxation time, μ electron mobility, $\tilde{\mu}$ Hall mobility of the electrons, the other denotations are the same as in Ref. 1). Under ordinary conditions, this formula is sufficiently accurate. The following relation is obtained for the electric field

$$E_x=\frac{\tilde{\mu}H}{c}\frac{4\pi eD}{\varepsilon L}\Delta n_{cT}\tau\frac{\left\{\left[\left(\frac{1}{\tau}-\frac{1}{\tau_2}\right)t-1\right]e^{-\frac{t}{\tau_0}}+e^{-\frac{t}{\tau}}\right\}}{\left(1-\frac{\tau}{\tau_0}\right)^2} \qquad (6)$$

where Δn_{cT} is the concentration of the unbalanced carriers in the neutral part of the illumination range of the specimen with $t\longrightarrow\infty$, $N_{cM}=N_c\exp(-\Delta E_M/kT)$, where N_c is the effective density of the states of

Unipolar nonsteady photomagnetic effect

the conduction band, M the total concentration of the defects, and m_o the concentration of the defects which, in the case of thermal equilibrium, is occupied by electrons, q photon capture cross section in a defect. Fig. 3 shows the relaxation effect of E_x for two ratios $\tau/\tau\sigma$.

$$E_x^{(max)} \simeq \frac{\beta H}{c} \frac{4\pi eD}{\varepsilon L_y} \Delta n_{cr.} \frac{\tau_\sigma^2}{\tau}. \qquad (9)$$

holds for the maximum value. The short-circuit current is

$$I_{s.s.} = -\frac{\beta H}{c} eDL_z \frac{e^{-\frac{t}{\tau_\sigma}} - e^{-\frac{t}{\tau}}}{\left(1-\frac{\tau}{\tau_\sigma}\right)} \Delta n_{cr.}, \qquad (10),$$

the maximum short-circuit current amounts to

$$I_{s.s.}^{(max)} = eD \frac{\beta H}{c} L_z \Delta n_{cr.} \left[\frac{\tau}{\tau_\sigma}\right]^{\left(\frac{\tau}{\tau_\sigma - \tau}\right)}. \qquad (11).$$

The ratio (10) : (11) indicates that the nonsteady unipolar PME is strongly

S/181/61/003/008/028/034
B109/B202

Unipolar nonsteady photomagnetic effect

marked in poorly conductive materials. Thus, with the following values $L_z = 1$cm, $L_x = L_y = 0.1$ cm, $\varepsilon = 16$, $\mu H/c \simeq 1$, $\Delta n \simeq n_o$, $I_o m_o q \simeq 10^{15}$ 1/sec·cm^3, $4 \cdot 10^{-10}$ a is obtained for the maximum short-circuit current. With a mobility of $\mu \simeq 10^3$ cm^2/v sec the interval resistance $R_i = 10^7$ ohm. Thus voltage of 10^{-3} v is formed at a load resistance $R \simeq 0.3\ R_i$. The authors thank L. E. Gurevich for valuable help. There are 3 figures and 1 Soviet reference.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AH CCCP, Leningrad (Institute of Physics and Technology imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: March 18, 1961 (initially), April 5, 1961 (after revision)

29702
S/181/61/003/010/032/036
B125/B102

26,2421

AUTHORS: Ryvkin, S. M., Khansevarov, R. Yu., and Yaroshetskiy, I. D.

TITLE: Impurity photoconductivity with gamma-irradiated germanium

PERIODICAL: Fizika tverdogo tela, v. 3, no. 10, 1961, 3211 - 3219

TEXT: Gamma irradiation of n-type germanium gives rise to an appreciable impurity photoconductivity which exceeds that in nonirradiated germanium by some orders of magnitude. It was examined in n-type germanium specimens (ϱ = 20 - 30 ohm·cm) irradiated with Co^{60} γ-quanta. Since irradiation took place at $\sim 10^{\circ}C$, the radiation defects were stable at room temperature. The experimental setup is shown in Fig. 1. The specimen was placed in a cryostat with KBr-window. All measurements were made at $\sim 100^{\circ}K$. Parasitic light was eliminated by a set of filters. The gamma-induced defects in n-type Ge form four levels in the forbidden band which are 0.02, 0.11 and 0.26 ev above the edge of the valence band and 0.2 ev below the bottom of the conduction band. The Fermi level was considerably above the level at 0.2 ev throughout the temperature range involved. The typical dependence of this photoconductivity on the energy

Impurity photoconductivity...

of incident quanta is presented in Fig. 3. The relaxation of unipolar impurity photoconductivity was also examined. In these experiments, the light frequency was chosen such that electron transitions occurred only from the 0.2-ev level. Growth and decay curves of photoconductivity, when, respectively, switching the light on and off, are "asymmetric" and do not obey the exponential law. The experimental results may be explained by calculations of S. M. Ryvkin et al. (FTT, III, no. 1, 1961). Quenching was observed in all n-type specimens when irradiating simultaneously by light corresponding to the self-absorption band and the impurity band. Fig. 5 presents typical curves of quenching spectra. The complicated character, the great variety of relaxation curves, and of spectral properties of quenching are due to the superposition of two concurring processes, namely, of quenching and of the impurity photoelectric effect. The shape of the spectral distribution curve, while depending on the ratio between the two light intensities depends on the experimental conditions and is not characteristic of the examined material. Conclusions: The radiation defects forming as a result of gamma irradiation of germanium gives rise to an impurity photoconductivity reaching as far as 6 microns. The position of the two independent radiation defect levels agrees with results

earlier found from the measurement of the Hall constant and from the kinetics of intrinsic photoconduction. Quenching resulting from the combined action of light corresponding to the self-absorption and impurity bands results in the trapping of minority carriers. There are 7 figures, 1 table, and 16 references: 8 Soviet and 8 non-Soviet. The three most recent references to English-language publications read as follows:
R. Newman, W. W. Tyler, Sol. State Phys. Acad. Press., 8, 1959;
Z. Johnson a. H. Levinstein. Phys. Rev., 117, no. 5, 1191, 1960;
R. Newman, H. H. Woodbury a. W. W. Tyler. Phys. Rev., 102, 613, 1956.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR
Leningrad (Physicotechnical Institute imeni A. F. Ioffe
AS USSR, Leningrad)

SUBMITTED: March 6, 1961 (initially),
June 13, 1961 (after revision)

Card 3/6 3

30800
S/181/61/003/011/047/056
B104/B138

9.4340 (1143, 1150)

AUTHORS: Berkovskiy, F. M., Ryvkin, S. M., and Strokan, N. B.

TITLE: Effect of adhesion levels on current relaxation in instruments with n-p junctions

PERIODICAL: Fizika tverdogo tela, v. 3, no. 11, 1961, 3535-3537

TEXT: Using the results of another work (FTT, 3, 1, 230, 1961) the authors study the effect of α- and β adhesions on the relaxation of a current flowing in a junction with a thin base. This case corresponds to real conditions, and is treated by the example of a photo-diode. Only in the case of α-adhesions and $t_o \gg \theta$ is If, the relaxation of the photo-current, retarded by $(1 + M/P_{vm})$. $t_o = w^2/2D$, where w is the thickness of the base and D the diffusion coefficient; $\theta = 1/\gamma(P_{vm} + M)$. For any marked retardation the concentration of adhesion levels M must satisfy the conditions $M \gg P_{vm}$; $t_o \gg 1/\gamma(M + P_{vm})$, i. e., $t_o \geq 1/\gamma M$. On the basis of published data an estimate for germanium and silicon gives

Card 1/2

VITOVSKIY, N.A.; MALEYEV, P.I.; MATVEYEV, O.A.; RYVKIN, S.M.; TARKHIN, D.V.

Silicon n-p counters of heavy charged particles operating without sources of power supply. Prib. i tekh. eksp. 6 no.2:82-83 Mr-Ap '61 (MIRA 14:9)

1. Fiziko-tekhnicheskiy institut AN SSSR.
(Nuclear counters)

27401
S/089/61/011/003/002/013
B102/B138

21.6000

AUTHORS: Ryvkin, S. M., Maslova, L. V., Matveyev, O. A., Strokan, N. B., Tarkhin, D. V.

TITLE: Silicon counters in nuclear spectrometry

PERIODICAL: Atomnaya energiya, v. 11, no. 3, 1961, 217 - 220

TEXT: Silicon counters were developed at the Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN USSR (Physicotechnical Institute imeni A. F. Ioffe AS USSR) in 1960. The counters were small (active area: 2·2, 5·5, and 10·10 mm^2). Their pulse height was $\sim$ 1 mv/Mev, and resolution less than 1% for E_α = 5.5 Mev. They were produced by sputtering gold to n-type silicon and diffusing phosphorus into the p-type silicon. The following characteristics were investigated: (1) Volt-ampere characteristics. They were the usual shape for p-n junctions. Reverse current was 0.5 - 0.05 μa (at 40 v) for the small-sized counters, and increased proportionally with area; breakdown voltage was between 50 and 60 v. (2) Capacitance-barrier voltage dependence. The capacitance of the sensitive layer (the volume-charge domain) was in accordance with the usual capacitor formula $d = \varepsilon_0 S/4\pi C$

(S - area, ε_0 - dielectric constant); since the thickness d of the sensitive layer is proportional to $\sqrt{V+V_0}$, the capacitance decreases as $(V+V_0)^{-1/2}$ with increasing voltage. (3) Pulse height-voltage dependence. Pulse height was determined by $Q = eN$ (N - number of pairs formed in ionization); the mean pair formation energy, ε, was measured for Pu^{238} alpha particles ($Q = 2.5 \cdot 10^{-13}$ k): $\varepsilon = 3.53 \pm 0.15$ ev; this value agrees with that found in Ref. 4 (see below). (4) Pulse height-energy dependence. Pulse height ϕ as a function of voltage V was measured for the alpha energy groups 8.78 and 6.05 Mev. For the short-range group, pulse height reached saturation at $\sim$ 15 v, for the long-range group at $\sim$ 35 v. $\phi(E_\alpha)$ was found to be a straight line. It is predicted that at V = 60 v linearity will also be maintained for alpha particles of up to 10 Mev or for any other particles with ranges of up to 60μ. (5) Amplitude resolution. This was determined on a 100-channel analyzer using Pu^{238} alpha emission. After correction for noise background, resolution was found to be 27 kev or 0.5% for the small counter, 1% for the medium, and 10% for the large one. The spread is attributed to inhomogeneities of the silicon. In the OIYaI at

Silicon counter in nuclear ...

Dubna the 10·10-mm^2 counter has been used for U^{233}-fission-fragment recording with high alpha background; G. N. Flerov, Corresponding Member of the AS USSR, has submitted a spectrum recorded with this counter to the authors of the present article. These junction counters may be used not only for recording of α-particles and fission fragments but also for fast and slow neutrons. The authors thank G. V. Khozov, Engineer. T. A. Lebedeva and G. D. Gusarina, laboratory assistents, and P. I. Gorshkov, mecnanic, for assistance. There are 7 figures and 4 non-Soviet references. They read as follows: Ref. 1: J. Blankenship, C. Borkowski. Bull. Amer. Phys. Soc., ser. II, 5, No. 1, 38 (1960). Ref. 2: S. Friedland, L. Mauer, J. Wiggins. Nucleonics, 18, No. 2, 54 (1960). Ref. 3: J. Mc Kenzie, J. Waugh. Bull. Amer. Phys. Soc., ser. II, 5, No. 5, 355 (1960). Ref. 4: M. Halbert, J. Blankenship. Nucl. Instrum. and Methods, 8, No. 1, 106 (1960).

SUBMITTED: March 18, 1961

Card 3/3

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

89611

9,4160 (also 1137, 1043, 1143)

S/020/61/136/002/015/034
B019/B056

26.2421
26.2360

AUTHORS: Grinberg, A. A., Novikov, S. R., and Ryvkin, S. M.

TITLE: The New Effect of Negative Photoconductivity in a Magnetic Field

PERIODICAL: Doklady Akademii nauk SSSR, 1961, Vol. 136, No. 2, pp. 329-331

TEXT: Fig. 1 shows a scheme of the experimental order, by means of which the authors carried out their experiments. By means of this device they were able to transmit light pulses to the semiconductor in the case of the existence or non-existence of a magnetic field. The photoconductivity without a magnetic field corresponded to the "positive" conductivity, that with magnetic field corresponding to the "negative" conductivity. The effect produced by the photo-emf of the specimen could be inhibited. The explanation of this effect proceeds from the fact that in the motion of the carriers in a magnetic transversal field their trajectory is curved, whereby the resistance is increased. The Hall field formed in this connection partly aligns the trajectories again, and thus decreases the

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The New Effect of Negative Photoconductivity in a Magnetic Field

S/020/61/136/002/015/034
B019/B056

growth of the resistance in a magnetic field. Thus, by some decrease of the Hall field, the resistance of the semiconductor is increased. By irradiation with light from the absorption band, electron-hole pairs are produced, and the increase of the electron concentration leads to a decrease of the Hall field. A formula is derived for calculating the negative change in the photoconductivity in n-type germanium, and further, two inequalities are given, by means of which it is possible to determine when no negative photoeffect may be observed in n-type or p-type material. There are 3 figures.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk SSSR (Institute of Physics and Technology of the Academy of Sciences USSR)

PRESENTED: August 1, 1960, by A. F. Ioffe, Academician

SUBMITTED: July 28, 1960

34226
S/181/62/004/002/009/051
B102/B138

26.1512
9.4177 (also 1051, 1035)

AUTHORS: Berkovskiy, F. M., and Ryvkin, S. M.

TITLE: Sensitivity of germanium and silicon photoelements in the range of impurity excitation

PERIODICAL: Fizika tverdogo tela, v. 4, no. 2, 1962, 366-375

TEXT: The authors study the possibility of the occurrence of a photo-emf in the p-n junction in the long-wave range behind the intrinsic absorption band. The theoretical results were checked by an experimental investigation of gold-doped Ge and Si elements. It is shown that photo-emf may arise with impurity excitation in conditions where minority carriers are generated in sufficient quantity. Fig. 1 shows the transitions possible when the semiconductor contains only one kind of impurity and is irradiated with photons whose energy is less than the forbidden-band width. It is demonstrated theoretically that with impurity excitation in general, minority as well as majority carriers are produced if the quantum energy is greater than the half-width of the forbidden band. If it is less, however, only majority carriers are produced. Photo-emf

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Sensitivity of germanium and silicon...

was observed on Ge p-n junctions obtained by diffusion of antimony into p-type Ge with a gold concentration of 10^{15} cm^{-3}. From the λ-dependence of photoconductivity and photocurrent it can be seen that both cover the region of impurity excitation. Photoconductivity extends farther than photo-emf into the long-wave range. Photoconductivity and photo-emf at $\lambda > 2\ \mu$ are due to the deep acceptor levels of gold: 0.2 ev from the conduction band and 0.15 ev from the valence band. The voltages obtained experimentally are less than the calculated value, but may reach considerable values. For a load resistance of 10^8 ohms at $\lambda = 2.3\ \mu$ the emf reaches 150 mv. For an incident energy of $3 \cdot 10^{-5}$ w, this corresponds to a sensitivity of 5000 v/w. The p-n junction in gold-doped n-type silicon was obtained by electrodeposition of nickel. Photocurrent and photoconductivity have very similar spectral distribution and occur between 1.5 and 2.5 μ. They are ascribed to the level, 0.54 ev off the c-band which is near to the middle of the forbidden band. As compared with photoresistors, photoelectric signal transformers on the basis of p-n junctions have several advantages: low dark current, insensitivity to adhesion levels, independence of external voltage sources. The design of

Sensitivity of germanium and silicon...

a photoresistor (Fig. 7a) and of a photocell with p-n junction are compared in an appendix to the paper. N. B. Strokan and L. G. Paritskiy are thanked for discussion and D. V. Tarkhin and Yu. V. Shmartsev for the specimens. V. Ye. Lashkarev, K. M. Kosonogova (Izv. AN SSSR, ser. fiz. No. 5-6, 1941), G. M. Avakyants and Yu. L. Ivanov are mentioned. There are 7 figures and 7 references: 5 Soviet and 2 non-Soviet. The reference to the English-language publication reads as follows: J. M. Waddel et al. Proc. IRE, 102, part B, 757, 1955.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: July 29, 1961

Fig. 1. Band scheme with possible transitions.

Fig. 7. Photoresistance and photo cell.

MASLOVA, L. V.; MATVEYEV, O. A.; RYVKIN, S. M.; STROKAN, N. B.; TARKHIN, D. V.; KHOZOV, V. G.

Possibilities for using silicon counters in nuclear research. Izv. AN SSSR. Ser. fiz. 16 no.12:1498-1505 D '62. (MIRA 16:1)

(Nuclear counters--Design and construction)

35376 S/058/62/000/005/118/119
A061/A101

9,4160
26.1512

AUTHORS: Ryvkin, S. M., Strokan, N. B., Makovskiy, L. L.

TITLE: The kinetics of photoelectric cells with n-p junctions

PERIODICAL: Referativnyy zhurnal, Fizika, no. 5, 1962, 31, abstract 5-3-62y (V sb. "Fotoelektr. i optich. yavleniya v poluprovodnikakh", Kiyev, AN USSR, 1959, 360 - 366)

J.

TEXT: The kinetics of ЛЭТИ (LETI) photodiodes was considered with lighted n-region and taking only the hole current into account. The relaxation of the rectifier element emf of the open photodiode circuit is shown to be determined by the lifetime, τ, of nonequilibrium holes if the inequality $\tau \gg R_0C$ is satisfied. C is the total capacity of the junction and assembly, and R_0 is the resistance of the n-p junction at zero voltage. The similarity between the curves of rise and drop of the photo-emf depends on the intensity of light considerably. At an increase of the latter, this similarity is disturbed. The inequality $\tau \gg R_0C$ can be disturbed by a decrease of temperature, in the case of a high capacity C, and in dependence of the type of photodiode. The general case of

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A061/A101

The kinetics of photoelectric cells with n-p junctions

photodiode connection at a load R_1 is examined quantitatively. The curves describing the approximate solution of the system of equations of the relaxation process in limit cases of emf drop are analyzed. The results obtained with both accurate and approximate formulas for the emf agree well with experimental data. Provisional information is presented for the kinetics of LETI germanium photodiodes of a sensitivity from 1 to 4 a/lumen, a dark current of 700 to 500 μa, an admissible voltage limit of $\sim$5 v, and a lag of 10^{-5} sec. There is 1 reference.

V. Shch.

[Abstracter's note: Complete translation]

34227
S/181/62/004/002/010/051
B102/B138

9,4177 (1035, 1051)

AUTHORS: Berkovskiy, F. M., and Ryvkin, S. M.

TITLE: Nonsteady photo-emf at an n-p junction due to majority carriers

PERIODICAL: Fizika tverdogo tela, v. 4, no. 2, 1962, 376-378

TEXT: Steady photo-emf in semiconductors is only observed if a potential barrier exists and if minority carriers are generated. However, since the periods required to establish the photo-emf of an inhomogeneous semiconductor may be different, a nonsteady photo-emf may also be observed when only majority carriers are generated. The time required for establishment in this kind of semiconductor will depend on the lifetime τ and the time for establishment of diffusion-migration equilibrium $\varepsilon/4\pi\sigma$, which are different. A nonsteady photo-emf due to majority-carrier generation was observed at n-p junctions produced by diffusion of antimony into gold-doped p-type Ge, with an Au concentration of $\sim 10^{15}$ cm^{-3}. The spectral photo-emf distribution is shown in Fig. 2 for steady illumination (a) and pulsed

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Nonsteady photo-emf at an...

illumination of 10 cps (b). Steady photo-emf stops at 2.8 μ. At $\lambda > 2.8$ μ, only majority carriers are generated. There are 2 figures and 6 Soviet references.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: July 29, 1961

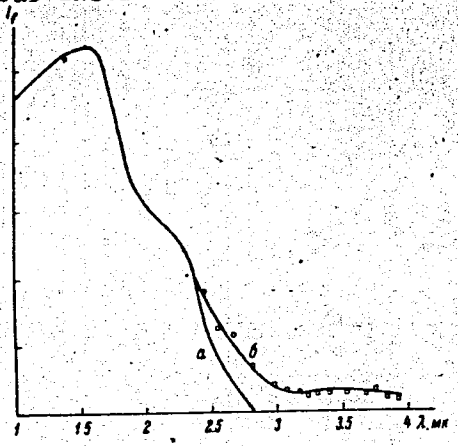


Fig. 2

Card 2/2

34228
S/181/62/004/002/011/051
B102/B138

24,7700 (1035,1043,1385)

AUTHORS: Konovalenko, B. M., Ryvkin, S. M., and Yaroshetskiy, I. D.

TITLE: Radiation defects caused by fast electrons in n-type germanium

PERIODICAL: Fizika tverdogo tela, v. 4, no. 2, 1962, 379-382

TEXT: The concentration M of radiation defects, the number l of the defect levels and their energies were determined for n-type Ge ($\sim$1 ohm·cm, $n \simeq 2 \cdot 10^{15}$ cm^{-3}) which was irradiated by 2.5-Mev electrons. The electron current density was ~ 5 $\mu a/cm^2$, pulse duration was ~ 2 μsec and repetition frequency was 50 sec^{-1}. The samples ($8 \cdot 1 \cdot 1$ mm^3) were water-cooled. The electron energy behind the specimens was $\sim$1.5 Mev, so that for calculations the electron energy in the specimen was taken to be $\sim$2 Mev. Carrier concentration was determined by measuring the Hall constant between 77°K and room temperature. M and l were determined using the relations: $n_2 = N_d - Ml_1$ and $n_4 = N_d - M(l-1)$; n_2 is the electron

Card 1/3

Radiation defects caused by fast...

concentration in the conduction band at low temperatures, when all defect levels are filled up and all donor levels are completely ionized (section I in Fig. 1). At high temperatures, when the upper defect levels are completely ionized, n_4 is the electron concentration (section II in Fig. 1). M was also determined from the activation energy of the upper levels and the carrier concentration of the linear part of II, using the relation $n-n_2 = \sqrt{MN_c}\exp(-\Delta E_M/2kT)$. N_c was calculated for the effective mass $m_n^* = 0.25\ m_o$. For several different specimens, the following results were obtained: N_d was $(2.08-2.26)\cdot10^{15}$ cm^{-3}, M1 was $(1.65-2.03)\cdot10^{15}$cm^{-3}, M was $(4.25-5.2)\cdot10^{14}$ cm^{-3}, 1 was 3.9 - 4.2, ΔE_M 0.20 - 0.23 ev, and the radiation defect formation cross section was 1.45-1.55 barn; it was calculated from $\sigma = M/\phi N_{Ge}$, ϕ - electron flux density, N_{Ge} - number of Ge atoms per cm^3. Electrons with ~25 Mev were found to produce defects with the following levels: E_c-0.24 ev, E_c-0.36 ev, E_v+0.25 ev and E_v+0.11 ev.

There are 3 figures, 2 tables, and 7 references: 3 Soviet and 4 non-Soviet. The three references to English-language publications read as

Card 2/3

31220
S/181/62/004/002/011/051
B102/B138

follows: J. W. Cleland et al. Phys. Rev. 102, 772, 1956; W. L. Brown et al. Phys. Rev. 92, 591, 1953; J. W. Cleland, J. H. Crawford. Progress in Semiconductors, 2, 1957.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: August 8, 1961

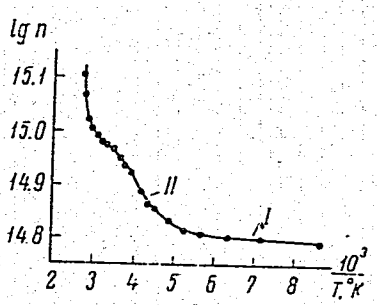


Fig. 1

3424
S/181/62/004/002/043/051
B102/B138

9,4177 (1051,1482)

AUTHORS: Dobrego, V. P., and Ryvkin, S. M.

TITLE: Negative photoconductivity in germanium at liquid-helium temperature

PERIODICAL: Fizika tverdogo tela, v. 4, no. 2, 1962, 553 - 555

TEXT: Negative photoconductivity was discovered in n-type Ge with specific resistivity of 0.2 - 0.4 ohm·cm and p-type Ge of 0.5 ohm·cm at helium temperature. In n-type Ge above 1 ohm·cm no effect was observed. At low illumination intensities conductivity decreases in a very short range (a in Fig. 1). Oscillograms were taken of the current rise and drop in a cell with the specimen exposed to square light pulses. From the oscillograms it can be seen that positive and negative photo-conductivity have different increase and decrease constants, the latter being particularly marked. Both curves are non-exponential. The red edge of negative photoconductivity of n-type Ge is at about 0.74 ev. At the short-wave side photoconductivity decreases slowly and vanishes at 1.1 - 1.3 μ. It is assumed that the negative photoconductivity may be

Negative photoconductivity...

due to increased population of the donor levels, caused by illumination. There are 2 figures, 1 table, and 4 non-Soviet references. The three references to English-language publications read as follows: C. S. Hung. J. R. Gliessmann. Phys. Rev. 79, 726, 1950; H. Fritzsche. J. Phys. Chem. Solids, 6, 69, 1958; P. Csavinszky. Phys. Rev. 119, 1605, 1960.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: November 3, 1961

Fig. 1. Lux-ampere characteristics.

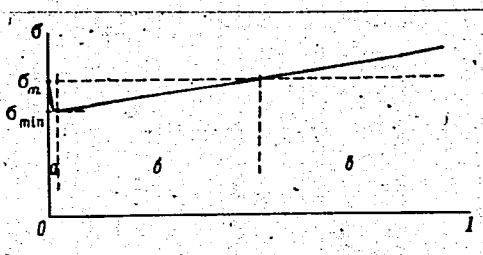


Fig. 1

36486
S/181/62/004/003/041/045
B101/B102

24.7700
9.4310

AUTHORS: Fitovskiy, N. A., Lukirskiy, D. P., Mashovets, T. V., and Ryvkin, S. M.

TITLE: Energy spectrum of some impurity atoms in germanium and silicon

PERIODICAL: Fizika tverdogo tela, v. 4, no. 3, 1962, 816 - 818

TEXT: In a previous paper (FTT, 1, 1381, 1959) the authors suggested a method of determining the total number of acceptor (or donor) levels pertaining to one structural defect and lying in the forbidden band of a semiconductor. The method consists in measuring the temperature dependence of the Hall constant in specimens with known ratio of the concentration of the "ordinary" carriers (of the elements of the groups III and V) to the defect concentration. Such measurements were made in gold-doped n-type Ge, copper-doped n-type Ge, and gold-doped p- and n-type Si. Specimens with known impurity concentrations are obtained by diffusion. In the measurement, the concentration M of the atoms added must be such that $Ml < N_1$, or $Mk < Na$, where l is the number of the acceptor levels, k

Card 1/4

Energy spectrum of some...

the number of the donor levels, N_d, N_a are the concentrations of the "ordinary" donors or acceptors, respectively. The results (Fig. 1) which show a concentration n_o of the ordinary donors prior to doping which corresponds to complete ionization, and n_2 after doping.indicate that at liquid-nitrogen temperature filling of the ordinary donors (V-group elements) sets in. The concentration which increases with temperature (Iα and IIδ) corresponds to the ionization of the uppermost level of the impurity atom and the concentration n_1 (Fig. 1) to the complete emptying of this level. The relation $l = (n_o - n_2)/(n_1 - n_2)$ for Cu in Ge is 3.1; for Au in Ge (2 specimens) $l = 2.8$ and $l = 3.1$. With n-type and p-type Si the curves I and II coincide at high temperatures (approximately 500°K) from which it follows that in silicon gold forms one acceptor level ($l = 1$) and one donor level ($k = 1$). The calculated activation energies for the upper acceptor levels of Cu and Au in Ge, and the acceptor and donor levels of Au in Si agree with published data. There are 2 figures and 5 references: 2 Soviet and 3 non-Soviet. The three references to English-language publications read as follows: H. H. Woodbury a. W. W. Card 2/4 3

Energy spectrum of some...

Tyler, Phys. Rev., 105, 84, 1957; R. Newman, Phys. Rev., 94, 278, 1954; C. B. Collins, R. O. Carlson, a. Gallagher, Phys. Rev., 105, 1168, 1957.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute imeni A. F. Ioffe of the AS USSR, Leningrad)

SUBMITTED: December 30, 1961

Fig. 1. Temperature dependence of the carrier concentration in germanium. (a) doped with Cu; (б) doped with Au.

36893
S/181/62/004/004/038/042
B102/B104

24.6111
27.7000

AUTHORS: Nasledov, D. N., Rogachev, A. A., Ryvkin, S. M., and Tsarenkov, B. V.

TITLE: Recombination radiation of gallium arsenide

PERIODICAL: Fizika tverdogo tela, v. 4, no. 4, 1962, 1062-1065

TEXT: Monocrystalline n-type InAs plates with an electron concentration of $\leq 10^{17}$ cm^{-3} were used to study the intrinsic recombination radiation. A p-n junction of ≈ 0.1 cm^2 was produced by diffusion of Zn or Cd into the InAs plate. The nonequilibrium carriers were excited by pulsed injection through the junction. The radiation was observed in parallel to the p-n junction plane. At 77°K the emission spectrum has a narrow peak at 1.47 ev (optical self-absorption edge) and two maxima at lower energies which are in connection with recombination via impurity levels. One of these levels is 0.2 ev distant from the middle of the forbidden band, the other 0.25 ev from a band edge. The relative height of all maxima depends on the current density through the p-n junction. At less

Recombination radiation of gallium ...

than 1 a/cm^2 only impurity radiation is observed, then intrinsic radiation arises and increases rapidly, and between 10 and 100 a/cm^2 the relative height of the maxima remains constant. The results can be explained by assuming volume-charge recombination at weak currents and injection at high currents. At above 10 a/cm^2 the emission intensity increases linearly with the current density through the p-n junction and decreases only above $\sim 10^3$ a/cm^2. The forbidden band width is temperature-dependent according to the law $(1.51-5.6\cdot10^{-4}T)$ ev. The intrinsic emission line narrowing observed at high current densities can be explained by inverse band filling (production of states with "negative temperature") or by assuming that the injected carriers cause degenerate filling of one band only. The latter possibility is more probable. There are 2 figures.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: January 11, 1962

38909
S/181/62/004/006/015/051
B125/B104

24.7700
24.2600

AUTHORS: Ivanov, Yu. L., and Ryvkin, S. M.

TITLE: Optical charge exchange of impurity centers and kinetics of impurity photoconduction

PERIODICAL: Fizika tverdogo tela, v. 4, no. 6, 1962, 1482-1491

TEXT: The kinetics of photoconduction in direct and reverse charge exchange through the C-zone has been investigated experimentally, and results have been interpreted qualitatively. The examined five groups of n-type germanium specimens with copper introduced by diffusion comprised almost all possible stages of compensation. The illumination of group I specimens (all Cu centers having a triple negative charge) and of group V gives rise to electron exchange between a single level (level III for group I, and level II for group V) and the corresponding zone. The relaxation curves then contain only one "fast" component. If specimens of groups II and III (containing triply and doubly charged centers) are irradiated with $0.43\ ev > h\nu > 0.26\ ev$, both slow and fast relaxation appears. Under irradiation with $0.49\ ev > h\nu > 0.43\ ev$, the

Optical charge exchange of impurity ...

relaxation curve slopes down gently owing to charge exchange of the Cu centers. Th· irradiation of III (all centers having double negative charge) with 0.49 ev > hν > 0.43 ev causes reverse charge exchange which may change the rate of generation and, to a lesser degree, also the lifetime. In the irradiation of group IV specimens (containing singly and doubly charged centers) with 0.43 ev > hν > 0.32 ev as well as in the short-wave range, there appears a "fast" component. Theoretically possible slow processes are not observed. After illumination of a group III specimen with 0.49 ev > hν > 0.45 ev, electrons from levels II and III are transferred to the C-zone. The intensity of this reverse process ("flashing") increases with progressing filling of level III with electrons. A steady state sets in after a certain time. Hence, the amplitude of this "reverse flashing" (characterizing the concentration of triply charged non-equilibrium centers) tends toward a limiting value if preliminary illumination has been protracted for a sufficiently long time. The more intense the illumination, the more quickly this limiting value is attained. There are 6 figures. The most important English-language reference is: J. Lambe, C. C. Klick. Phys. Rev., 98, 909, 1955.

38919
S/181/62/004/006/030/051
B104/B112

9,4177

AUTHORS: Arkad'yeva, Ye. N., Paritskiy, L. G., and Ryvkin, S. M.

TITLE: A method of long-wave photoelectric probing of local levels in semiconductors

PERIODICAL: Fizika tverdogo tela, v. 4, no. 6, 1962, 1578 - 1588

TEXT: In the new method described here for the investigation of relaxation processes in semiconductors, the sample is irradiated with a probing pulse of long-wave light (Fig. 1б) along with a sufficiently long square light pulse (Fig. 1a) that excites the relaxation process under investigation. The wavelength of the probing pulse is so chosen that the levels under consideration are ionized. In this case, the signal on the oscilloscope screen has a definite form (Fig. 1в). The concentrations of free and bound carriers can be determined from the slope of the curve on the screen and from its peak produced by the probing pulse. The sample can be irradiated with a series of probing pulses during the interval of a single square pulse (Fig. 2), and this enables the relaxation of the concentrations to be determined. The light from the

source S (Fig. 3) and the probing infrared light of the monochromator M are regularly interrupted by the disks Π_1 (square pulse) and Π_2. The signals of photoconductivity are recorded by a double-beam oscilloscope and photographed. The probing pulse is automatically shifted along the square one. Examples of a qualitative analysis of the behavior of non-equilibrium carriers in CdS, CdTe, Ge, and Si during photoconduction at ~100°K are given, and a probing method for several types of local levels in semiconductors is described. There are 15 figures.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: February 5, 1962

14.7700

38925

S/181/62/004/006/049/051
B108/B138

AUTHORS: Rogachev, A. A., and Ryvkin, S. M.

TITLE: Temperature dependence of the radiative recombination cross section in germanium

PERIODICAL: Fizika tverdogo tela, v. 4, no. 6, 1962, 1676 - 1678

TEXT: The authors' preliminary experiments have shown that at 77°K and with a high injection level ($\Delta p \approx 10^{16}$ cm^{-3}) the time constants of photoconduction in germanium are greater than was concluded by van Roosbrock and W. Shockley (Phys. Rev., 94, 1558, 1954). They also meas red the temperature dependence of the radiative recombination cross section in n-type Ge diodes. Only a slight increase in intensity of the recombination radiation was observed as the n-p junction was cooled from room temperature to liquid nitrogen temperature: $\sigma_R \sim 1/T$. It is stated that the rapid decrease in σ_R with rising temperature, as established by van Roosbrock and Shockley, is probably due to an error in calculation. It is demonstrated

Temperature dependence ...

that even under ideal conditions σ_R cannot decrease more rapidly than in proportion to $T^{-5/2}$. There is 1 figure.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR
Leningrad (Physicotechnical Institute imeni A. F. Ioffe
AS USSR, Leningrad)

SUBMITTED: February 26, 1962

RYVKIN, S.M.; DOBREGO, V.P.; KONOVALENKO, B.M.; YAROSHETSKIY, I.D.

Induced impurity breakdown in compensated germanium and current oscillations related to it. Fiz.tver.tela 4 no.7: 1911-1914 Jl '62. (MIRA 16:6)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.
(Breakdown, Electric) (Germanium--Electric properties)

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

44144

S/181/62/004/010/032/063
B108/B104

24 7600

AUTHORS: Vitovskiy, N. A., Mashovets, T. V., and Ryvkin, S. M.

TITLE: The energy spectrum of the gamma radiation defects in silicon

PERIODICAL: Fizika tverdogo tela, v. 4, no. 10, 1962, 2845-2848

TEXT: The temperature dependence of the Hall constant was studied on n- and p-type silicon samples before and after their exposure to Co^{60} gamma radiation. Irradiation ($1.4 \cdot 10^{17}$ quanta/cm^2; $1.15 \cdot 10^{18}$ quanta/cm^2) reduced the conductivity of silicon. The measurements carried out in the range 55-450°K showed that irradiation gives rise to two levels in the upper half of the forbidden band that are capable of accepting electrons: E_c - 0.18 ev and E_c - 0.5 ev. The production cross-sections of these levels are approximately $1.4 \cdot 10^{-26}$ cm^2 and $1.8 \cdot 10^{-27}$ cm^2, respectively. In the lower half of the forbidden band there was one level (E_v + 0.23 ev) with a production cross-section of about $1.2 \cdot 10^{-27}$ cm^2. There are 2 figures and 2 tables.

Card 1/2

The energy spectrum of the gamma...

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: May 30, 1962

Card 2/2

S/181/62/004/010/033/063
B102/B112

AUTHORS: Vitovskiy, N. A., Mashovets, T. V., and Ryvkin, S. M.

TITLE: Determination of the activation energy of impurity center levels and of structural defects in semiconductors

PERIODICAL: Fizika tverdogo tela, v. 4, no. 10, 1962, 2849 - 2853

TEXT: A study was made of the temperature dependence of the carrier concentration in semiconductors with impurities and defects, the spectra of which are complicated by their being several types of levels. According to measurements log $n = f(1/T)$ is, in this case, a complicated curve comprising plateaus of different lengths and sections with different inclinations. The activation energy of all possible levels is calculated to obtain a quantitative theoretical description. For simplicity a semiconductor is considered having two levels in the forbidden band. At absolute zero one of them should be partially filled with electrons, and the other should be filled completely (Fig. 2). The results can then be generalized for an arbitrary number of levels. If, in the entire temperature range the relation $\Delta E_2 - \Delta E_1 \gg kT$ is valid where ΔE_i are the level activation energies,

then the neutrality condition of the system can be given by

$$N_c e^{\frac{\mu}{kT}} = m_1 - \frac{M_1}{1 + \gamma_1 e^{-\frac{\Delta E_1 + \mu}{kT}}} + \frac{M_2}{1 + \frac{1}{\gamma_2} e^{\frac{\Delta E_2 + \mu}{kT}}}, \quad (1);$$

the solution is

$$n = \frac{m_1 - \gamma_2 N_{cM_2}}{2} \pm \frac{1}{2} \sqrt{(\gamma_2 N_{cM_2} - m_1)^2 + \gamma_2 4 N_{cM_2} (M_2 + m_1)}, \quad (5).$$

$$N_{cM_2} \equiv N_c e^{-\frac{\Delta E_2}{kT}}.$$

The curve log n = f(1/T) is divided into 6 sections (2 plateaus, 2 sloping and 2 transition sections), n is calculated for each section and the state density is studied. With the aid of

$$\Delta E_2 = \frac{d \lg n}{d\left(\frac{1}{T}\right)} \left[1 - \frac{2.3 \cdot 2k}{m_1 \sqrt{(m_1 + M_2) m_1}}\right] - \frac{3}{2} kT. \quad (9)$$

Card 2/4 * Error in original

ΔE_2 can be determined experimentally from the high-temperature inclined section, if m_1 and (M_2+m_1) in the point $\gamma_2 N_{cM_2} = m_1$ is determined from

$$n = \sqrt{(m_1 + M_2)\gamma_2 N_{cM_2}} = \sqrt{(m_1 + M_2) m_1}. \quad (7)$$

and $d(\log n)/d(1/T)$ is determined from the curve. The statistical weights γ_1/γ_2 of the levels need not be known but γ_2 can be calculated from (7). These relations are valid if $M_2 \lesssim m_1$. If $M_2 \gg m_1$ then the activation energy can be calculated directly from the inclination of the curve with the aid of

$$\frac{d \lg n}{d\left(\frac{1}{T}\right)} = -\frac{1}{2}\left(\frac{\Delta E_2}{k} + \frac{3}{2} T\right), \quad (11).$$

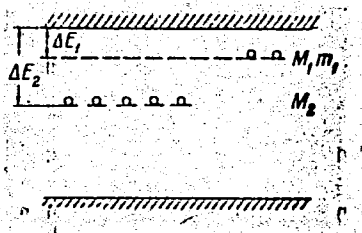
This is calculated for a practical case. Finally, a further possibility is pointed out of calculating ΔE_2 from the temperature dependence of the carrier density: the curve $\log(n-m_1)=f(1/T)$ can be constructed and the

tangent whose inclination gives the activation energy directly can be drawn at the point corresponding to Eq. (7). N_c denotes the effective state density in the conduction band, M_i are the level concentrations and m_1 is the electron concentration on the M_1 level. There are 3 figures.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: May 30, 1962

Fig. 2



33238

S/089/62/012/002/010/013
B102/B138

26.2264
21.6000

AUTHORS: Kazarinov, N. M., Matveyev, O. A., Ryvkin, S. M., Solov'yev, S. M., Strokan, N. B., Tarkhin, D. V.

TITLE: Investigation of semiconductor spectrometer counters for measuring fragment energies

PERIODICAL: Atomnaya energiya, v. 12, no. 2, 1962, 153 - 154

TEXT: U^{235} fission fragment energy was measured by semiconductor counters developed at the fiziko-tekhnicheskiy institut im. A. F. Ioffe (Physicotechnical Institute imeni A. F. Ioffe). The surface-barrier junction of these counters was produced by spraying gold onto an n-type silicon plate. These counters, which were studied earlier by the authors (Atomnaya energiya, 11, no. 3, 217, 1961), were found to be well suited for alpha spectrometry (resolution 0.5% for E_α = 5.5 Mev). The volume charge region was about 60 μ for maximum voltage, much greater than the fragment range in silicon. Fragment energy was measured with a 0.5 mm Al target, placed in a thin-walled aluminum vacuum chamber. The target had a vacuum-sprayed layer of UF_4, enriched in U^{235} to 92.8%. Diameter of the

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

Investigation of semiconductor ...

layer was 1.2 cm, and the total weight was 120 μg. The silicon counter was placed 1.5 cm below the target to avoid being hit by the neutron beam collimated into the chamber. The counter pulses were fed to a preamplifier and thence to a 100-channel analyzer. The fragment energy spectra thus measured differed considerably from those obtained from time-of-flight measurements. This was found to be due to energy losses in the counter surface, which were strongly dependent on the angle of incidence of the fragments. As the fragments lose most of their energy in the first part of their path this effect was much higher for them than for alphas.

Special counters of 16 mm^2 area were produced with a thinner layer of gold and the energy spectrum was measured again and compared as before. This time the shape was the same, with a difference of about 7 Mev in absolute values. This is attributed partly to energy losses in the fissile layer, and partly to the energy being carried away by fission neutrons. In the Au layer losses do not exceed 1 Mev. Apart from other advantages the silicon counters yield better results than e. g. ionization chambers. There are 2 figures and 5 references: 1 Soviet and 4 non-Soviet. The four references to English-language publications read as follows: W. Stein.

VITOVSKIY, N.A.; MASHOVETS, T.V.; RYVKIN, S.M.

Energy spectrum of gamma-radiation defects in silicon. Fiz. tver.tela 4 no.10:2845-2848 O '62. (MIRA 15:12)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.
(Hall effect) (Silicon crystals--Defects)
(Gamma rays)

VITOVSKIY, N.A.; MASHOVETS, T.V.; RYVKIN, S.M.

Determining the activation energy of the different levels of impurity centers and structural defects in semiconductors. Fiz.tver.tela 4 no.10:2849-2853 O '62. (MIRA 15:12)

1. Fiziko-tekhnicheskiy institut imeni Ioffe AN SSSR, Leningrad.
(Crystals—Defects) (Semiconductors) (Quantum theory)

NASLEDOV, D.N.; ROGACHEV, A.A.; RYVKIN, S.M.; KHARTSIYEV, V.Ye.; TSARENKOV, B.V.

Structure of direct recombination spectra of gallium arsenide. Fiz. tver. tela 4 no.11:3346-3348 N '62. (MIRA 15:12)

1. Fiziko-tekhnicheskiy institut imeni A.F. Ioffe AN SSSR, Leningrad.

(Gallium arsenide--Spectra)

RYVKIN, Solomon Meyerovich; MATVEYEV, Oleg Aleksandrovich; STROKAN, Nikita Borisovich

[Transistorized nuclea counters] Poluprovodnikovye schetchiki iadernykh chastits. Leningrad, 1963. 39 p. (Leningradskii dom nauchno-tekhnicheskoi propagandy, no.10) (MIRA 17:7)

AM4016851 **BOOK EXPLOITATION** S/

Ry*vkin, Solomon Meyerovich

Photoelectric phenomena in semiconductors (Fotoelektricheskiye yavleniya v poluprovodnikakh) Moscow, Fizmatgiz, 63. 0494 p. illus., biblio. 13000 copies printed.

Series Note: Fizika poluprovodnikov i poluprovodnikovy*kh priborov

TOPIC TAGS: photoconductivity, photoelectric phenomena, semiconductor, carrier generation, carrier motion, carrier recombination, adhesion, diffusion, drift, photoemf, intrinsic photoconductivity, extrinsic photoconductivity

PURPOSE AND COVERAGE: The monograph considers processes of generation, motion, and recombination of non-equilibrium carriers in semiconductors. Principal attention is paid to an analysis of recombination via local centers, adhesion, diffusion and drift of non-

equilibrium carriers in electric and magnetic fields, to the related phenomena of photoconductivity (intrinsic and extrinsic) and photo emf, and also to methods of experimental investigation of the kinetics of photoelectric processes. The book is for physicists and engineers dealing with semiconductors.

TABLE OF CONTENTS [abridged]:

AM4016851

SUB CODE: PH SUBMITTED: 12Jul63 NR REF SOV: 187

OTHER: 110 DATE ACQ: 19Dec63

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

S/030/63/000/001/005/013
B104/B102

AUTHOR: Ryvkin, S. M., Doctor of Physics and Mathematics

TITLE: Semiconductor counters for nuclear particles

PERIODICAL: Akademiya nauk SSSR. Vestnik, no. 1, 1963, 56-58

TEXT: The development of the production of crystal counters which began 17 years ago is briefly outlined, and the advantages and shortcomings of germanium or silicon junction counters and of homogeneous semiconductor counters are discussed. Methods of producing spectrometric n-p surface barrier counters and n-i-p counters have been developed at the Fiziko-tekhnicheskiy institut im. A.F. Ioffe Akademii nauk SSSR (Physicotechnical Institute imeni A.F. Ioffe of the Academy of Sciences USSR). The n-p junction counters consist of a Si plate on the surface of which an n-p surface barrier junction is produced. The junction charge is the effective region of this counter. If one particle produces an electron-hole pair in this region, then this pair is separated by the strong field and virtually no recombination losses arise. If the particle remains inside the volume charge region, then the pulse arising when the

Semiconductor counters for ...

counter capacitance is charged is exactly proportional to the particle energy. Two types have been developed at the Institute. The sensitive surface of the first type was 50 mm^2 in area, or less, and 100μ thick. These counters are provided for the spectroscopy of alphas, fission fragments, ions etc. The resolution for 5-Mev α-particles was 0.5%. The second type had a sensitive surface of approximately 5 cm^2. 2-Mev α-particles could be detected. Using a B^{10} converter, thermal neutrons could be detected with a counting efficiency of 1%. The author developed an n-i-p counter with a sensitive surface 4 cm^2 in area and approximately 2 mm thick for detecting 5-Mev α-particles. The signal-to-noise ratio was ≈ 50. There are 2 figures.

BERKOVSKIY, F.M.; RYVKIN, S.M.

Effect of the optical recharging of impurity centers on the kinetics of a photo-emf. in germanium. Fiz. tver. tela 5 no.2:381-385 F '63. (MIRA 16:5)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.
(Photoelectricity) (Germanium)

BERKOVSKIY, F.M.; KASYMOVA, R.S.; RYVKIN, S.M.

Sensitization of photodiodes resulting from optical recharging of impurities. Fiz. tver. tela 5 no.2:524-533 F '63. (MIRA 16:5)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.
(Diodes) (Photoconductivity)

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7

L 18000-63 EWT(1)/EWG(k)/EWP(q)/EWT(m)/BDS AFFTC/ASD/ESD-3/IJP(C)
Pz-4 RDW/AT/JD

ACCESSION NR: AP3001286 S/0181/63/005/006/1649/1656

AUTHORS: Mekhtiyev, R. F.; Paritskiy, L. G.; Ryvkin, S. M.

TITLE: Kinetics of impurity photoconductivity in crystals of GaSe

SOURCE: Fizika tverdogo tela, v. 5, no. 6, 1963, 1649-1656

TOPIC TAGS: impurity photoconductivity, emitter level, capture cross section, multiple capture, valence band, impurity absorption, Ga, Se

ABSTRACT: The purpose of this work was to study the spectrum of local levels responsible for impurity photoconductivity (emitter levels), to examine the parameters of these centers, and the role of the levels of capture by analyzing spectral dependence of standard photoconductivity and the structure of relaxation curves. In single crystals of GaSe the authors detected considerable photosensitivity in the region of impurity absorption up to about 3 microns, determined by the presence of 3 types of "emitter" levels lying at 0.4, 0.56, and 0.71 ev from the top of the valence band. Investigation of relaxation of photoconductivity permitted them to determine the capture cross sections of nonequilibrium holes, each of the levels of capture cross section of photons, and

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ACCESSION NR: AP3001286

2

the concentration of levels. They established the presence of levels of multiple capture and showed that when emitter levels are nearly full and equilibrium conductivity is considerable the presence of capture does not affect the measured relaxation time. By comparatively simple measurements of the concentration of emitter levels and the capture cross sections of photons they found it possible to determine the basic parameters of local levels responsible for the impurity photoconductivity. Orig. art. has: 6 figures and 7 formulas.

ASSOCIATION: Fiziko-technicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physical and Technical Institute); Institut fiziki AN Az. SSR, Baku (Institute of Physics, Academy of Sciences, Azerbaijan SSR)

SUBMITTED: 29Jan63 DATE ACQ: 01Jul63 ENCL: 00

SUB CODE: PH NO REF SOV: 012 OTHER: 002

L 13809-63 EWP(q)/EWT(m)/BDS AFFTC/ASD JD

ACCESSION NR: AP3003878 S/0181/63/005/007/1833/1841

AUTHOR: Vitovskiy, N. A.; Konovalenko, B. M.; Mashovets, T. V.; Ryvkin, S. M.; Yaroshetskiy, I. D.

TITLE: Gamma-ray-generated defects in germanium

SOURCE: Fizika tverdogo tela, v. 5, no. 7, 1963, 1833-1841

TOPIC TAGS: gamma-ray semiconductor irradiation, radiation defect, monopolar annealing, bipolar annealing, germanium irradiation, germanium defect, germanium

ABSTRACT: In the latest stage of research on the subject, dating back to 1959, a large number of n- and p-type specimens was investigated. N-type germanium was doped with antimony and had a donor concentration between $2 \cdot 10^{12}$ to $8 \cdot 10^{15}$ cm^{-3}; p-type germanium was doped with gallium and had an acceptor concentration between 10^{12} to 10^{15} cm^{-3}. The source was Co^{60} at a dosage of $2 \cdot 10^{11}$ $kv/cm^2 \cdot sec$ and temperature of 10C. The work was aimed at clarifying the saturation of irradiated specimens which occurs after polarity reversal, whereby further exposure to radiation, however prolonged, no longer affects the slope of the thermal dependence of carrier concentration. The latter remains equal to the activation energy. While the saturation process is evident up to very high concentrations

Card 1/2

"APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001443520002-7"

L 13809-63

ACCESSION NR: AP3003878

of radiation defects, a substantially different situation is obtained in monopolar annealing of interstitial atoms, ultimately leading to a variety of limiting states of specimens exposed to gamma radiation. A bipolar annealing effect occurring during the irradiation process is considered responsible for the drop in the defect-formation rate with increased dosage of radiation. Both monopolar and bipolar annealing effects were found above room temperature. "The authors are indebted to S. R. Novikov for interesting discussions." Orig. art. has: 9 figures.

ASSOCIATION: Leningradskiy fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR (Leningrad Physicotechnical Institute, AN SSSR)

SUBMITTED: 31Jan63 DATE ACQ: 15Aug63 ENCL: 00

SUB CODE: PH NO REF SOV: 006 OTHER: 003

Card 2/2

L 14266-63 EWP(q)/EWT(m)/BDS AFFTC/ASD JD
ACCESSION NR: AP3003879 S/0181/63/005/007/1842/1851

61
56

AUTHOR: Konopleva, R. F.; Novikov, S. R.; Ryzhkin, S. M.

TITLE: Energy levels in Ge due to fast neutron bombardment

SOURCE: Fizika tverdogo tela, v. 5, no. 7, 1963, 1842-1851

TOPIC TAGS: fast-neutron irradiation, neutron irradiation, neutron bombardment, defect energy level, defect level, defect state

ABSTRACT: An experimentally obtained temperature dependence of the Hall constant was utilized in determining the defect-energy-level spectrum of n-type Ge with a concentration of Sb of 2×10^{15} cm^{-3}. Electrical conductivity and Hall effect were measured before and after irradiation by integrated fast-neutron fluxes varying from 4.7×10^{14} to 4.2×10^{16} fast neutrons/cm^2. The measurements were conducted in the 77—300K temperature range. The energies of the five levels found in the forbidden band of Ge and the initial and relative rates of formation of impurity centers determined from the experimental data are given in the Enclosure. Analysis of the data obtained shows that, in contradiction to the Lark-Horowitz model, there are three acceptor levels (the three lowest energy levels).

Card 1/3 2

The fact that the rate of formation and the rate of annealing of the three lower levels differ very little indicates that all three are probably vacancy levels.
"The authors express their gratitude to coworkers of the Physicotechnical Institute reactor crew, who made it possible to carry out the present work. The authors also thank N. A. Vitovskiy, B. M. Konovalenko, T. V. Mashovets, and I. D. Yaroshetskiy for valuable discussion." Orig. art. has: 10 formulas, 6 figures, and 1 table.

ASSOCIATION: Fiziko-tekhnicheskiy institut imeni A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute)

SUBMITTED: 01Feb63 DATE ACQ: 15Aug63 ENCL: 01

SUB CODE: PH NO REF SOV: 003 OTHER: 010

L 18718-63 EWP(q)/EWT(m)/BDS AFFTC/ASD JD

ACCESSION NR: AP3003910 S/0181/63/005/007/2023/2025

AUTHORS: Berkovskiy, F. M.; Ryvkin, S. M. 58 53

TITLE: Impurity photoelectromotive force induced by a current

SOURCE: Fizika tverdogo tela, v. 5, no. 7, 1963, 2023-2025

TOPIC TAGS: photoelectromotive force, impurity, induction, absorption band, radiation defect, recharge, electron, hole, injection

ABSTRACT: A new effect has been discovered at illuminated silicon photodiodes: after passage of a current pulse through the n-p junction in the permissive direction, the photodiodes prove to be sensitive in a new spectral region for the fundamental absorption band. This relationship is shown in Fig. 1 (see enclosure). The photoelectromotive force has the character of a flash, the amplitude and duration of which are determined by the intensity of current or light. Electrical recharging (of electron-hole pairs) is better than optical because the injection takes place at a distance from the n-p junction representing the layer in which the photoelectromotive force is generated and because nonequilibrium

Card 1/: 02

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

L 18718-63

ACCESSION NR: AP3003910

concentrations can be injected at higher values, the time for charging a sample thus being very small. In their work the authors used silicon photodiodes with radiation defects formed by gamma radiation from Co^{60}. Recharge of the levels of radiation defects consequently took place. It is clear that a similar effect must be observed in other materials with impurities corresponding to deep levels. Preliminary experiments have shown that the effect is observed also in Ge photodiodes that have been exposed to fast electrons. It is felt that the present need is for more detailed investigation on various materials. "The authors thank Ye. V. Ostroumova and R. S. Kasymova for their help in carrying out the experiments." Orig. art. has: 2 figures.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physical and Technical Institute, Academy of Sciences, SSSR)

SUBMITTED: 09Mar63 DATE ACQ: 15Aug63 ENCL: 01

SUB CODE: PH NO REF SOV: 005 OTHER: 001

Card 2/2

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

KONOVALENKO, B.M.; RYVKIN, S.M.; YAROSHETSKIY, I.D.

Radiation defects in germanium caused by fast 28 Mev. electrons. Fiz. tver. tela 5 no.8:2075-2086 Ag '63. (MIRA 16:9)

1. Fiziko-tekhnicheskiy institut im. A.F.Ioffe AN SSSR, Leningrad. (Germanium crystals--Defects) (Electrons)

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7

AFANAS'YEV, V.F.; PARITSKIY, L.G.; PRIKOT, N.F.; RYVKIN, S.M.

Effect of trapping levels on the lux-ampere characteristics in silicon. Fiz. tver. tela 5 no.11:3179-3182 N '63. (MIRA 16:12)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

ZIBUTS, Yu.A.; PARITSKIY, L.G.; RYVKIN, S.M.

Some properties of silicon with admixtures of mercury, tungsten, molybdenum, and platinum. Fiz. tver. tela 5 no.11:3301-3304 N '63. (MIRA 16:12)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.

VITOVSKIY, N.A.; MASHOVETS, T.V.; RYVKIN, S.M.; KHASEVAROV, R.Yu.

Change of the electric and photoelectric properties of gallium arsenide irradiated by 1 Mev. electrons. Fiz. tver. tela 5 no.12:3510-3523 D'63. (MIRA 17:2)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

IVANOV, Yu.L.; RYVKIN, S.M.

Photoelectret effect in silicon. Fiz. tver. tela 5 no.12:3541-3544 D '63. (MIRA 17:2)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

RYVKIN, S. M., doktor fiz.-matem. nauk

Semiconductor counters of nuclear particles. Vest. AN SSSR 33 no.1:56-58 Ja '63. (MIRA 16:1)

(Nuclear counters)

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

S/089/60/009/005/010/020
B006/B070

9.4300 (3203, 1043, 1143)
26.2532

AUTHORS: Konovalenko, B. M., Ryvkin, S. M., Yaroshetskiy, I. D., Bogomazov, L. P.

TITLE: An Apparatus for Studying the Effect of Gamma Radiation on Semiconductor Materials

PERIODICAL: Atomnaya energiya, 1960, Vol. 9, No. 5, pp. 408 - 409

TEXT: In the present "Letter to the Editor", a cobalt apparatus for the study of the effect of gamma radiation on the electrical properties of semiconductors is described. The apparatus was developed in 1958 by the Fiziko-tekhnicheskiy institut AN SSSR (Institute of Physics and Technology of the AS USSR). The principal use of the apparatus is in the production of defects that are constant in time. To obtain enough defects, fluxes of 10^{11} $cm^{-2}sec^{-1}$ are required. Fig.1 gives a schematic representation of the apparatus; Fig.2 shows the experimental chamber. Both are described in detail. The dose rate was measured at different points of the chamber, and some of the results are given in a Table. The highest dose rate of 128 r/sec was found at the center of

An Apparatus for Studying the Effect of Gamma Radiation on Semiconductor Materials

S/089/60/009/005/010/020
B006/B070

the chamber floor; 10 mm above the floor it was only 72 r/sec; 20 mm above, 43 r/sec, and 40 mm above, 22 r/sec (all values refer to the center of the chamber). There were no disturbances during the experiment, the work was satisfactory in all respects. L. V. Maslova is thanked for help in measuring the field of gamma radiation. There are 2 figures, 1 table, and 2 Soviet references.

SUBMITTED: April 6, 1960

Fig.1

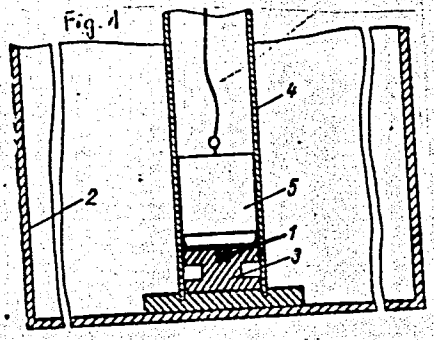

Fig.1

Legend to Fig.1: Scheme of the apparatus: 1 - Co^{60} standard source; activity: 400 g-equ.Ra; 2 - iron tank, 2.9 m high, filled completely with water. Base: 2.5 × 0.6 m^2; wall thickness: 5 mm; 4 - copper tube 125 mm wide on the inside; 5 - chamber with the sample.

Fig-2

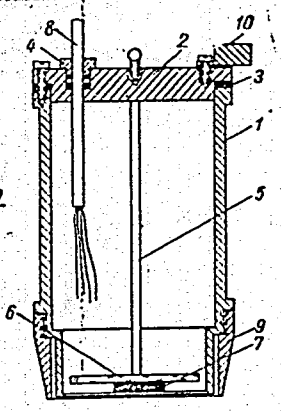

Fig. 2

Legend to Fig.2:
Scheme of the sample chamber. 1 - measuring vessel; 2 - cover; 3 - rubber ring; 4 - hermetically closable opening through which a cable (8) is introduced for the measurement of the electrical parameters of the irradiated samples; 5 - two supports; 6 - holder for the sample (7) made of asbestos cement; 9 - conical insert; 10 - guide box.

RYVKIN, S. M.

"Impurity Photoconductivity Kinetics,"

report to be submitted for the Intl. Conference on Photoconductivity, IUPAP, Cornell University, Ithaca, N. Y., 21-24 Aug 1961.

Leningrad Physico-Tech. Inst.

S/120/61/000/002/012/042
E210/E594

9.6150 (and 2705)
24.6810

AUTHORS: Vitovskiy, N. A., Maleyev, P. I., Matveyev, O.A., Ryvkin, S.M. and Tarkhin, D. V.

TITLE: Silicon N-P Counters of Heavy Charged Particles Operating Without an External Power Supply

PERIODICAL: Pribory i tekhnika eksperimenta, 1961, No.2, pp.82-83

TEXT: Fused silicon diodes having an n-p junction area of about 1 mm^2 have been studied in order to determine their counting properties when operated as short-circuited rectifiers. The saturation current in the counters studied was not over 0.1 μA; the leakage resistance was several megohms. Under such conditions, short-circuit current rectification can be realized by using a 250 kilohm load. In counters irradiated with α-particles under the above conditions and tested at room temperature, pulse amplitudes reached 2-3 mV with practically no noise. This performance equals that of counters operating as photodiodes, but the noise in the latter case increases rapidly with increasing cut-off voltage. In both cases (operating as rectifiers or photodiodes) pulse rise time varies from 1 to 5 μsec. The decay time is determined by the R-C of the circuit. This is shown in the oscillograms, Fig.1. In

Silicon N-P Counters of ...

S/120/61/000/002/012/042
E210/E594

Fig.1a the duration of the markers is 1 μsec. Fig.1б - leading edge of the pulse; marker duration 0.2 μsec. Trigger delay 0.5 μsec. With decreasing temperature the pulse amplitude and duration remain unchanged. Silicon n-p counters are regarded as highly promising since even at room temperature they can operate as photovoltaic cells without an external power supply.
Comments made during the proof-reading: The here described counters show considerable variance in the amplitudes of the pulses during the counting of monochromatic particles, i.e. they are not suitable for spectrometry. At present, the laboratory of the authors manufactures surface-barrier silicon counters which are suitable for spectrometry (amplitude resolution less than 1% for α-particles with energies of 5.5 MeV). The considerations presented in the paper are in principle applicable also for such spectrometric n-p counters. There are 1 figure and 3 Soviet references.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN SSSR (Physico-technical Institute AS USSR)

SUBMITTED: February 20, 1960

Card ~~2/3~~ 2/2

BERKOVSKIY, F.M.; RYVKIN, S.M.; STROKAN, N.B.

Influence of adhesion levels on the relaxation of current through the p—n junction. Fiz. tver. tela 3 no.1:230-235 Ja '61. (MIRA 14:3)

1. Leningradskiy fiziko-tekhnicheskiy institut AN SSSR imeni akad. A.F.Ioffe.

(Transistors)

S/181/61/003/001/036/042
B102/B204

9.4160 (1137, 1395)
9.4177

AUTHORS: Ryvkin, S. M., Paritskiy, L. G., Khansevarov, R. Yu., and Yaroshetskiy, I. D.

TITLE: Investigation of the kinetics of impurity photoconductivity for the purpose of determining the parameters of local levels

PERIODICAL: Fizika tverdogo tela, v. 3, no. 1, 1961, 252-266

TEXT: An investigation of impurity photoconductivity is not only of interest in principle, but is also of practical importance for studying the local electron states in the forbidden band and especially of its interaction with exciting radiation. Apart from an earlier paper by the authors, relaxation processes of impurity photoconductivity have hitherto not been investigated in detail; this was, however, the aim of the present voluminous paper. The authors set themselves the task of investigating theoretically the most important cases of photocurrent relaxation during excitation in the impurity region. The rules governing the kinetics of impurity photoconductivity have certain peculiar features as is shown

Investigation of the kinetics of...

here, due to which impurity photoconductivity relaxation differs essentially from that of intrinsic photoconductivity. An exact analysis of these rules shows that an experimental investigation of the kinetics of impurity photoconductivity may serve the purpose of determining various parameters of impurity centers as, e.g., the photon capture cross section, the trapping cross section for free carriers, as well as the energy position of the impurity level in the forbidden band, the concentration of centers and the degree of their completion. In part 1 of this paper, the most important rules of the kinetics of impurity photoconductivity in the excitation of carriers for one type of local centers are dealt with. This is done on the basis of an example of a semiconductor, in whose forbidden band there is a sort of local level with concentration M; these levels are assumed to be in the upper half of the band, so that they are in heat exchange with the conduction band. This semiconductor is irradiated with monochromatic light of such a wavelength that only electrons pass from the local levels onto the conduction band, and that monopolar impurity photoconductivity occurs. The equation of motion (13) $d\Delta n/dt = (m_o - \Delta n)qJ - \gamma \Delta n(N_{cM}+M-m_o+n_o+\Delta n)$

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Investigation of the kinetics of...

is set up, where q is the capture cross section of an electron on the M-level for a photon; $m = m_0 - \Delta m$ is the electron concentration on the level M; γ is the recombination coefficient; J is the light intensity; $n = n_0 + \Delta n$ is the electron concentration in the conduction band; n_0 is the dark concentration of the electrons; N_{cM} is the effective state density in the conduction band; and $\Delta m = \Delta n$. The solution in the case of excitation by square light pulses is, for the case of growth (switching on of light), given by

$$\Delta n_{\text{св.}} = A \operatorname{th}(\gamma A t + B) - C, \qquad (1.6)$$

где

$$A = \sqrt{C^2 + m_0 \frac{qJ}{\gamma}}; \quad B = \frac{1}{2} \ln\left(1 + \frac{2C}{\Delta n_{\text{св.}}}\right);$$

$$C = \frac{1}{2}\left(N_{cM} + M - m_0 + n_0 + \frac{qJ}{\gamma}\right),$$

and for switching off

Investigation of the kinetics of...

different conditions and for different special cases, and expressions are derived for the relaxation times. The dependence of relaxation times on light intensity is investigated, and explicit formulas are derived, for q. In part 2 of this paper, the effect of a constant exposure in the impurity region upon the kinetics of impurity photoconductivity is investigated. (1.3) acquires the form

$$\frac{d\Delta n}{dt} = (m_0 - n_{J_0}) q\Delta J - \gamma\Delta n \times$$
$$\times \left(N_{eff} + M - m_0 + n_0 + 2n_{J_0} + \Delta n + \frac{qJ_0}{\gamma} + \frac{q\Delta J}{\gamma}\right). \quad (2.1)$$

where J_0 is the intensity of constant exposure, ΔJ the amplitude of the square light pulse, and n_{J_0} the steady carrier concentration in the conduction band. The solutions (growth, drop, steady) have the form

$\Delta n_H = \Delta n_{st}\left[1-\exp(-t/\tau_H)\right]$; $\Delta n_c = \Delta n_{st}\exp(-t/\tau_c)$; and

Investigation of the kinetics of...

where β is the quantum yield of the intrinsic effect, k the absorption coefficient in the intrinsic region, whose solution for switching in long-wave light is given by

$$\Delta n = \frac{qm_0\Delta f\left(\frac{1}{\tau_N'} + q\Delta f + r_1\right)\left(\frac{1}{\tau_N} + q\Delta f + r_2\right)}{\frac{1}{\tau_M}\left(\frac{1}{\tau_N} + q\Delta f\right)(r_1 - r_2)}\left[\exp(r_1 t) - \exp(r_2 t)\right], \qquad (3.9)$$

где

$$r_{1,2} = -\frac{1}{2}\left(\frac{1}{\tau} + \frac{1}{\tau_N} + \frac{1}{\tau_M} + q\Delta f\right) \pm$$

$$\pm\sqrt{\frac{1}{4}\left(\frac{1}{\tau} + \frac{1}{\tau_N} + \frac{1}{\tau_M} + q\Delta f\right)^2 - \left(\frac{1}{\tau_N'} + \frac{q\Delta f}{\tau_M}\right)}.$$

and for switching off long-wave light by

Card 7/8

VITOVSKIY, N.A.; MASHOVETS, T.V.; RYVKIN, S.M.; SONDAYEVSKIY, V.P.

Energy spectrum of defects arising in Ge under the effect of gamma radiation. Fiz. tver. tela 3 no. 3:998-1001 Mr '61. (MIRA 14:5)

(Crystals—Defects) (Germanium) (Gamma rays)

S/181/61/003/004/030/030
B102/B209

24,7700 (1035, 1143, 1469)

AUTHORS: Dobrego, V. P., Rogachev, A. A., Ryvkin, S. M., and Yaroshetskiy, I. D.

TITLE: Low-temperature breakdown in germanium in connection with radiative defects

PERIODICAL: Fizika tverdogo tela, v. 3, no. 4, 1961, 1298-1300

TEXT: In germanium doped with elements of the third or fifth group, the current may suddenly rise at helium temperatures when the field applied exceeds a certain critical value. This effect is known as low-temperature breakdown. The following is the mechanism of this effect: At these temperatures, the majority of carriers causing impurity conduction is localized at impurity centers, and resistivity is high. When a field is applied, the free carriers are accelerated and, at a certain field strength, their energy is high enough to cause impact ionization of the filled impurity centers. The low-temperature breakdown in Ge or Si due to donor or acceptor impurities has been investigated repeatedly. The present paper is a report on studies of this effect which is caused by radiative defects; such defects have been

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22064
S/181/61/003/004/030/030
B102/B209

Low-temperature ...

produced by irradiating the semiconductor with gamma quanta or fast neutrons. First, the energy levels of the radiative defects are discussed; Fig. 1 shows the level scheme for gamma-irradiated (a) and fast-neutron irradiated (b) germanium. The two shallow levels of the radiative defects are only 0.02 and 0.01 ev, respectively, off the valency band; at helium temperatures, they are occupied by electrons only partly or not at all. In neutron-irradiated Ge specimens, the 0.01-ev level was found to be free from electrons at helium temperatures. In chemically impure specimens, the presence of donor centers offered a certain compensation, and the level was partly occupied by electrons. Volt-ampere characteristics of such specimens were taken by means of a "characteriograph." They were analogous to those obtained by B. Vul, E. Zavaritskaya, and V. Chuyenkov for the low-temperature breakdown due to impurity centers. Altogether, three specimens were examined: gamma-irradiated 1-γ had a concentration of shallow radiation levels of $N_a = 7.10^{13}cm^{-3}$ and a hole concentration on them of $p_a = 1.10^{13}cm^{-3}$; 1-n and 2-n were n-type specimens having a resistivity of 2 ohm·cm; after neutron irradiation they were p-type. n-type and p-type specimens having a resistivity of 3 and 12 ohm·cm, respectively, were measured for comparison. The

Low-temperature ...

values of the critical field strength (1) and of the breakdown field strength (2) for these two specimens are listed in columns (3) and (4) of the table. The authors thank T. V.Mashovets and N. A. Vitovskiy for having prepared the gamma-irradiated specimens, as well as S. R. Novikov and R. F. Konoplevaya for the neutron-irradiated specimens. There are 2 figures, 1 table, and 11 references: 5 Soviet-bloc and 6 non-Soviet-bloc. The most recent reference to an English-language publication reads as follows: McWhorter, R. Rediker, Proc. IRE, 47, 1207, 1959.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. akad. A. F. Ioffe AN SSSR Leningrad (Institute of Physics and Technology imeni Academician A. F. Ioffe AS USSR Leningrad)

SUBMITTED: December 20, 1960

	1-г	1-в	2-в	контрольный, n-типа (3)	контрольный, p-типа (4)
③ $E_{кр.}$, в/см	14	110	12	9.5	7.5
② $E_{а}$, в/см	44	110	15	10.2	9

Card 3/4

S/181/61/003/004/030/030
B102/B209

Low-temperature ...

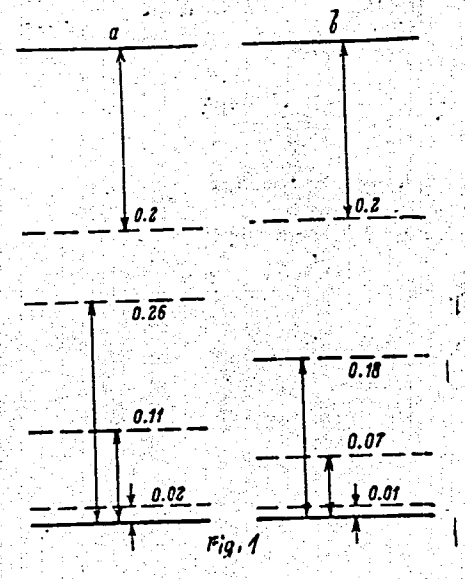

Fig. 1

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S/181/61/003/005/039/042
B111/B202

9,4160

AUTHORS: Paritskiy, L. G., Rogachev, A. A., and Ryvkin, S. M.

TITLE: Kinetics of photocells with an "external" photoelectric effect from a metal into a semiconductor

PERIODICAL: Fizika tverdogo tela, v. 3, no. 5, 1961, 1613-1616

TEXT: The paper by R. Williams and R. Bube (Appl. Phys., 36, No. 6, 1960) gives a series of proofs for the existence of an "external" photoelectric effect taking place from a metal into a semiconductor in photocells consisting of a Cu-coated low-resistance CdS crystal. Earlier measurements made by the author showed a low inertia in such photocells. The studies of the kinetics of the photocells are similar to those of photocells with n-p junctions which were dealt with in Ref. 3 (S. M. Ryvkin, ZhTF, XXVII,8, 1676, 1957) and Ref. 4 (S. M. Ryvkin, N. B. Strokan, L. L. Makovskiy, ZhTF, XXVIII, 9, 1958) for, actually, a metal connected with an n-type semiconductor replaces a p-type semiconductor. In this case those electrons which have absorbed a photon and whose energy exceeds the barrier height play the part of the unbalanced minority carriers in the metal. On the same

conditions as in Ref. 3 a value of $\sim 10^{-12}$ sec was obtained for the time in which a photoelectron passes the region of space charge. In the following, the authors demonstrate that the relaxation time of a photocell τ_j depends on the charging resistance in the following way: with $R_H \gg R_{BH}$ (R_H = charging resistance, R_{BH} = external differential resistance of a photocell) τ_j is independent of R_H and equal to $R_{BH}C$ (C = capacitance between the layer of space charge and support); with small R_H and if $R_T \ll R_{BH}$ (R_T = resistance of the semiconductor) τ_j depends linearly on R_H. Photocells Cu - CdS with a resistivity CdS being ≈ 1 ohm.cm were measured. The Cu-layer was electrolytically applied from a Cu_2SO_4 solution by N. F. Prikot, student of the LGU (Leningrad State University). τ_j was measured by the method of phase compensation of light which was sinusoidally modulated by a frequency of 1 Mc. 240 and 260 were obtained for the capacitance of the space charge. The capacitance of the support was 60 pf. 1 kohm and 440

Kinetics of ...

ohms were obtained for for R_{BH}. Photocells of this type can be used as photosensitive receivers with low inertia for the red and infrared range of the spectrum; also the range of sensitivity can be varied according to the metal and the semiconductor employed. The authors thank F. M. Berkovskiy for measuring the time constants. There are 2 figures and 5 references: 4 Soviet-bloc and 1 non-Soviet-bloc.

ASSOCIATION: Fiziko-tekhnicheskiy institut imeni A. F. Ioffe AN SSSR Leningrad (Institute of Physics and Technology imeni A. F. Ioffe AS USSR Leningrad)

SUBMITTED: November 26, 1960

Card 3/3

27276

94.7700 (1035, 1138)
26.1512

S/181/61/003/008/006/034
B102/B201

AUTHORS: Paritskiy, L. G. and Ryvkin, S. M.

TITLE: Study of "nonlinear" processes of relaxation of photoconductivity in the presence of adhesion levels

PERIODICAL: Fizika tverdogo tela, v. 3, no. 8, 1961, 2245 - 2258

TEXT: The investigations described here in great detail were conducted for the purpose of calculating the relaxation of monopolar photoconductivity with any ("nonlinear") filling of adhesion levels. The relaxation curves are shown in this case to display characteristic sections or points, by which the level parameters can be calculated. Earlier already, Ryvkin had studied the effect of carrier trapping by adhesion levels upon the relaxation of monopolar photoconductivity in the "linear" case (adhesion levels are little filled during the relaxation process, and the carrier lifetime is constant). By way of experiments, the authors have discovered an intense α-adhesion on the relaxation curves of CdS single crystals (FTT, II, 3, 1960). The study is here continued by first observing theoretically the kinetics of monopolar photoconductivity at any degree of excitation (considerable

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Study of "nonlinear" processes of...

filling of adhesion levels). The effect of a high filling degree of adhesion levels upon the existence of a nonlinearly ascending section in the photoconductivity curve is examined in Chapter 1 of the present paper on the basis of the band scheme (Fig. 1). The forbidden band contains the recombination centers S, to which the fact is to be ascribed that the electron lifetime τ_n in the conduction band is large compared with the hole lifetime τ_p in the valence band, so that photoconduction is purely n-type. In addition, the forbidden band includes adhesion levels of concentration M; multiple adhesion on them should be possible. The photoelectron concentration (n) in the conduction band grows in the initial stage of relaxation ($t \ll \tau_n$) following the law

$$n = \beta k J 0^2 \gamma M \left(1 - e^{-\frac{t}{\theta}}\right) + \frac{1}{2}\beta k J (\tau_n - t)\left[\pm\sqrt{1 + \frac{4N_{eff}t}{\beta k J (\tau_n - t)}} - 1\right]; \quad (9)$$

Card 2/B5

Study of "nonlinear" processes of...

where β denotes the quantum yield of the inner photoelectric effect, k is the light absorption coefficient, J is the light intensity, γ is the trapping factor of electrons from the c-band onto the M levels, $\theta = 1/\gamma(M+N_{cM})$, $N_{cM} = N_c \exp(-\Delta E_M/kT)$, N_c is the effective state density in the c-band, ΔE_M the energy of M levels, calculated from the bottom of the conduction band; $\theta \ll (M+N_{cM})/\beta kJ$. Fig. 2 shows n(t) in case of "nonlinear" filling of the adhesion levels. The greater the light intensity, the smoother will be the course of the n(t) curves, i. e., the larger the first linear sections, the farther they will be shifted to the right. Chapter 2 deals with the effect of adhesion levels upon the general character of the relaxation curves of photoconductivity. This is done for the case of τ_n = const and in the presence of an intense multiple adhesion. An S-shaped ascent of photoconductivity can be observed in this case. An experimental study was made of the photoconductivity curves on CdS single crystals that were strongly alloyed with silver; the experimental arrangement shown in Fig. 6 was used for the purpose. Square light pulses were used (front 2 sec) that were produced by means of a disk M rotating

Study of "nonlinear" processes of...

in the pre-vacuum chamber. The experimental curves showed a good agreement with theory. A method for the optical longwave sounding of local levels is discussed in chapter 4. The method is essentially based on what follows: the intensity of carrier generation, g, can be determined from the initial inclination of the curve of the growth of impurity conductivity, and is proportional to the concentration of carriers occupying a given level: $g = mqJ$; m is the carrier concentration on a given level, q the photon capture cross section, and J the intensity of the longwave light. Since qJ is easily determinable, the m can be determined from the measurement of g. If a semiconductor is irradiated with a longwave light pulse having a shorter duration than the time of growth of impurity photoconductivity, $m = c\Delta i_\phi$, will be valid, where i_ϕ is the amplitude value of the photocurrent pulse induced by the light pulse and c is an experimental constant which, inter alia, depends on the form of the light pulse. For the case of a linear filling of adhesion levels, Fig. 12 presents the curves of the optical sounding of adhesion levels during the relaxation of photoconductivity. Oscillograms obtained experimentally are in agreement with them. By optical sounding, n, m, dn/dt, and dm/dt can be determined at any instant. In case of nonlinear relaxation processes, determinations are made

Study of "nonlinear" processes of...

analogously. Yu. A. Zibuts and A. A. Purtskhvanidze are thanked for their assistance. M. I. Boyko and V. Ye. Lashkarev are mentioned. There are 13 figures and 17 references: 9 Soviet-bloc and 8 non-Soviet-bloc.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR Leningrad (Institute of Physics and Technology imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: February 4, 1961

Fig. 1: Scheme of electron transition

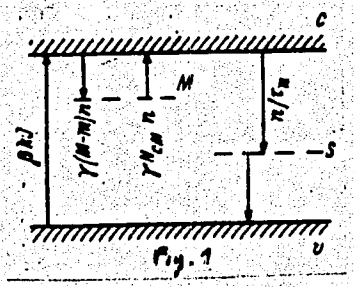

Fig. 1

27295

S/181/61/003/008/025/034
B109/B202

9.4177
26.2420

AUTHORS: Arkad'yeva, Ye. N., Kasymova, R. S., Ryvkin, S. M.

TITLE: Kinetics of the induced defect photoconductivity in telluric cadmium

PERIODICAL: Fizika tverdogo tela, v. 3, no. 8, 1961, 2417-2426

TEXT: The authors describe the energy band schemes and the determination of its various energy levels for monocrystalline CdTe. The effect of induced defect photoconductivity occurs according to the energy band scheme shown in Fig. 7. Upon illumination by infrared light the electrons on M are promoted to the conduction band c from which they either 1) return to M or 2) go to S (n-type). Case 2) plays an important part when the infrared light is switched on. In the course of time its effect is, however, weakened (the photocurrent decreases). If the hole concentration in M increases and in S decreases to such a degree that case 1) becomes more probable than case 2), then the photocurrent does no longer decrease and the quasisteady state is attained. The exact positions of the individual levels of the energy band schemes are determined by measuring the properties of the

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APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

Kinetics of the induced defect ...

conductivity of n- and p-type CdTe in this special state. The measurements are made according to Ye. N. Arkad'yeva, L. G. Paritskiy, S. M. Ryvkin (Ref. 1: FTT, II, 6, 1161, 1960) and S. M. Ryvkin, L. G. Paritskiy, R. Yu. Khansevarov, I. D. Yaroshetskiy (Ref. 3: FTT, III, 252, 1961) via the photon capture cross section q of the level M. The Fermi level is measured by determining the temperature dependence of the logarithm of the specimen conductivity which is practically a straight line. It follows from the slope of this straight line that the p-type has approximately 0.33 ev from below, and the n-type approximately 0.38 ev from above. To determine the energy level which is the principal cause of induced photoconductivity, the authors measure the spectral behavior of induced defect photoconductivity (maxima for p- and n-type approximately 1.8 μ red boundary for p-type approximately 4.3 μ, for n-type approximately 3.5 μ) as well as the dependence of the increase- and decrease-time constants on induced defect photoconductivity. From these values the quantity q is determined according to Ref. 3. Thus, the values 0.30 ev are obtained for the p-type from below, and 0.33 ev for the n-type from above. The complete energy band scheme is shown in Fig. 7 (a S,s donor level, n-type; 6 S,s acceptor level, p-type). There are 8 figures, 1 table, and 5 references: 3 Soviet

Card 2/3

Kinetics of the induced defect ...

and 2 non-Soviet.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR Leningrad (Institute of Physics and Technology imeni A. F. Ioffe AS USSR Leningrad)

SUBMITTED: February 11, 1961 (initially), March 24, 1961 (after revision)

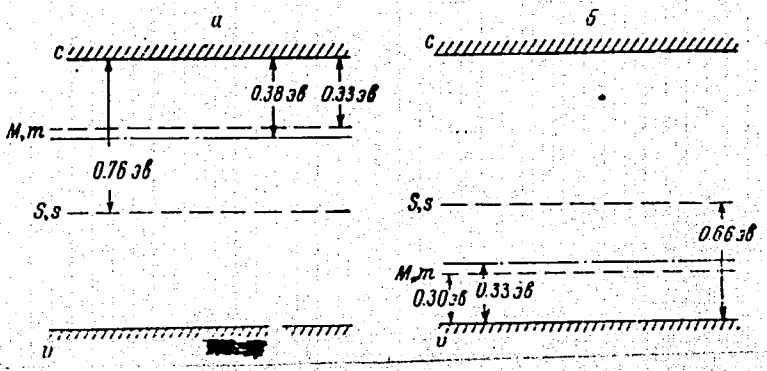

Fig. 7

Card 3/3

27298

S/181/61/003/008/028/034
B109/B202

9,4178

AUTHORS: Grinberg, A. A., Ryvkin, S. M.

TITLE: Unipolar nonsteady photomagnetic effect

PERIODICAL: Fizika tverdogo tela, v. 3, no. 8, 1961, 2470-2474

TEXT: While under steady conditions the ordinary photomagnetic effect (Kikoin-Noskov) occurs only in the case of bipolar photoconductivity of a semiconductor, a photomagnetic effect (PME) may occur also in a unipolar semiconductor under nonsteady conditions. At the moment of illumination a diffusion current of unbalanced charge carriers is formed because the charges do not have sufficient time to form a counterfield. The noncompensated diffusion current of the unbalanced charge carriers is deflected in the magnetic field thus causing the PME voltage. After the illumination is switched off a voltage of reverse polarity occurs (Fig. 1) due to "suction" of the volume charges. Quantitative estimation: The authors proceed from the formula

Card 1/4

Unipolar onsteady photomagnetic effect

$$\mathbf{j}=\varphi\left\{\mathbf{j}^*-\frac{\tilde{\mu}H}{c}[\mathbf{j}^*\mathbf{k}]\right\}+(1-\varphi)(\mathbf{j}^*\mathbf{k})\mathbf{k},$$

где $\mathbf{j}^*=e\mu n_0\mathbf{E}+eD\,\mathrm{grad}\,\Delta n$; $\varphi=\sqrt{\frac{e}{m^*\mu}\left(\frac{\tau_p}{1+\left(\frac{e\tau_p}{m^*c}H\right)^2}\right)}$; τ_p — время релакса- (1)

given by A. A. Grinberg (Ref. 1: FTT, II, 836, 1960) (τ_p relaxation time, μ electron mobility, $\tilde{\mu}$ Hall mobility of the electrons, the other denotations are the same as in Ref. 1). Under ordinary conditions, this formula is sufficiently accurate. The following relation is obtained for the electric field

$$E_x=\frac{\tilde{\mu}H}{c}\frac{4\pi eD}{\varepsilon L}\Delta n_{cT}\tau\frac{\left\{\left[\left(\frac{1}{\tau}-\frac{1}{\tau_2}\right)t-1\right]e^{-\frac{t}{\tau_0}}+e^{-\frac{t}{\tau}}\right\}}{\left(1-\frac{\tau}{\tau_0}\right)^2} \qquad (6)$$

where Δn_{cT} is the concentration of the unbalanced carriers in the neutral part of the illumination range of the specimen with $t\longrightarrow\infty$, $N_{cM}=N_c\exp(-\Delta E_M/kT)$, where N_c is the effective density of the states of

Unipolar nonsteady photomagnetic effect

the conduction band, M the total concentration of the defects, and m_o the concentration of the defects which, in the case of thermal equilibrium, is occupied by electrons, q photon capture cross section in a defect. Fig. 3 shows the relaxation effect of E_x for two ratios $\tau/\tau\sigma$.

$$E_x^{(max)} \simeq \frac{\beta H}{c} \frac{4\pi eD}{\varepsilon L_y} \Delta n_{cr.} \frac{\tau_\sigma^2}{\tau}. \qquad (9)$$

holds for the maximum value. The short-circuit current is

$$I_{s.s.} = -\frac{\beta H}{c} eDL_z \frac{e^{-\frac{t}{\tau_\sigma}} - e^{-\frac{t}{\tau}}}{\left(1-\frac{\tau}{\tau_\sigma}\right)} \Delta n_{cr.}, \qquad (10),$$

the maximum short-circuit current amounts to

$$I_{s.s.}^{(max)} = eD \frac{\beta H}{c} L_z \Delta n_{cr.} \left[\frac{\tau}{\tau_\sigma}\right]^{\left(\frac{\tau}{\tau_\sigma - \tau}\right)}. \qquad (11).$$

The ratio (10) : (11) indicates that the nonsteady unipolar PME is strongly

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Unipolar nonsteady photomagnetic effect

marked in poorly conductive materials. Thus, with the following values $L_z = 1$cm, $L_x = L_y = 0.1$ cm, $\varepsilon = 16$, $\mu H/c \simeq 1$, $\Delta n \simeq n_o$, $I_o m_o q \simeq 10^{15}$ 1/sec·cm^3, $4 \cdot 10^{-10}$ a is obtained for the maximum short-circuit current. With a mobility of $\mu \simeq 10^3$ cm^2/v sec the interval resistance $R_i = 10^7$ ohm. Thus voltage of 10^{-3} v is formed at a load resistance $R \simeq 0.3\ R_i$. The authors thank L. E. Gurevich for valuable help. There are 3 figures and 1 Soviet reference.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AH CCCP, Leningrad (Institute of Physics and Technology imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: March 18, 1961 (initially), April 5, 1961 (after revision)

29702
S/181/61/003/010/032/036
B125/B102

26,2421

AUTHORS: Ryvkin, S. M., Khansevarov, R. Yu., and Yaroshetskiy, I. D.

TITLE: Impurity photoconductivity with gamma-irradiated germanium

PERIODICAL: Fizika tverdogo tela, v. 3, no. 10, 1961, 3211 - 3219

TEXT: Gamma irradiation of n-type germanium gives rise to an appreciable impurity photoconductivity which exceeds that in nonirradiated germanium by some orders of magnitude. It was examined in n-type germanium specimens (ϱ = 20 - 30 ohm·cm) irradiated with Co^{60} γ-quanta. Since irradiation took place at $\sim 10^{\circ}C$, the radiation defects were stable at room temperature. The experimental setup is shown in Fig. 1. The specimen was placed in a cryostat with KBr-window. All measurements were made at $\sim 100^{\circ}K$. Parasitic light was eliminated by a set of filters. The gamma-induced defects in n-type Ge form four levels in the forbidden band which are 0.02, 0.11 and 0.26 ev above the edge of the valence band and 0.2 ev below the bottom of the conduction band. The Fermi level was considerably above the level at 0.2 ev throughout the temperature range involved. The typical dependence of this photoconductivity on the energy

Impurity photoconductivity...

of incident quanta is presented in Fig. 3. The relaxation of unipolar impurity photoconductivity was also examined. In these experiments, the light frequency was chosen such that electron transitions occurred only from the 0.2-ev level. Growth and decay curves of photoconductivity, when, respectively, switching the light on and off, are "asymmetric" and do not obey the exponential law. The experimental results may be explained by calculations of S. M. Ryvkin et al. (FTT, III, no. 1, 1961). Quenching was observed in all n-type specimens when irradiating simultaneously by light corresponding to the self-absorption band and the impurity band. Fig. 5 presents typical curves of quenching spectra. The complicated character, the great variety of relaxation curves, and of spectral properties of quenching are due to the superposition of two concurring processes, namely, of quenching and of the impurity photoelectric effect. The shape of the spectral distribution curve, while depending on the ratio between the two light intensities depends on the experimental conditions and is not characteristic of the examined material. Conclusions: The radiation defects forming as a result of gamma irradiation of germanium gives rise to an impurity photoconductivity reaching as far as 6 microns. The position of the two independent radiation defect levels agrees with results

earlier found from the measurement of the Hall constant and from the kinetics of intrinsic photoconduction. Quenching resulting from the combined action of light corresponding to the self-absorption and impurity bands results in the trapping of minority carriers. There are 7 figures, 1 table, and 16 references: 8 Soviet and 8 non-Soviet. The three most recent references to English-language publications read as follows:
R. Newman, W. W. Tyler, Sol. State Phys. Acad. Press., 8, 1959;
Z. Johnson a. H. Levinstein. Phys. Rev., 117, no. 5, 1191, 1960;
R. Newman, H. H. Woodbury a. W. W. Tyler. Phys. Rev., 102, 613, 1956.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR
Leningrad (Physicotechnical Institute imeni A. F. Ioffe
AS USSR, Leningrad)

SUBMITTED: March 6, 1961 (initially),
June 13, 1961 (after revision)

Card 3/6 3

30800
S/181/61/003/011/047/056
B104/B138

9.4340 (1143, 1150)

AUTHORS: Berkovskiy, F. M., Ryvkin, S. M., and Strokan, N. B.

TITLE: Effect of adhesion levels on current relaxation in instruments with n-p junctions

PERIODICAL: Fizika tverdogo tela, v. 3, no. 11, 1961, 3535-3537

TEXT: Using the results of another work (FTT, 3, 1, 230, 1961) the authors study the effect of α- and β adhesions on the relaxation of a current flowing in a junction with a thin base. This case corresponds to real conditions, and is treated by the example of a photo-diode. Only in the case of α-adhesions and $t_o \gg \theta$ is If, the relaxation of the photo-current, retarded by $(1 + M/P_{vm})$. $t_o = w^2/2D$, where w is the thickness of the base and D the diffusion coefficient; $\theta = 1/\gamma(P_{vm} + M)$. For any marked retardation the concentration of adhesion levels M must satisfy the conditions $M \gg P_{vm}$; $t_o \gg 1/\gamma(M + P_{vm})$, i. e., $t_o \geq 1/\gamma M$. On the basis of published data an estimate for germanium and silicon gives

Card 1/2

VITOVSKIY, N.A.; MALEYEV, P.I.; MATVEYEV, O.A.; RYVKIN, S.M.; TARKHIN, D.V.

Silicon n-p counters of heavy charged particles operating without sources of power supply. Prib. i tekh. eksp. 6 no.2:82-83 Mr-Ap '61 (MIRA 14:9)

1. Fiziko-tekhnicheskiy institut AN SSSR.
(Nuclear counters)

27401
S/089/61/011/003/002/013
B102/B138

21.6000

AUTHORS: Ryvkin, S. M., Maslova, L. V., Matveyev, O. A., Strokan, N. B., Tarkhin, D. V.

TITLE: Silicon counters in nuclear spectrometry

PERIODICAL: Atomnaya energiya, v. 11, no. 3, 1961, 217 - 220

TEXT: Silicon counters were developed at the Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN USSR (Physicotechnical Institute imeni A. F. Ioffe AS USSR) in 1960. The counters were small (active area: 2·2, 5·5, and 10·10 mm^2). Their pulse height was $\sim$ 1 mv/Mev, and resolution less than 1% for E_α = 5.5 Mev. They were produced by sputtering gold to n-type silicon and diffusing phosphorus into the p-type silicon. The following characteristics were investigated: (1) Volt-ampere characteristics. They were the usual shape for p-n junctions. Reverse current was 0.5 - 0.05 μa (at 40 v) for the small-sized counters, and increased proportionally with area; breakdown voltage was between 50 and 60 v. (2) Capacitance-barrier voltage dependence. The capacitance of the sensitive layer (the volume-charge domain) was in accordance with the usual capacitor formula $d = \varepsilon_0 S/4\pi C$

(S - area, ε_0 - dielectric constant); since the thickness d of the sensitive layer is proportional to $\sqrt{V+V_0}$, the capacitance decreases as $(V+V_0)^{-1/2}$ with increasing voltage. (3) Pulse height-voltage dependence. Pulse height was determined by $Q = eN$ (N - number of pairs formed in ionization); the mean pair formation energy, ε, was measured for Pu^{238} alpha particles ($Q = 2.5 \cdot 10^{-13}$ k): $\varepsilon = 3.53 \pm 0.15$ ev; this value agrees with that found in Ref. 4 (see below). (4) Pulse height-energy dependence. Pulse height ϕ as a function of voltage V was measured for the alpha energy groups 8.78 and 6.05 Mev. For the short-range group, pulse height reached saturation at $\sim$ 15 v, for the long-range group at $\sim$ 35 v. $\phi(E_\alpha)$ was found to be a straight line. It is predicted that at V = 60 v linearity will also be maintained for alpha particles of up to 10 Mev or for any other particles with ranges of up to 60μ. (5) Amplitude resolution. This was determined on a 100-channel analyzer using Pu^{238} alpha emission. After correction for noise background, resolution was found to be 27 kev or 0.5% for the small counter, 1% for the medium, and 10% for the large one. The spread is attributed to inhomogeneities of the silicon. In the OIYaI at

Silicon counter in nuclear ...

Dubna the 10·10-mm^2 counter has been used for U^{233}-fission-fragment recording with high alpha background; G. N. Flerov, Corresponding Member of the AS USSR, has submitted a spectrum recorded with this counter to the authors of the present article. These junction counters may be used not only for recording of α-particles and fission fragments but also for fast and slow neutrons. The authors thank G. V. Khozov, Engineer. T. A. Lebedeva and G. D. Gusarina, laboratory assistents, and P. I. Gorshkov, mecnanic, for assistance. There are 7 figures and 4 non-Soviet references. They read as follows: Ref. 1: J. Blankenship, C. Borkowski. Bull. Amer. Phys. Soc., ser. II, 5, No. 1, 38 (1960). Ref. 2: S. Friedland, L. Mauer, J. Wiggins. Nucleonics, 18, No. 2, 54 (1960). Ref. 3: J. Mc Kenzie, J. Waugh. Bull. Amer. Phys. Soc., ser. II, 5, No. 5, 355 (1960). Ref. 4: M. Halbert, J. Blankenship. Nucl. Instrum. and Methods, 8, No. 1, 106 (1960).

SUBMITTED: March 18, 1961

Card 3/3

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

89611

9,4160 (also 1137, 1043, 1143)

S/020/61/136/002/015/034
B019/B056

26.2421
26.2360

AUTHORS: Grinberg, A. A., Novikov, S. R., and Ryvkin, S. M.

TITLE: The New Effect of Negative Photoconductivity in a Magnetic Field

PERIODICAL: Doklady Akademii nauk SSSR, 1961, Vol. 136, No. 2, pp. 329-331

TEXT: Fig. 1 shows a scheme of the experimental order, by means of which the authors carried out their experiments. By means of this device they were able to transmit light pulses to the semiconductor in the case of the existence or non-existence of a magnetic field. The photoconductivity without a magnetic field corresponded to the "positive" conductivity, that with magnetic field corresponding to the "negative" conductivity. The effect produced by the photo-emf of the specimen could be inhibited. The explanation of this effect proceeds from the fact that in the motion of the carriers in a magnetic transversal field their trajectory is curved, whereby the resistance is increased. The Hall field formed in this connection partly aligns the trajectories again, and thus decreases the

Card 1/2

The New Effect of Negative Photoconductivity in a Magnetic Field

S/020/61/136/002/015/034
B019/B056

growth of the resistance in a magnetic field. Thus, by some decrease of the Hall field, the resistance of the semiconductor is increased. By irradiation with light from the absorption band, electron-hole pairs are produced, and the increase of the electron concentration leads to a decrease of the Hall field. A formula is derived for calculating the negative change in the photoconductivity in n-type germanium, and further, two inequalities are given, by means of which it is possible to determine when no negative photoeffect may be observed in n-type or p-type material. There are 3 figures.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk SSSR (Institute of Physics and Technology of the Academy of Sciences USSR)

PRESENTED: August 1, 1960, by A. F. Ioffe, Academician

SUBMITTED: July 28, 1960

34226
S/181/62/004/002/009/051
B102/B138

26.1512
9.4177 (also 1051, 1035)

AUTHORS: Berkovskiy, F. M., and Ryvkin, S. M.

TITLE: Sensitivity of germanium and silicon photoelements in the range of impurity excitation

PERIODICAL: Fizika tverdogo tela, v. 4, no. 2, 1962, 366-375

TEXT: The authors study the possibility of the occurrence of a photo-emf in the p-n junction in the long-wave range behind the intrinsic absorption band. The theoretical results were checked by an experimental investigation of gold-doped Ge and Si elements. It is shown that photo-emf may arise with impurity excitation in conditions where minority carriers are generated in sufficient quantity. Fig. 1 shows the transitions possible when the semiconductor contains only one kind of impurity and is irradiated with photons whose energy is less than the forbidden-band width. It is demonstrated theoretically that with impurity excitation in general, minority as well as majority carriers are produced if the quantum energy is greater than the half-width of the forbidden band. If it is less, however, only majority carriers are produced. Photo-emf

Card 1/3

Sensitivity of germanium and silicon...

was observed on Ge p-n junctions obtained by diffusion of antimony into p-type Ge with a gold concentration of 10^{15} cm^{-3}. From the λ-dependence of photoconductivity and photocurrent it can be seen that both cover the region of impurity excitation. Photoconductivity extends farther than photo-emf into the long-wave range. Photoconductivity and photo-emf at $\lambda > 2\ \mu$ are due to the deep acceptor levels of gold: 0.2 ev from the conduction band and 0.15 ev from the valence band. The voltages obtained experimentally are less than the calculated value, but may reach considerable values. For a load resistance of 10^8 ohms at $\lambda = 2.3\ \mu$ the emf reaches 150 mv. For an incident energy of $3 \cdot 10^{-5}$ w, this corresponds to a sensitivity of 5000 v/w. The p-n junction in gold-doped n-type silicon was obtained by electrodeposition of nickel. Photocurrent and photoconductivity have very similar spectral distribution and occur between 1.5 and 2.5 μ. They are ascribed to the level, 0.54 ev off the c-band which is near to the middle of the forbidden band. As compared with photoresistors, photoelectric signal transformers on the basis of p-n junctions have several advantages: low dark current, insensitivity to adhesion levels, independence of external voltage sources. The design of

Sensitivity of germanium and silicon...

a photoresistor (Fig. 7a) and of a photocell with p-n junction are compared in an appendix to the paper. N. B. Strokan and L. G. Paritskiy are thanked for discussion and D. V. Tarkhin and Yu. V. Shmartsev for the specimens. V. Ye. Lashkarev, K. M. Kosonogova (Izv. AN SSSR, ser. fiz. No. 5-6, 1941), G. M. Avakyants and Yu. L. Ivanov are mentioned. There are 7 figures and 7 references: 5 Soviet and 2 non-Soviet. The reference to the English-language publication reads as follows: J. M. Waddel et al. Proc. IRE, 102, part B, 757, 1955.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: July 29, 1961

Fig. 1. Band scheme with possible transitions.

Fig. 7. Photoresistance and photo cell.

MASLOVA, L. V.; MATVEYEV, O. A.; RYVKIN, S. M.; STROKAN, N. B.; TARKHIN, D. V.; KHOZOV, V. G.

Possibilities for using silicon counters in nuclear research. Izv. AN SSSR. Ser. fiz. 16 no.12:1498-1505 D '62. (MIRA 16:1)

(Nuclear counters--Design and construction)

35376 S/058/62/000/005/118/119
A061/A101

9,4160
26.1512

AUTHORS: Ryvkin, S. M., Strokan, N. B., Makovskiy, L. L.

TITLE: The kinetics of photoelectric cells with n-p junctions

PERIODICAL: Referativnyy zhurnal, Fizika, no. 5, 1962, 31, abstract 5-3-62y (V sb. "Fotoelektr. i optich. yavleniya v poluprovodnikakh", Kiyev, AN USSR, 1959, 360 - 366)

J.

TEXT: The kinetics of ЛЭТИ (LETI) photodiodes was considered with lighted n-region and taking only the hole current into account. The relaxation of the rectifier element emf of the open photodiode circuit is shown to be determined by the lifetime, τ, of nonequilibrium holes if the inequality $\tau \gg R_0C$ is satisfied. C is the total capacity of the junction and assembly, and R_0 is the resistance of the n-p junction at zero voltage. The similarity between the curves of rise and drop of the photo-emf depends on the intensity of light considerably. At an increase of the latter, this similarity is disturbed. The inequality $\tau \gg R_0C$ can be disturbed by a decrease of temperature, in the case of a high capacity C, and in dependence of the type of photodiode. The general case of

Card 1/2

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A061/A101

The kinetics of photoelectric cells with n-p junctions

photodiode connection at a load R_1 is examined quantitatively. The curves describing the approximate solution of the system of equations of the relaxation process in limit cases of emf drop are analyzed. The results obtained with both accurate and approximate formulas for the emf agree well with experimental data. Provisional information is presented for the kinetics of LETI germanium photodiodes of a sensitivity from 1 to 4 a/lumen, a dark current of 700 to 500 μa, an admissible voltage limit of $\sim$5 v, and a lag of 10^{-5} sec. There is 1 reference.

V. Shch.

[Abstracter's note: Complete translation]

34227
S/181/62/004/002/010/051
B102/B138

9,4177 (1035, 1051)

AUTHORS: Berkovskiy, F. M., and Ryvkin, S. M.

TITLE: Nonsteady photo-emf at an n-p junction due to majority carriers

PERIODICAL: Fizika tverdogo tela, v. 4, no. 2, 1962, 376-378

TEXT: Steady photo-emf in semiconductors is only observed if a potential barrier exists and if minority carriers are generated. However, since the periods required to establish the photo-emf of an inhomogeneous semiconductor may be different, a nonsteady photo-emf may also be observed when only majority carriers are generated. The time required for establishment in this kind of semiconductor will depend on the lifetime τ and the time for establishment of diffusion-migration equilibrium $\varepsilon/4\pi\sigma$, which are different. A nonsteady photo-emf due to majority-carrier generation was observed at n-p junctions produced by diffusion of antimony into gold-doped p-type Ge, with an Au concentration of $\sim 10^{15}$ cm^{-3}. The spectral photo-emf distribution is shown in Fig. 2 for steady illumination (a) and pulsed

Card 1/2

Nonsteady photo-emf at an...

illumination of 10 cps (b). Steady photo-emf stops at 2.8 μ. At $\lambda > 2.8$ μ, only majority carriers are generated. There are 2 figures and 6 Soviet references.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: July 29, 1961

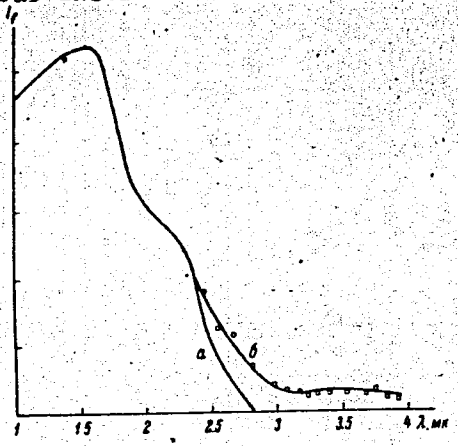

Fig. 2

Card 2/2

34228
S/181/62/004/002/011/051
B102/B138

24,7700 (1035,1043,1385)

AUTHORS: Konovalenko, B. M., Ryvkin, S. M., and Yaroshetskiy, I. D.

TITLE: Radiation defects caused by fast electrons in n-type germanium

PERIODICAL: Fizika tverdogo tela, v. 4, no. 2, 1962, 379-382

TEXT: The concentration M of radiation defects, the number l of the defect levels and their energies were determined for n-type Ge ($\sim$1 ohm·cm, $n \simeq 2 \cdot 10^{15}$ cm^{-3}) which was irradiated by 2.5-Mev electrons. The electron current density was ~ 5 $\mu a/cm^2$, pulse duration was ~ 2 μsec and repetition frequency was 50 sec^{-1}. The samples ($8 \cdot 1 \cdot 1$ mm^3) were water-cooled. The electron energy behind the specimens was $\sim$1.5 Mev, so that for calculations the electron energy in the specimen was taken to be $\sim$2 Mev. Carrier concentration was determined by measuring the Hall constant between 77°K and room temperature. M and l were determined using the relations: $n_2 = N_d - Ml_1$ and $n_4 = N_d - M(l-1)$; n_2 is the electron

Card 1/3

Radiation defects caused by fast...

concentration in the conduction band at low temperatures, when all defect levels are filled up and all donor levels are completely ionized (section I in Fig. 1). At high temperatures, when the upper defect levels are completely ionized, n_4 is the electron concentration (section II in Fig. 1). M was also determined from the activation energy of the upper levels and the carrier concentration of the linear part of II, using the relation $n-n_2 = \sqrt{MN_c}\exp(-\Delta E_M/2kT)$. N_c was calculated for the effective mass $m_n^* = 0.25\ m_o$. For several different specimens, the following results were obtained: N_d was $(2.08-2.26)\cdot10^{15}$ cm^{-3}, M1 was $(1.65-2.03)\cdot10^{15}$cm^{-3}, M was $(4.25-5.2)\cdot10^{14}$ cm^{-3}, 1 was 3.9 - 4.2, ΔE_M 0.20 - 0.23 ev, and the radiation defect formation cross section was 1.45-1.55 barn; it was calculated from $\sigma = M/\phi N_{Ge}$, ϕ - electron flux density, N_{Ge} - number of Ge atoms per cm^3. Electrons with ~25 Mev were found to produce defects with the following levels: E_c-0.24 ev, E_c-0.36 ev, E_v+0.25 ev and E_v+0.11 ev.

There are 3 figures, 2 tables, and 7 references: 3 Soviet and 4 non-Soviet. The three references to English-language publications read as

Card 2/3

31220
S/181/62/004/002/011/051
B102/B138

follows: J. W. Cleland et al. Phys. Rev. 102, 772, 1956; W. L. Brown et al. Phys. Rev. 92, 591, 1953; J. W. Cleland, J. H. Crawford. Progress in Semiconductors, 2, 1957.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: August 8, 1961

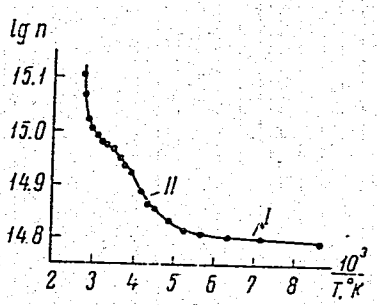

Fig. 1

3424
S/181/62/004/002/043/051
B102/B138

9,4177 (1051,1482)

AUTHORS: Dobrego, V. P., and Ryvkin, S. M.

TITLE: Negative photoconductivity in germanium at liquid-helium temperature

PERIODICAL: Fizika tverdogo tela, v. 4, no. 2, 1962, 553 - 555

TEXT: Negative photoconductivity was discovered in n-type Ge with specific resistivity of 0.2 - 0.4 ohm·cm and p-type Ge of 0.5 ohm·cm at helium temperature. In n-type Ge above 1 ohm·cm no effect was observed. At low illumination intensities conductivity decreases in a very short range (a in Fig. 1). Oscillograms were taken of the current rise and drop in a cell with the specimen exposed to square light pulses. From the oscillograms it can be seen that positive and negative photo-conductivity have different increase and decrease constants, the latter being particularly marked. Both curves are non-exponential. The red edge of negative photoconductivity of n-type Ge is at about 0.74 ev. At the short-wave side photoconductivity decreases slowly and vanishes at 1.1 - 1.3 μ. It is assumed that the negative photoconductivity may be

Negative photoconductivity...

due to increased population of the donor levels, caused by illumination. There are 2 figures, 1 table, and 4 non-Soviet references. The three references to English-language publications read as follows: C. S. Hung. J. R. Gliessmann. Phys. Rev. 79, 726, 1950; H. Fritzsche. J. Phys. Chem. Solids, 6, 69, 1958; P. Csavinszky. Phys. Rev. 119, 1605, 1960.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: November 3, 1961

Fig. 1. Lux-ampere characteristics.

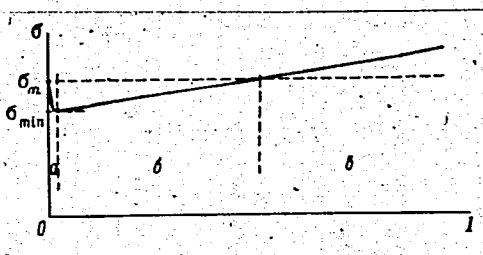

Fig. 1

36486
S/181/62/004/003/041/045
B101/B102

24.7700
9.4310

AUTHORS: Fitovskiy, N. A., Lukirskiy, D. P., Mashovets, T. V., and Ryvkin, S. M.

TITLE: Energy spectrum of some impurity atoms in germanium and silicon

PERIODICAL: Fizika tverdogo tela, v. 4, no. 3, 1962, 816 - 818

TEXT: In a previous paper (FTT, 1, 1381, 1959) the authors suggested a method of determining the total number of acceptor (or donor) levels pertaining to one structural defect and lying in the forbidden band of a semiconductor. The method consists in measuring the temperature dependence of the Hall constant in specimens with known ratio of the concentration of the "ordinary" carriers (of the elements of the groups III and V) to the defect concentration. Such measurements were made in gold-doped n-type Ge, copper-doped n-type Ge, and gold-doped p- and n-type Si. Specimens with known impurity concentrations are obtained by diffusion. In the measurement, the concentration M of the atoms added must be such that $Ml < N_1$, or $Mk < Na$, where l is the number of the acceptor levels, k

Card 1/4

Energy spectrum of some...

the number of the donor levels, N_d, N_a are the concentrations of the "ordinary" donors or acceptors, respectively. The results (Fig. 1) which show a concentration n_o of the ordinary donors prior to doping which corresponds to complete ionization, and n_2 after doping.indicate that at liquid-nitrogen temperature filling of the ordinary donors (V-group elements) sets in. The concentration which increases with temperature (Iα and IIδ) corresponds to the ionization of the uppermost level of the impurity atom and the concentration n_1 (Fig. 1) to the complete emptying of this level. The relation $l = (n_o - n_2)/(n_1 - n_2)$ for Cu in Ge is 3.1; for Au in Ge (2 specimens) $l = 2.8$ and $l = 3.1$. With n-type and p-type Si the curves I and II coincide at high temperatures (approximately 500°K) from which it follows that in silicon gold forms one acceptor level ($l = 1$) and one donor level ($k = 1$). The calculated activation energies for the upper acceptor levels of Cu and Au in Ge, and the acceptor and donor levels of Au in Si agree with published data. There are 2 figures and 5 references: 2 Soviet and 3 non-Soviet. The three references to English-language publications read as follows: H. H. Woodbury a. W. W. Card 2/4 3

Energy spectrum of some...

Tyler, Phys. Rev., 105, 84, 1957; R. Newman, Phys. Rev., 94, 278, 1954; C. B. Collins, R. O. Carlson, a. Gallagher, Phys. Rev., 105, 1168, 1957.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute imeni A. F. Ioffe of the AS USSR, Leningrad)

SUBMITTED: December 30, 1961

Fig. 1. Temperature dependence of the carrier concentration in germanium. (a) doped with Cu; (б) doped with Au.

36893
S/181/62/004/004/038/042
B102/B104

24.6111
27.7000

AUTHORS: Nasledov, D. N., Rogachev, A. A., Ryvkin, S. M., and Tsarenkov, B. V.

TITLE: Recombination radiation of gallium arsenide

PERIODICAL: Fizika tverdogo tela, v. 4, no. 4, 1962, 1062-1065

TEXT: Monocrystalline n-type InAs plates with an electron concentration of $\leq 10^{17}$ cm^{-3} were used to study the intrinsic recombination radiation. A p-n junction of ≈ 0.1 cm^2 was produced by diffusion of Zn or Cd into the InAs plate. The nonequilibrium carriers were excited by pulsed injection through the junction. The radiation was observed in parallel to the p-n junction plane. At 77°K the emission spectrum has a narrow peak at 1.47 ev (optical self-absorption edge) and two maxima at lower energies which are in connection with recombination via impurity levels. One of these levels is 0.2 ev distant from the middle of the forbidden band, the other 0.25 ev from a band edge. The relative height of all maxima depends on the current density through the p-n junction. At less

Recombination radiation of gallium ...

than 1 a/cm^2 only impurity radiation is observed, then intrinsic radiation arises and increases rapidly, and between 10 and 100 a/cm^2 the relative height of the maxima remains constant. The results can be explained by assuming volume-charge recombination at weak currents and injection at high currents. At above 10 a/cm^2 the emission intensity increases linearly with the current density through the p-n junction and decreases only above $\sim 10^3$ a/cm^2. The forbidden band width is temperature-dependent according to the law $(1.51-5.6\cdot10^{-4}T)$ ev. The intrinsic emission line narrowing observed at high current densities can be explained by inverse band filling (production of states with "negative temperature") or by assuming that the injected carriers cause degenerate filling of one band only. The latter possibility is more probable. There are 2 figures.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: January 11, 1962

38909
S/181/62/004/006/015/051
B125/B104

24.7700
24.2600

AUTHORS: Ivanov, Yu. L., and Ryvkin, S. M.

TITLE: Optical charge exchange of impurity centers and kinetics of impurity photoconduction

PERIODICAL: Fizika tverdogo tela, v. 4, no. 6, 1962, 1482-1491

TEXT: The kinetics of photoconduction in direct and reverse charge exchange through the C-zone has been investigated experimentally, and results have been interpreted qualitatively. The examined five groups of n-type germanium specimens with copper introduced by diffusion comprised almost all possible stages of compensation. The illumination of group I specimens (all Cu centers having a triple negative charge) and of group V gives rise to electron exchange between a single level (level III for group I, and level II for group V) and the corresponding zone. The relaxation curves then contain only one "fast" component. If specimens of groups II and III (containing triply and doubly charged centers) are irradiated with $0.43\ ev > h\nu > 0.26\ ev$, both slow and fast relaxation appears. Under irradiation with $0.49\ ev > h\nu > 0.43\ ev$, the

Optical charge exchange of impurity ...

relaxation curve slopes down gently owing to charge exchange of the Cu centers. Th· irradiation of III (all centers having double negative charge) with 0.49 ev > hν > 0.43 ev causes reverse charge exchange which may change the rate of generation and, to a lesser degree, also the lifetime. In the irradiation of group IV specimens (containing singly and doubly charged centers) with 0.43 ev > hν > 0.32 ev as well as in the short-wave range, there appears a "fast" component. Theoretically possible slow processes are not observed. After illumination of a group III specimen with 0.49 ev > hν > 0.45 ev, electrons from levels II and III are transferred to the C-zone. The intensity of this reverse process ("flashing") increases with progressing filling of level III with electrons. A steady state sets in after a certain time. Hence, the amplitude of this "reverse flashing" (characterizing the concentration of triply charged non-equilibrium centers) tends toward a limiting value if preliminary illumination has been protracted for a sufficiently long time. The more intense the illumination, the more quickly this limiting value is attained. There are 6 figures. The most important English-language reference is: J. Lambe, C. C. Klick. Phys. Rev., 98, 909, 1955.

38919
S/181/62/004/006/030/051
B104/B112

9,4177

AUTHORS: Arkad'yeva, Ye. N., Paritskiy, L. G., and Ryvkin, S. M.

TITLE: A method of long-wave photoelectric probing of local levels in semiconductors

PERIODICAL: Fizika tverdogo tela, v. 4, no. 6, 1962, 1578 - 1588

TEXT: In the new method described here for the investigation of relaxation processes in semiconductors, the sample is irradiated with a probing pulse of long-wave light (Fig. 1б) along with a sufficiently long square light pulse (Fig. 1a) that excites the relaxation process under investigation. The wavelength of the probing pulse is so chosen that the levels under consideration are ionized. In this case, the signal on the oscilloscope screen has a definite form (Fig. 1в). The concentrations of free and bound carriers can be determined from the slope of the curve on the screen and from its peak produced by the probing pulse. The sample can be irradiated with a series of probing pulses during the interval of a single square pulse (Fig. 2), and this enables the relaxation of the concentrations to be determined. The light from the

source S (Fig. 3) and the probing infrared light of the monochromator M are regularly interrupted by the disks Π_1 (square pulse) and Π_2. The signals of photoconductivity are recorded by a double-beam oscilloscope and photographed. The probing pulse is automatically shifted along the square one. Examples of a qualitative analysis of the behavior of non-equilibrium carriers in CdS, CdTe, Ge, and Si during photoconduction at ~100°K are given, and a probing method for several types of local levels in semiconductors is described. There are 15 figures.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: February 5, 1962

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38925

S/181/62/004/006/049/051
B108/B138

AUTHORS: Rogachev, A. A., and Ryvkin, S. M.

TITLE: Temperature dependence of the radiative recombination cross section in germanium

PERIODICAL: Fizika tverdogo tela, v. 4, no. 6, 1962, 1676 - 1678

TEXT: The authors' preliminary experiments have shown that at 77°K and with a high injection level ($\Delta p \approx 10^{16}$ cm^{-3}) the time constants of photoconduction in germanium are greater than was concluded by van Roosbrock and W. Shockley (Phys. Rev., 94, 1558, 1954). They also meas red the temperature dependence of the radiative recombination cross section in n-type Ge diodes. Only a slight increase in intensity of the recombination radiation was observed as the n-p junction was cooled from room temperature to liquid nitrogen temperature: $\sigma_R \sim 1/T$. It is stated that the rapid decrease in σ_R with rising temperature, as established by van Roosbrock and Shockley, is probably due to an error in calculation. It is demonstrated

Temperature dependence ...

that even under ideal conditions σ_R cannot decrease more rapidly than in proportion to $T^{-5/2}$. There is 1 figure.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR
Leningrad (Physicotechnical Institute imeni A. F. Ioffe
AS USSR, Leningrad)

SUBMITTED: February 26, 1962

RYVKIN, S.M.; DOBREGO, V.P.; KONOVALENKO, B.M.; YAROSHETSKIY, I.D.

Induced impurity breakdown in compensated germanium and current oscillations related to it. Fiz.tver.tela 4 no.7: 1911-1914 Jl '62. (MIRA 16:6)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.
(Breakdown, Electric) (Germanium--Electric properties)

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

44144

S/181/62/004/010/032/063
B108/B104

24 7600

AUTHORS: Vitovskiy, N. A., Mashovets, T. V., and Ryvkin, S. M.

TITLE: The energy spectrum of the gamma radiation defects in silicon

PERIODICAL: Fizika tverdogo tela, v. 4, no. 10, 1962, 2845-2848

TEXT: The temperature dependence of the Hall constant was studied on n- and p-type silicon samples before and after their exposure to Co^{60} gamma radiation. Irradiation ($1.4 \cdot 10^{17}$ quanta/cm^2; $1.15 \cdot 10^{18}$ quanta/cm^2) reduced the conductivity of silicon. The measurements carried out in the range 55-450°K showed that irradiation gives rise to two levels in the upper half of the forbidden band that are capable of accepting electrons: E_c - 0.18 ev and E_c - 0.5 ev. The production cross-sections of these levels are approximately $1.4 \cdot 10^{-26}$ cm^2 and $1.8 \cdot 10^{-27}$ cm^2, respectively. In the lower half of the forbidden band there was one level (E_v + 0.23 ev) with a production cross-section of about $1.2 \cdot 10^{-27}$ cm^2. There are 2 figures and 2 tables.

Card 1/2

The energy spectrum of the gamma...

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: May 30, 1962

Card 2/2

S/181/62/004/010/033/063
B102/B112

AUTHORS: Vitovskiy, N. A., Mashovets, T. V., and Ryvkin, S. M.

TITLE: Determination of the activation energy of impurity center levels and of structural defects in semiconductors

PERIODICAL: Fizika tverdogo tela, v. 4, no. 10, 1962, 2849 - 2853

TEXT: A study was made of the temperature dependence of the carrier concentration in semiconductors with impurities and defects, the spectra of which are complicated by their being several types of levels. According to measurements log $n = f(1/T)$ is, in this case, a complicated curve comprising plateaus of different lengths and sections with different inclinations. The activation energy of all possible levels is calculated to obtain a quantitative theoretical description. For simplicity a semiconductor is considered having two levels in the forbidden band. At absolute zero one of them should be partially filled with electrons, and the other should be filled completely (Fig. 2). The results can then be generalized for an arbitrary number of levels. If, in the entire temperature range the relation $\Delta E_2 - \Delta E_1 \gg kT$ is valid where ΔE_i are the level activation energies,

then the neutrality condition of the system can be given by

$$N_c e^{\frac{\mu}{kT}} = m_1 - \frac{M_1}{1 + \gamma_1 e^{-\frac{\Delta E_1 + \mu}{kT}}} + \frac{M_2}{1 + \frac{1}{\gamma_2} e^{\frac{\Delta E_2 + \mu}{kT}}}, \quad (1);$$

the solution is

$$n = \frac{m_1 - \gamma_2 N_{cM_2}}{2} \pm \frac{1}{2} \sqrt{(\gamma_2 N_{cM_2} - m_1)^2 + \gamma_2 4 N_{cM_2} (M_2 + m_1)}, \quad (5).$$

$$N_{cM_2} \equiv N_c e^{-\frac{\Delta E_2}{kT}}.$$

The curve log n = f(1/T) is divided into 6 sections (2 plateaus, 2 sloping and 2 transition sections), n is calculated for each section and the state density is studied. With the aid of

$$\Delta E_2 = \frac{d \lg n}{d\left(\frac{1}{T}\right)} \left[1 - \frac{2.3 \cdot 2k}{m_1 \sqrt{(m_1 + M_2) m_1}}\right] - \frac{3}{2} kT. \quad (9)$$

Card 2/4 * Error in original

ΔE_2 can be determined experimentally from the high-temperature inclined section, if m_1 and (M_2+m_1) in the point $\gamma_2 N_{cM_2} = m_1$ is determined from

$$n = \sqrt{(m_1 + M_2)\gamma_2 N_{cM_2}} = \sqrt{(m_1 + M_2) m_1}. \quad (7)$$

and $d(\log n)/d(1/T)$ is determined from the curve. The statistical weights γ_1/γ_2 of the levels need not be known but γ_2 can be calculated from (7). These relations are valid if $M_2 \lesssim m_1$. If $M_2 \gg m_1$ then the activation energy can be calculated directly from the inclination of the curve with the aid of

$$\frac{d \lg n}{d\left(\frac{1}{T}\right)} = -\frac{1}{2}\left(\frac{\Delta E_2}{k} + \frac{3}{2} T\right), \quad (11).$$

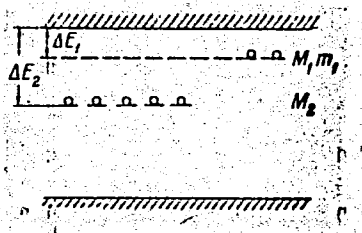
This is calculated for a practical case. Finally, a further possibility is pointed out of calculating ΔE_2 from the temperature dependence of the carrier density: the curve $\log(n-m_1)=f(1/T)$ can be constructed and the

tangent whose inclination gives the activation energy directly can be drawn at the point corresponding to Eq. (7). N_c denotes the effective state density in the conduction band, M_i are the level concentrations and m_1 is the electron concentration on the M_1 level. There are 3 figures.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: May 30, 1962

Fig. 2



33238

S/089/62/012/002/010/013
B102/B138

26.2264
21.6000

AUTHORS: Kazarinov, N. M., Matveyev, O. A., Ryvkin, S. M., Solov'yev, S. M., Strokan, N. B., Tarkhin, D. V.

TITLE: Investigation of semiconductor spectrometer counters for measuring fragment energies

PERIODICAL: Atomnaya energiya, v. 12, no. 2, 1962, 153 - 154

TEXT: U^{235} fission fragment energy was measured by semiconductor counters developed at the fiziko-tekhnicheskiy institut im. A. F. Ioffe (Physicotechnical Institute imeni A. F. Ioffe). The surface-barrier junction of these counters was produced by spraying gold onto an n-type silicon plate. These counters, which were studied earlier by the authors (Atomnaya energiya, 11, no. 3, 217, 1961), were found to be well suited for alpha spectrometry (resolution 0.5% for E_α = 5.5 Mev). The volume charge region was about 60 μ for maximum voltage, much greater than the fragment range in silicon. Fragment energy was measured with a 0.5 mm Al target, placed in a thin-walled aluminum vacuum chamber. The target had a vacuum-sprayed layer of UF_4, enriched in U^{235} to 92.8%. Diameter of the

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

Investigation of semiconductor ...

layer was 1.2 cm, and the total weight was 120 μg. The silicon counter was placed 1.5 cm below the target to avoid being hit by the neutron beam collimated into the chamber. The counter pulses were fed to a preamplifier and thence to a 100-channel analyzer. The fragment energy spectra thus measured differed considerably from those obtained from time-of-flight measurements. This was found to be due to energy losses in the counter surface, which were strongly dependent on the angle of incidence of the fragments. As the fragments lose most of their energy in the first part of their path this effect was much higher for them than for alphas.

Special counters of 16 mm^2 area were produced with a thinner layer of gold and the energy spectrum was measured again and compared as before. This time the shape was the same, with a difference of about 7 Mev in absolute values. This is attributed partly to energy losses in the fissile layer, and partly to the energy being carried away by fission neutrons. In the Au layer losses do not exceed 1 Mev. Apart from other advantages the silicon counters yield better results than e. g. ionization chambers. There are 2 figures and 5 references: 1 Soviet and 4 non-Soviet. The four references to English-language publications read as follows: W. Stein.

VITOVSKIY, N.A.; MASHOVETS, T.V.; RYVKIN, S.M.

Energy spectrum of gamma-radiation defects in silicon. Fiz. tver.tela 4 no.10:2845-2848 O '62. (MIRA 15:12)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.
(Hall effect) (Silicon crystals--Defects)
(Gamma rays)

VITOVSKIY, N.A.; MASHOVETS, T.V.; RYVKIN, S.M.

Determining the activation energy of the different levels of impurity centers and structural defects in semiconductors. Fiz.tver.tela 4 no.10:2849-2853 O '62. (MIRA 15:12)

1. Fiziko-tekhnicheskiy institut imeni Ioffe AN SSSR, Leningrad.
(Crystals—Defects) (Semiconductors) (Quantum theory)

NASLEDOV, D.N.; ROGACHEV, A.A.; RYVKIN, S.M.; KHARTSIYEV, V.Ye.; TSARENKOV, B.V.

Structure of direct recombination spectra of gallium arsenide. Fiz. tver. tela 4 no.11:3346-3348 N '62. (MIRA 15:12)

1. Fiziko-tekhnicheskiy institut imeni A.F. Ioffe AN SSSR, Leningrad.

(Gallium arsenide--Spectra)

RYVKIN, Solomon Meyerovich; MATVEYEV, Oleg Aleksandrovich; STROKAN, Nikita Borisovich

[Transistorized nuclea counters] Poluprovodnikovye schetchiki iadernykh chastits. Leningrad, 1963. 39 p. (Leningradskii dom nauchno-tekhnicheskoi propagandy, no.10) (MIRA 17:7)

AM4016851 **BOOK EXPLOITATION** S/

Ry*vkin, Solomon Meyerovich

Photoelectric phenomena in semiconductors (Fotoelektricheskiye yavleniya v poluprovodnikakh) Moscow, Fizmatgiz, 63. 0494 p. illus., biblio. 13000 copies printed.

Series Note: Fizika poluprovodnikov i poluprovodnikovy*kh priborov

TOPIC TAGS: photoconductivity, photoelectric phenomena, semiconductor, carrier generation, carrier motion, carrier recombination, adhesion, diffusion, drift, photoemf, intrinsic photoconductivity, extrinsic photoconductivity

PURPOSE AND COVERAGE: The monograph considers processes of generation, motion, and recombination of non-equilibrium carriers in semiconductors. Principal attention is paid to an analysis of recombination via local centers, adhesion, diffusion and drift of non-

equilibrium carriers in electric and magnetic fields, to the related phenomena of photoconductivity (intrinsic and extrinsic) and photo emf, and also to methods of experimental investigation of the kinetics of photoelectric processes. The book is for physicists and engineers dealing with semiconductors.

TABLE OF CONTENTS [abridged]:

AM4016851

SUB CODE: PH SUBMITTED: 12Jul63 NR REF SOV: 187

OTHER: 110 DATE ACQ: 19Dec63

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

S/030/63/000/001/005/013
B104/B102

AUTHOR: Ryvkin, S. M., Doctor of Physics and Mathematics

TITLE: Semiconductor counters for nuclear particles

PERIODICAL: Akademiya nauk SSSR. Vestnik, no. 1, 1963, 56-58

TEXT: The development of the production of crystal counters which began 17 years ago is briefly outlined, and the advantages and shortcomings of germanium or silicon junction counters and of homogeneous semiconductor counters are discussed. Methods of producing spectrometric n-p surface barrier counters and n-i-p counters have been developed at the Fiziko-tekhnicheskiy institut im. A.F. Ioffe Akademii nauk SSSR (Physicotechnical Institute imeni A.F. Ioffe of the Academy of Sciences USSR). The n-p junction counters consist of a Si plate on the surface of which an n-p surface barrier junction is produced. The junction charge is the effective region of this counter. If one particle produces an electron-hole pair in this region, then this pair is separated by the strong field and virtually no recombination losses arise. If the particle remains inside the volume charge region, then the pulse arising when the

Semiconductor counters for ...

counter capacitance is charged is exactly proportional to the particle energy. Two types have been developed at the Institute. The sensitive surface of the first type was 50 mm^2 in area, or less, and 100μ thick. These counters are provided for the spectroscopy of alphas, fission fragments, ions etc. The resolution for 5-Mev α-particles was 0.5%. The second type had a sensitive surface of approximately 5 cm^2. 2-Mev α-particles could be detected. Using a B^{10} converter, thermal neutrons could be detected with a counting efficiency of 1%. The author developed an n-i-p counter with a sensitive surface 4 cm^2 in area and approximately 2 mm thick for detecting 5-Mev α-particles. The signal-to-noise ratio was ≈ 50. There are 2 figures.

BERKOVSKIY, F.M.; RYVKIN, S.M.

Effect of the optical recharging of impurity centers on the kinetics of a photo-emf. in germanium. Fiz. tver. tela 5 no.2:381-385 F '63. (MIRA 16:5)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.
(Photoelectricity) (Germanium)

BERKOVSKIY, F.M.; KASYMOVA, R.S.; RYVKIN, S.M.

Sensitization of photodiodes resulting from optical recharging of impurities. Fiz. tver. tela 5 no.2:524-533 F '63. (MIRA 16:5)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.
(Diodes) (Photoconductivity)

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7

L 18000-63 EWT(1)/EWG(k)/EWP(q)/EWT(m)/BDS AFFTC/ASD/ESD-3/IJP(C)
Pz-4 RDW/AT/JD

ACCESSION NR: AP3001286 S/0181/63/005/006/1649/1656

AUTHORS: Mekhtiyev, R. F.; Paritskiy, L. G.; Ryvkin, S. M.

TITLE: Kinetics of impurity photoconductivity in crystals of GaSe

SOURCE: Fizika tverdogo tela, v. 5, no. 6, 1963, 1649-1656

TOPIC TAGS: impurity photoconductivity, emitter level, capture cross section, multiple capture, valence band, impurity absorption, Ga, Se

ABSTRACT: The purpose of this work was to study the spectrum of local levels responsible for impurity photoconductivity (emitter levels), to examine the parameters of these centers, and the role of the levels of capture by analyzing spectral dependence of standard photoconductivity and the structure of relaxation curves. In single crystals of GaSe the authors detected considerable photosensitivity in the region of impurity absorption up to about 3 microns, determined by the presence of 3 types of "emitter" levels lying at 0.4, 0.56, and 0.71 ev from the top of the valence band. Investigation of relaxation of photoconductivity permitted them to determine the capture cross sections of nonequilibrium holes, each of the levels of capture cross section of photons, and

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ACCESSION NR: AP3001286

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the concentration of levels. They established the presence of levels of multiple capture and showed that when emitter levels are nearly full and equilibrium conductivity is considerable the presence of capture does not affect the measured relaxation time. By comparatively simple measurements of the concentration of emitter levels and the capture cross sections of photons they found it possible to determine the basic parameters of local levels responsible for the impurity photoconductivity. Orig. art. has: 6 figures and 7 formulas.

ASSOCIATION: Fiziko-technicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physical and Technical Institute); Institut fiziki AN Az. SSR, Baku (Institute of Physics, Academy of Sciences, Azerbaijan SSR)

SUBMITTED: 29Jan63 DATE ACQ: 01Jul63 ENCL: 00

SUB CODE: PH NO REF SOV: 012 OTHER: 002

L 13809-63 EWP(q)/EWT(m)/BDS AFFTC/ASD JD

ACCESSION NR: AP3003878 S/0181/63/005/007/1833/1841

AUTHOR: Vitovskiy, N. A.; Konovalenko, B. M.; Mashovets, T. V.; Ryvkin, S. M.; Yaroshetskiy, I. D.

TITLE: Gamma-ray-generated defects in germanium

SOURCE: Fizika tverdogo tela, v. 5, no. 7, 1963, 1833-1841

TOPIC TAGS: gamma-ray semiconductor irradiation, radiation defect, monopolar annealing, bipolar annealing, germanium irradiation, germanium defect, germanium

ABSTRACT: In the latest stage of research on the subject, dating back to 1959, a large number of n- and p-type specimens was investigated. N-type germanium was doped with antimony and had a donor concentration between $2 \cdot 10^{12}$ to $8 \cdot 10^{15}$ cm^{-3}; p-type germanium was doped with gallium and had an acceptor concentration between 10^{12} to 10^{15} cm^{-3}. The source was Co^{60} at a dosage of $2 \cdot 10^{11}$ $kv/cm^2 \cdot sec$ and temperature of 10C. The work was aimed at clarifying the saturation of irradiated specimens which occurs after polarity reversal, whereby further exposure to radiation, however prolonged, no longer affects the slope of the thermal dependence of carrier concentration. The latter remains equal to the activation energy. While the saturation process is evident up to very high concentrations

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L 13809-63

ACCESSION NR: AP3003878

of radiation defects, a substantially different situation is obtained in monopolar annealing of interstitial atoms, ultimately leading to a variety of limiting states of specimens exposed to gamma radiation. A bipolar annealing effect occurring during the irradiation process is considered responsible for the drop in the defect-formation rate with increased dosage of radiation. Both monopolar and bipolar annealing effects were found above room temperature. "The authors are indebted to S. R. Novikov for interesting discussions." Orig. art. has: 9 figures.

ASSOCIATION: Leningradskiy fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR (Leningrad Physicotechnical Institute, AN SSSR)

SUBMITTED: 31Jan63 DATE ACQ: 15Aug63 ENCL: 00

SUB CODE: PH NO REF SOV: 006 OTHER: 003

Card 2/2

L 14266-63 EWP(q)/EWT(m)/BDS AFFTC/ASD JD
ACCESSION NR: AP3003879 S/0181/63/005/007/1842/1851

61
56

AUTHOR: Konopleva, R. F.; Novikov, S. R.; Ryzhkin, S. M.

TITLE: Energy levels in Ge due to fast neutron bombardment

SOURCE: Fizika tverdogo tela, v. 5, no. 7, 1963, 1842-1851

TOPIC TAGS: fast-neutron irradiation, neutron irradiation, neutron bombardment, defect energy level, defect level, defect state

ABSTRACT: An experimentally obtained temperature dependence of the Hall constant was utilized in determining the defect-energy-level spectrum of n-type Ge with a concentration of Sb of 2×10^{15} cm^{-3}. Electrical conductivity and Hall effect were measured before and after irradiation by integrated fast-neutron fluxes varying from 4.7×10^{14} to 4.2×10^{16} fast neutrons/cm^2. The measurements were conducted in the 77—300K temperature range. The energies of the five levels found in the forbidden band of Ge and the initial and relative rates of formation of impurity centers determined from the experimental data are given in the Enclosure. Analysis of the data obtained shows that, in contradiction to the Lark-Horowitz model, there are three acceptor levels (the three lowest energy levels).

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The fact that the rate of formation and the rate of annealing of the three lower levels differ very little indicates that all three are probably vacancy levels.
"The authors express their gratitude to coworkers of the Physicotechnical Institute reactor crew, who made it possible to carry out the present work. The authors also thank N. A. Vitovskiy, B. M. Konovalenko, T. V. Mashovets, and I. D. Yaroshetskiy for valuable discussion." Orig. art. has: 10 formulas, 6 figures, and 1 table.

ASSOCIATION: Fiziko-tekhnicheskiy institut imeni A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute)

SUBMITTED: 01Feb63 DATE ACQ: 15Aug63 ENCL: 01

SUB CODE: PH NO REF SOV: 003 OTHER: 010

L 18718-63 EWP(q)/EWT(m)/BDS AFFTC/ASD JD

ACCESSION NR: AP3003910 S/0181/63/005/007/2023/2025

AUTHORS: Berkovskiy, F. M.; Ryvkin, S. M. 58 53

TITLE: Impurity photoelectromotive force induced by a current

SOURCE: Fizika tverdogo tela, v. 5, no. 7, 1963, 2023-2025

TOPIC TAGS: photoelectromotive force, impurity, induction, absorption band, radiation defect, recharge, electron, hole, injection

ABSTRACT: A new effect has been discovered at illuminated silicon photodiodes: after passage of a current pulse through the n-p junction in the permissive direction, the photodiodes prove to be sensitive in a new spectral region for the fundamental absorption band. This relationship is shown in Fig. 1 (see enclosure). The photoelectromotive force has the character of a flash, the amplitude and duration of which are determined by the intensity of current or light. Electrical recharging (of electron-hole pairs) is better than optical because the injection takes place at a distance from the n-p junction representing the layer in which the photoelectromotive force is generated and because nonequilibrium

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L 18718-63

ACCESSION NR: AP3003910

concentrations can be injected at higher values, the time for charging a sample thus being very small. In their work the authors used silicon photodiodes with radiation defects formed by gamma radiation from Co^{60}. Recharge of the levels of radiation defects consequently took place. It is clear that a similar effect must be observed in other materials with impurities corresponding to deep levels. Preliminary experiments have shown that the effect is observed also in Ge photodiodes that have been exposed to fast electrons. It is felt that the present need is for more detailed investigation on various materials. "The authors thank Ye. V. Ostroumova and R. S. Kasymova for their help in carrying out the experiments." Orig. art. has: 2 figures.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physical and Technical Institute, Academy of Sciences, SSSR)

SUBMITTED: 09Mar63 DATE ACQ: 15Aug63 ENCL: 01

SUB CODE: PH NO REF SOV: 005 OTHER: 001

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APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

KONOVALENKO, B.M.; RYVKIN, S.M.; YAROSHETSKIY, I.D.

Radiation defects in germanium caused by fast 28 Mev. electrons. Fiz. tver. tela 5 no.8:2075-2086 Ag '63. (MIRA 16:9)

1. Fiziko-tekhnicheskiy institut im. A.F.Ioffe AN SSSR, Leningrad. (Germanium crystals--Defects) (Electrons)

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AFANAS'YEV, V.F.; PARITSKIY, L.G.; PRIKOT, N.F.; RYVKIN, S.M.

Effect of trapping levels on the lux-ampere characteristics in silicon. Fiz. tver. tela 5 no.11:3179-3182 N '63. (MIRA 16:12)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

ZIBUTS, Yu.A.; PARITSKIY, L.G.; RYVKIN, S.M.

Some properties of silicon with admixtures of mercury, tungsten, molybdenum, and platinum. Fiz. tver. tela 5 no.11:3301-3304 N '63. (MIRA 16:12)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.

VITOVSKIY, N.A.; MASHOVETS, T.V.; RYVKIN, S.M.; KHASEVAROV, R.Yu.

Change of the electric and photoelectric properties of gallium arsenide irradiated by 1 Mev. electrons. Fiz. tver. tela 5 no.12:3510-3523 D'63. (MIRA 17:2)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.

APPROVED FOR RELEASE: Thursday, September 26, 2002 CIA-RDP86-00513R001446520002-7"

IVANOV, Yu.L.; RYVKIN, S.M.

Photoelectret effect in silicon. Fiz. tver. tela 5 no.12:3541-3544 D '63. (MIRA 17:2)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.

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RYVKIN, S. M., doktor fiz.-matem. nauk

Semiconductor counters of nuclear particles. Vest. AN SSSR 33 no.1:56-58 Ja '63. (MIRA 16:1)

(Nuclear counters)