Distribution of the electron...

$$\chi_1 = -\frac{4\pi e^2 AN}{6mc^2}\int_0^\infty e^{-\alpha r^2} r^4\, dr = -23{,}6\cdot 10^{-6}\,\frac{A}{\alpha^{5/2}}. \qquad (9),$$

with A and α being determined by experiment from the intensities of the X-rays scattered from the crystal planes $(h_1k_1l_1)$ and $(h_2k_2l_2)$. χ_2 depends considerably on the lattice type, and from X-ray diffraction studies is estimated as being proportional to $r^4\rho_2$:

$$\chi_2 = -\frac{4\pi e^2 N}{6mc^2}\sum_l r_l^4 \rho_{2l}\Delta r = -\frac{4\pi e^2 N}{6mc^2}\sum_l \bar{r}_l^4 \sum\sum\sum F_2 \exp\left[-2\pi i \bar{r}\bar{H}\right]\Delta r. \qquad (14).$$

F_2 is obtained from the difference of the structural amplitude determined by experiment and that computed on the basis of a known electron distribution. The deviations are explained by the fact that the diamagnetic component of the susceptibility has been neglected in the calculations. It is demonstrated that the anisotropy of the diamagnetic component of susceptibility caused by the deviation of the electron distribution from

Card 2/3

Distribution of the electron ...

spherical symmetry as well as by the temperature dependence of the diamagnetic susceptibility can be estimated from X-ray diffraction studies. There are 1 table and 5 references: 3 Soviet and 2 non-Soviet.

ASSOCIATION: Otdel fiziki tverdogo tela i poluprovodnikov Akademii nauk BSSR (Division of Solid State Physics and Semiconductors of the Academy of Sciences BSSR)

SUBMITTED: October 11, 1961

Card 3/3

35671
S/020/62/143/001/026/030
B101/B147

AUTHORS: Sirota, N. N., Academician AS BSSR, and Gololobov, Ye. M.

TITLE: Electron density distribution in indium antimonide

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 143, no. 1, 1962, 156 - 158

TEXT: The authors studied the change of the atomic scattering factor of indium and antimony ions in InSb single crystals purified by zone melting and then pulverized (particle size 5 μ) with a УРС - 50 - М (URS - 50 - I) x - ray recording unit. The absolute intensity I_{hkl} of the reflexes was determined from experimental data, and the structural factors f_1(Sb) and f_2(In) were calculated. The logarithms of f_1 at $\sum_{i=1}^{3} h_i^2 > 8$ and f_2

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S/020/62/143/001/026/030
B101/B147

Electron density distribution ...

at $\sum_{i=1}^{3} h_i^2 > 11$ form a straight line. The straight sections are characterized by $f_{Sb}(0) = 44.46$, $\tan_{Sb}\vartheta = 0.02$; $f_{In}(0) = 39.65$, $\tan_{In}\vartheta = 0.019$. The electron density distribution follows the Gauss function $\rho_1 = A \exp(-\alpha r_1^2)$, with $A_{Sb} = 323.084$; $A_{In} = 317.414$; $\alpha_{Sb} = 11.780$; $\alpha_{In} = 12.396$. Increased electron density between In and Sb ions was observed in the (110) plain: between 000 and 1/4 1/4 1/4, and betwenn 1/4 1/4 1/4 and 111 along [111], and also between 1/4 1/4 1/4 and 001 along [113]. In the plane with the electron density 0.5 el/Å^3, the ionic radius of Sb is 1.00 Å, that of In is 1.05 Å. In the 0.25 el/Å^3 plane, the ionic radii of both Sb and In are 1.40 Å. There are 4 figures and 5 references: 4 Soviet and

Card 2/3

1 non - Soviet. The reference to the English-language publication reads as follows: G. Giesecke, H. Pfister, Acta Cryst., 11, no. 5 (1958).

ASSOCIATION: Otdel fiziki tverdogo tela i poluprovodnikov Akademii nauk BSSR (Department of Solid State and Semiconductor Physics of the Academy of Sciences BSSR)

SUBMITTED: October 21, 1961

Card 3/3

S/020/62/143/002/017/022
B145/B138

AUTHORS: Sirota, N. N., Member of the AS BSSR, and Olekhnovich, N. N.

TITLE: Electron density distribution in aluminum arsenide at 20 and -100°C

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 143, no. 2, 1962, 370 - 372

TEXT: In a study of compounds $A^{III}B^{V}$, the atomic scattering factors of aluminum and arsenide ions in aluminum arsenide were determined. The measurement and calculation methods had been described earlier (DAN, 136, no. 3, 660 (1961)). The samples were obtained from the initial components using the two-temperature method (evacuated quartz ampoules, 650 and 1150°C, duration of synthesis 5 hrs). The arsenide crystals were comminuted in argon atmosphere to a particle size below 15 - 20 μ. The diagrams were plotted using a [illegible] - 50, (URS - 50 I) instrument with a Geiger counter and Cu K_α radiation in argon atmosphere. A cold N_2 jet was applied for low-temperature measurements. Results show that the curves in the

Card 1/3

Electron density distribution ...

$\ln f_i - \sum_{j=1}^{3} h_j^2$ diagram approach a linear course as from $\sum_{j=1}^{3} h_j^2 > 12$.

The density distribution for this part of electrons can therefore be described by the Gaussian curve $\rho_1 = A \exp(-ar^2)$. The resulting data, characterized by ρ_1 (See Table 1), show that, with a temperature drop, ρ_1 changes in such a way that the height of the Gaussian curve grows near the atomic center, whereas the dispersion of the curve itself becomes less. The distribution in the outer part of the ions is characterized by ρ_2, which is determined by the difference $f_2 = f - f_1$ (f being the experimental value of atomic scattering factors and f_1 the value calculated from the Gaussian distribution). On a temperature drop, f_2 grows both with Al and with As. In other words, the electron density distribution changes in the outer part of the ions. The analysis of electron density distribution

Card 2/4

Electron density distribution ...

diagrams shows that, with a temperature drop, the electron density between adjoining aluminum and arsenide ions rises somewhat in the [111] direction, whereas in the (110) plane the zone of low electron density expands considerably in the [110] direction. It is concluded that the electron density distribution has to be systematically investigated at different, and especially at low, temperatures. Ye. M. Cololobov and A. U. Sheleg helped in working out the methods of low-temperature measurements. There are 4 figures, 1 table, and 3 Soviet references.

ASSOCIATION: Otdel fiziki tverdogo tela i poluprovodnikov Akademii nauk BSSR (Departement of Solid-state and Semiconductor Physics of the Academy of Sciences BSSR)

SUBMITTED: November 9, 1961

Card 3/4

35518

S/020/62/143/003/012/029
B104/B102

24.7700 (1043, 1055, 1385)

AUTHOR: Sirota, N. N., Member of the AS BSSR

TITLE: Temperature dependence of the electric conductivity of solids

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 143, no. 3, 1962, 567 - 569

TEXT: On the assumption that the reciprocal relaxation time in a crystal lattice is proportional to the sum of the mean squares $\overline{u^2_{S,T}}$ of the dynamic, and the mean squares $\overline{u^2_{S,C}}$ of the statistical shifts of the ions from the equilibrium positions, $\rho = \frac{2m^*}{ne^2}(\overline{u^2_{S,T}} + \overline{u^2_{S,C}})$ holds for the electric resistivity. m* is the effective electron mass, e the electron charge, n the effective electron concentration. $\overline{u^2_{S,T}}$ can be calculated by the Debye-Waller theory for the temperature factor M_T of X-ray scattering in a lattice if the characteristic temperature Θ is known:

$$\overline{u^2_{S,T}} = \frac{3h^2}{MK\Theta}\left[\frac{\Phi\chi}{\chi} + \frac{1}{4}\right] = \frac{M_T}{8\pi^2}\frac{\lambda^2}{\sin^2\vartheta}, \quad (4).$$

Card 1/ 3

Temperature dependence of ...

$\bar{\Phi}(\chi) = \frac{1}{\chi}\int_0^{\chi}\frac{x\,dx}{e^x-1}$, $\chi = \frac{\Theta}{T}$, M is the ion mass.

$$\rho_T = \frac{6m^*\hbar^3}{ne^2Mk\Theta}\left[\left(\frac{T}{\Theta}\right)^2\int_0^{\Theta/T}\frac{x\,dx}{e^x-1}+\frac{1}{4}\right],$$

(5) is obtained from both equations. It describes the temperature dependence of the resistivity of a metal with constant electron concentration and with constant m^*. If the electron concentration depends on temperature in the form $n = n_o\exp(-\Delta E/2kT)$,

$$\rho_T = \frac{6m^*\hbar^3}{ne^2Mk\Theta}e^{\Delta E/2kT}\left[\left(\frac{T}{\Theta}\right)^2\int_0^{\Theta/T}\frac{x\,dx}{e^x-1}+\frac{1}{4}\right].$$

(6) is obtained for the resistivity. With combined (n+p) conductivity

$$\rho_T = \frac{6\hbar^2}{Mk\Theta}\left[\left(\frac{T}{\Theta}\right)^2\int_0^{\Theta/T}\frac{x\,dx}{e^x-1}+\frac{1}{4}\right]\times$$

$$\times\left(A_e e^{\Delta E_e/2kT}+A_p e^{\Delta E_p/2kT}\right).$$

(7) is obtained if $m_e^*/n_{Oe}e^2 = A_e$ and $m_p^*/n_{Op}^+e^2 = A_p$. The temperature dependence of the electric conductivity is determined

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by functions of the characteristics temperature and the activation energy. The latter is directly related to the lattice energy. Hence, the electric conductivity considerably depends on the lattice energy. For metals in which the current is conducted both by metal electrons and by electrons bound to impurities,

$$\rho = \rho_0 + \frac{6m^* \hbar^2}{n_0 e^2 k M \theta}\left[\frac{\Phi(\chi)}{(\chi)} + \frac{1}{4}\right]\frac{B}{1 + \frac{n_{01} m_1^*}{n_0 m^*} e^{-\Delta E/kT}}. \quad (8)$$

... (?) is obtained. There are 3 figures and 6 references: 1 Soviet and 5 non-Soviet.

ASSOCIATION: Otdel fiziki tverdogo tela i poluprovodnikov Akademii nauk BSSR (Department of Splid State Physics and Semiconductors of the Academy of Sciences BSSR)

SUBMITTED: November 15, 1961

Card 3/3

Dependence of the temperature ...

only harmonic vibrations are considered. The mean square displacement $\overline{u^2_{S,T}}$ of coupled lattice oscillators of a gram-atom of a solid is given by $\overline{u^2_{S,T}} = \frac{\hbar^2 n(p/n)^{(p+1)/n}}{mk\theta\,\Gamma((p+1)/n)} \left\{\frac{1}{2}\frac{\Gamma(p/n)}{n(p/n)^{p/n}} + \frac{1}{X^p} I(X,p,n)\right\}$, where $1/X = kT/h\nu_o$; $x = h\upsilon/kT$; $\theta = h\upsilon_o/k$; $\beta = (p/n)(T/\theta)^n$; $I(X,p,n) = \int_0^\infty \frac{x^{p-1}e^{-\beta x^n}}{e^x - 1}dx$. As the equation $B_T = 6\pi^2 \cdot \overline{u^2_{S,T}}$ relates the temperature coefficient to the mean square displacement, one has $B_T = \frac{2h^2}{mk\theta}\frac{n(p/n)^{(p+1)/n}}{\Gamma((p+1)/n)}\left\{\frac{1}{2}\frac{\Gamma(p/n)}{n(p/n)^{p/n}} + \frac{1}{X^p}I(X,p,n)\right\}$. For a special case where $p = 2$ and $n = 1$, one finds: $B_T = \frac{4h^2}{mk\theta}\left\{\frac{1}{4} + \frac{2}{X^2} I_{2,1}(X)\right\}$. For the Gauss frequency spectrum $dz = Ae^{-a\Delta\upsilon^2}\,d\upsilon$ one obtains $\overline{u^2_{S,T}}$ (Gauss) $= (4h/4\pi^2 m)\sqrt{a/\pi}\left[\frac{1}{4} + 2\varphi(X)\right]$ and

Card 2/3

38111

S/020/62/144/002/024/028
B101/B110

24 7000

AUTHORS: Sirota, N. N., Academician AS BSSR, and Gololobov, Ye. M.

TITLE: Atomic scattering factors and electron density distribution in aluminum antimonide at 20 and -100°C

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 144, no. 2, 1962, 398 - 401

TEXT: Concluding a series of studies on atomic scattering factors of antimonides the authors give the scattering factors of the AlSb ions and the electron density in AlSb as determined by a method described earlier (DAN, 143, no. 2 (1962)). The squares F^2 of the structural amplitudes are calculated from the intensity of the powder pattern reflexes (cf. Fig. 1). The following values were obtained for the Gaussian distribution $\rho_1 = Al_3^{-\alpha r^2}$ of the electron density: at 20°C: $A_{Al} = 62.381$; $\alpha_{Al} = 11.587$; $A_{Sb} = 418.413$; $\alpha_{Sb} = 14.716$; at - 100°C: $A_{Al} = 68.951$; $\alpha_{Al} = 12.411$; $A_{Sb} = 466.46$; $\alpha_{Sb} = 15.871$. The electron density distribution in the [111] and [113] directions of the (110) plane of the unit cell does not essentially differ from that of GaSb and InSb. Estimation of the ionic radii gives the following

Card 1/3

Atomic scattering factors and ...

values in the plane with 1 el/Å electron density: r_{Al} = 0.6 Å, r_{Sb} = 0.93 Å, and in the plane with 0.5 el/Å electron density: r_{Al} = 0.75 Å, r_{Sb} = 1.2 Å. The characteristic temperatures Θ for AlSb, GaSb, and InSb are 320, 240, and 210°K, respectively. The data serve as a contribution to the investigation of interatomic interaction in $A^{III}B^{V}$ semiconductors. There are 4 figures. The most important English-language reference is: G. Gisecke, H. Pfister, Acta Crystallogr., 11, pt. 5 (1958).

ASSOCIATION: Otdel fiziki tverdogo tela i poluprovodnikov Akademii nauk BSSR (Department of Solid-state Physics and Semiconductors of the Academy of Sciences BSSR)

SUBMITTED: January 26, 1962

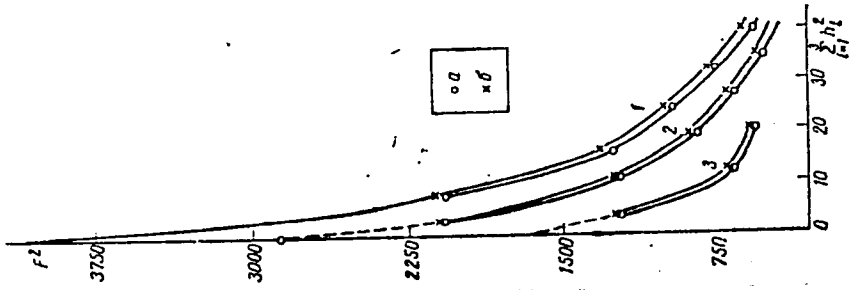
Fig. 1. F^2 as a function of $\sum_{i=1}^{3} h_i^2$: (1) for reflexes with even indices, whose sum is divisible by four; (2) for reflexes with odd indices; (3) for reflexes with even indices whose sum is indivisible by four; (a) at 20°C;

Card 2/3

Atomic scattering factors and ...

(б) at -100°C.

Fig. 1



Card 3/3

S/020/62/147/006/017/034
B104/B180

AUTHORS: Sirota, N. N., Academician AS BSSR, Sheleg, A. U.

TITLE: Diamagnetic susceptibility and electron density distribution in grey tin

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 147, no. 6, 1962, 1344-1347

TEXT: The aim was to determine experimentally the atom-scattering f of grey tin at room temperature and at -100°C and to find the electron density distribution in the crystal from it. The grey tin was obtained from high-purity white tin by recrystallization between -10 and -20°C. The CuK_α-radiation reflexions from powder compact samples, were taken on a УРС-50И (URS-50I) apparatus with GM counters. Results: From the graph $\ln f_{Sn}$ as function of $\sum_i h_i^2$, where h_i is the lattice index, it follows that f is a Gaussian curve, if $h_i^2 > 16$. Using a method given by N. N. Sirota, A. U. Sheleg and N. M. Olekhnovich (DAN, 132, no. 1, (1960)) the

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S/020/62/147/006/017/034
B104/B180

electron density distribution $\varrho = \varrho_1 + \varrho_2$ in plane (110) of the grey tin crystal lattice is calculated. For the parameters A and α in the relation $\varrho_1 = A\exp(-\alpha r^2)$ the values A = 406,31 and α = 15.708 were obtained for room temperature and A = 571,98 and α = 19.637 for -100°. The ϱ_2 distribution was obtained by summation of a three-dimensional Fourier series. Results: As with diamond, silicon and germanium, in grey iron there is a "bridge" with density of 0.37 electrons/$Å^3$, lying in the [111] direction between neighboring atoms with coordinates 000 and 1/4, 1/4, 1/4. Temperature changes hardly touch this value. In the sites 1/2, 1/2, 1/2 and 3/4, 3/4, 3/4 electron density minima, 0.05 electrons/$Å^3$ and 0 respectively, were found. A temperature drop raises the maxima and lowers the minima. The diamagnetic susceptibility $\chi = 38 \cdot 10^{-6}$ calculated from the electron density distribution according to N. N. Sirota (DAN, 142, no. 6 (1962)) agrees satisfactorily with experimental data. There are 4 figures.

ASSOCIATION: Otdel fiziki tverdogo tela i poluprovodnikov Akademii nauk BSSR (Division of Solid State and Semiconductor Physics of the Academy of Sciences BSSR)

S/020/62/147/006/017/034
B104/B180

Diamagnetic susceptibility ...

SUBMITTED: June 22, 1962

Card 3/3

SIROTA, N.N., akademik, otv. red.; SOTSKOV, B.S., red.; ROZENBLAT, M.A., prof., red.; BASHKIROV, L.A., kand. khim. nauk, red.; KHOLYAVSKIY, S., red.izd-va; VOLOKHANOVICH, I., tekhn. red.

[Ferrites and contactless elements] Ferrity i beskontaktnye elementy; doklady. Minsk, Izd-vo AN BSSR, 1963. 418 p. (MIRA 17:3)

1. Vsesoyuznoye soveshchaniye po ferritam i po beskontaktnym magnitnym elementam avtomatiki. 3d, Minsk. 2. Akademiya nauk Bel.SSR (for Sirota). 3. Chlen-korrespondent AN SSSR (for Sotskov).

SIROTA, N. N. and VARIKASH, V. M.

"Change of X-ray Diffraction and Physical Properties of Triglycine Sulfate at the Curie Point."

report presented at the Symposium on Ferroelectricity and Ferromagnetism, Leningrad, 30 May - 5 June 1963.

Solid solutions in the system InP-GaP. N. N. Sirota, V. V. Rozov.

Investigation of solid solutions of InP-GaAs. N. N. Sirota, L. A. Makovetskaya.

Physical properties of the system ZnTe-CdTe. N. N. Sirota, V. D. Yanovich.

Physical properties of ternary alloys of the system Zn_3As_2-Cd_3As_2. N. N. Sirota, E. M. Smolyarenko.

Semiconducting properties of manganese-telluride and selenide. N. N. Sirota, G. I. Makovetskiy.

Production of films of semiconducting compounds of the type $A^{V}B^{VI}$ and $A^{II}B^{V}$ on antimony by reactive diffusion. N. N. Koren', N. N. Sirota. (25 minutes). (Presented by N. N. Sirota).

Report presented at the 3rd National Conference on Semiconductor Compounds, Kishinev, 16-21 Sept 1963

ACCESSION NR: AT4035412 S/0000/63/000/000/005/0010

AUTHOR: Sirota, N. N.

TITLE: The kinetics of irreversible processes in the magnetization reversal of ferrites with a rectangular hysteresis loop

SOURCE: Vsesoyuznoye soveshchaniye po ferritam i po beskontaktny*m magnitny*m elementam avtomatiki. 3d, Minsk. Ferrity* i beskontaktny*ye elementy* (Ferrites and noncontact elements); doklady* soveshchaniya. Minsk, Izd-vo AN BSSR, 1963, 5-10

TOPIC TAGS: computer, magnetic core storage, ferrite, ferrite magnetization, magnetization reversal

ABSTRACT: In a theoretical treatment of the multitude of elementary processes involved in ferrite magnetization reversal (generation and growth of centers influenced by the direction of the field and magnetization axes, reorientation of domains and other effects), the author identifies two possible approaches in the study - a minute analysis of the microscopic mechanism of domain wall movement and magnetization vector rotation, and a static macroscopic investigation of the birth and growth of reversal centers in which the domain growth rate is taken into account. Proceeding from the theory of crystallization and the fundamental ex-

Card 1/2

SIROTA, N.N.; KHACHATRYAN, Yu.M.

Effect of hydrostatic pressure on the susceptibility of copper-zinc ferrites. Fiz. tver. tela 5 no.11:3110-3112 N '63. (MIRA 16:12)

1. Otdel fiziki tverdogo tela i poluprovodnikov AN BSSR, Minsk.

S/250/63/007/003/004/006
A059/A126

AUTHORS: Sirota, N.N., Koren', N.N.

TITLE: The reactive diffusion constants and the main physical parameters of the semiconducting compounds $A^{II}B^{VI}$ and $A^{II}B^{V}$

PERIODICAL: Doklady Akademii nauk BSSR, v. 7, no. 3, 1963, 160 - 162

TEXT: The relation between parameters characterizing the interatomic interaction energy in the compounds of zinc with elements of the 5th and 6th groups of the periodic system, and the constants of reactive diffusion of these elements into zinc are established. Starting from the general expression of the reactive diffusion coefficient given as a function of temperature

$$D = D_0 e^{-Q/RT},$$

the relation between the factor D_0 and the activation energy of diffusion, on the one hand, and the characteristic temperatures, heats of formation, fusion temperatures, and lattice energies of the forming compounds on the other, is examined. Reactive diffusion is accompanied by the formation of films of the semi-

Card 1/3

The reactive diffusion constants and the ....

conducting compounds mentioned on the surface of single crystals of zinc. The activation energy of diffusion was found to depend on the position of the relative element in the periodic system, and to decrease, for the case given, in the order ZnO — ZnS — ZnSe — ZnTe — ZnSb, which also holds for the heats of formation and the lattice energies of these compounds. The activation energy depends almost linearly on the heat of formation and the lattice energy, with the greatest deviation found for the relation between Q and ΔU. The relation between the activation energies of diffusion and the fusion temperatures of the compounds forming in the reactive diffusion of the elements of the 6th group into zinc, is also almost linear. Thus, the mechanism of reactive diffusion is, without fail, connected with the diffusion of zinc and the elements of the 5th group through the semiconductor films formed, with the limiting factor being the diffusion through the compounds formed and not the formation of these compounds. The proportionality between the fusion temperature of the compounds forming in reactive diffusion and the activation energy of diffusion shows that the mean square shifts of the ions in these compounds are inversely proportional to their fusion temperature. The width of the forbidden zone of the compounds mentioned is the greater, the greater their heats of formation and the greater the activa-

The reactive diffusion constants and the ....

S/250/63/007/003/004/006
A059/A126

tion energy of reactive diffusion. There are 2 figures and 2 tables.

ASSOCIATION: Otdel fiziki tverdogo tela i poluprovodnikov AN BSSR (Department of Solid-State and Semiconductor Physics of the AS BSSR)

SUBMITTED: November 17, 1962

Card 3/3

SIROTA, N. N.
AID Nr. 989-1 13 June

InP-GaAs SYSTEM (USSR)

Sirota, N. N., and L. A. Makovetskaya. IN: Akademiya nauk BSSR. Doklady, v. 7, no. 4, Apr 1963, 230-232. S/250/63/007/004/002/005

The Department of Solid-State Physics and Semiconductors of the Belorussian Academy of Sciences has conducted a study of the quasi-binary InP-GaAs system. Nine alloys of the system with GaAs content increasing in steps of 10 mol % were synthesized from In, Ga, P, and As with purities of 99.995%, 99.95%, 99.999%, and 99.999%, respectively. Synthesis and subsequent homogenization (by zone melting) of the alloys were carried out at 1100 to 1300°C. X-ray diffraction patterns showed that the lattice constant "a" varied as follows with increasing GaAs content: 5.883 ± 0.002 Å for pure InP, a decrease to a minimum of 5.561 ± 0.002 Å at 40% GaAs, and then an increase to 5.563 ± 0.002 Å for pure GaAs. The microhardness–composition curve followed the reverse pattern: it increased from 420 ± 20 kg/mm² for pure InP to a maximum of 800 ± 20 kg/mm² at 50% GaAs and then dropped to 640 ± 50 kg/mm² for pure GaAs. Both phenomena are characteristic for systems with a continuous series of solid solutions. Microscopic examination confirmed that all the alloys tested have a single-phase structure. [WW]

Card 1/1

SIROTA, N.N.; KOREN', N.N.

Formation of semiconducting films of zinc telluride on zinc single crystals in reactive diffusion. Dokl. AN BSSR 7 no.6:373-375 Je '63. (MIRA 16:10)

1. Otdel fiziki tverdogo tela i poluprovodnikov AN BSSR.

L 18276-63 EWP(q)/EWT(m)/BDS AFFTC/ASD JD

ACCESSION NR: AP3006003 S/0250/63/007/007/0446/0448

60

AUTHOR: Sirota, N. N.; Rozov, V. V.

57

TITLE: Identity period in the crystal lattice and microhardness of indium phosphide-gallium phosphide solid solutions

SOURCE: AN BSSR. Doklady*, v. 7, no. 7, 1963, 446-448

TOPIC TAGS: A(III)B(V), A(III)B(V) compound, semiconductor, indium phosphide, gallium phosphide, indium phosphide gallium phosphide system, pseudobinary system, solid solution, indium gallium alloy, phosphorus, synthesis, zone leveling, traveling hot zone, microhardness, identity period, lattice constant, Vegard law

ABSTRACT: Because literature data are contradictory, the pseudobinary InP-GaP semiconductor system has been studied to ascertain whether solid solutions exist in the system. Samples of InP-GaP covering the entire composition range were synthesized in a two-zone furnace with simultaneous zone leveling by diffusion of molten In-Ga alloys from a phosphorus source in an evacuated quartz ampoule. A phosphorus pressure of 5—7 atm was maintained inside the ampoule by setting

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L 18276-63 3
ACCESSION NR: AP3006003

the temperature of the cool zone, that containing P, at 430C. The temperature in the traveling hot zone varied from 1100 to 1280C depending on composition. Unreacted metal was removed in warm HCl. The microhardness of the crystals thus obtained was measured with a PMT-3 apparatus, and the lattice constant was determined from x-ray powder patterns in a URS-50I ionization chamber with Cu K_α-radiation. The results of both measurements are given in Fig. 1 of the Enclosure. The data of Fig. 1 and of micrographic analysis disclosed the existence, in the high-temperature region at least, of a continuous series of InP-GaP solid solutions with an almost linear relationship between lattice constant and composition, in accordance with the Vegard law. Orig. art. has: 1 figure.

ASSOCIATION: Otdel fiziki tverdogo tela i poluprovodnikov AN BSSR (Department of Solid State and Semiconductor Physics, AN BSSR)

SUBMITTED: 21Feb63 DATE ACQ: 06Sep63 ENCL: 01

SUB CODE: PH, MA NO REF SOV: 002 OTHER: 002

Card 2/3

KOREN', N.N.; SIROTA, N.N.

Formation of Sb_2S_3, Sb_2Se_3, and Sb_2Te_3 films on antimony in the process of reactive diffusion. Dokl. AN BSSR 7 no.10:666-668 O '63. (MIRA 16:11)

1. Otdel fiziki tverdogo tela i poluprovodnikov AN BSSR.

ACCESSION NR: AP4002835 S/0250/63/007/011/0740/0742

AUTHOR: Makovetskiy, G. I.; Sirota, N. N.

TITLE: Dilatometric analysis of manganese selenide

SOURCE: AN BSSR. Doklady*, v. 7, no. 11, 1963, 740-742

TOPIC TAGS: manganese selenide, dilatometric analysis, stable modification, unstable modification

ABSTRACT: The experiments described are part of a series of systematic investigations of compounds of manganese and elements of group VI which are being carried out in the laboratory of the Otdel fiziki tverdogo tela i poluprovodnikov AN BSSR (Department of Solid State Physics and Semiconductors, AN BSSR). The immediate purpose of the present work was the investigation of the temperature dependence of the linear expansion coefficient within the 100 to 700K range. A quartz dilatometer with a reading accuracy of 0.002 mm in vacuum was used in the measurements. The specimens, 25—30 mm long and 5.2 mm in diameter, were obtained by sintering MnSe at 800C after the two components had been synthesized in quartz tubes by prolonged heating at 1100C.

Card 1/2

ACCESSION NR: AR4002835

The specimens, according to analyses, were single-phase. The results show a considerable anomaly of the coefficient at about 140—150K, presumably caused by antiferromagnetic conversion. At 260—270K the dilatometric curve contracts appreciably. A considerable temperature hysteresis was observed during the cooling process, accompanied by expansion of the specimen with cooling between 180 and 160K. X-ray graphs of lattice modification, taken at room temperature and at 197K, show, in the latter case, the presence of lines characteristic of non-stable low-temperature modification of MnSe, whose specific volume appreciably exceeds that of high-temperature modification. Thus the anomalies observed in the 250—270K range cannot be ascribed to anti-ferromagnetic conversion, but represent a polymorphic phenomenon. Orig. art. has: 2 figures.

ASSOCIATION: Otdel fiziki tverdogo tela i poluprovodnikov AN BSSR (Department of Solid State Physics and Semiconductors, AN BSSR)

SUBMITTED: 23Jul63 DATE ACQ: 03Jan64 ENCL: 00

SUB CODE: PH NO REF SOV: 003 OTHER: 007

Card 2/2

ACCESSION NR: AP4007444 S/0250/63/007/012/0805/0806

AUTHOR: Sirota, N. N.; Khachatryan, Yu. M.

TITLE: Effect of hydrostatic pressure on the Curie point of nickel-copper-zinc ferrites

SOURCE: AN BSSR.. Doklady*, v. 7, no. 12, 1963, 805-806

TOPIC TAGS: pressure effect, nickel ferrite, copper ferrite, zinc ferrite, Curie point, hydrostatic pressure, ferrite

ABSTRACT: This work describes an investigation of the temperature and pressure dependence of the magnetic permeability of two types of zinc ferrites, both containing 60 mol% zinc. In addition to zinc, one type contained 40 mol% $CuFe_2O_4$, the other, 30 mol% $NiFe_2O_4$ and 10 mol% $CuFe_2O_4$. The toroidal specimens 4.2 and 2.6 mm in diameter and 2—4 mm thick, were placed in a pressurizing medium of aviation gasoline, in which temperature control was effected by an electrically heated miniature pyrophyllite cylinder enclosing the specimen. Precautions were taken to ensure a constant temperature and magnetic field. The results show that both types have maximum permeability

Card 1/2

ACCESSION NR: AP4007444

and the minimum Curie point at normal pressure. Increasing pressure causes a sharp drop in permeability and a slight rise in the Curie point without affecting the general character of the temperature dependence of the permeability of the specimens. The shift of the Curie point appeared as a linear function of pressure up to 8×10^3 kg/cm^2, but the curve was steeper for the three-component specimens (2.7×10^{-3} deg·cm^2/kg) than for the two-component specimens (1.52×10^{-3} deg·cm^2/kg). The permeability change as a function of pressure appeared to be a reversible process within the temperature range from 20 to 150C. Orig. art. has: 2 figures.

ASSOCIATION: Otdel fiziki tverdogo tela i poluprovodnikov AN BSSR (Department of Solid State Physics and Semiconductors, AN BSSR)

SUBMITTED: 27Jul63 DATE ACQ: 24Jan64 ENCL: 00

SUB CODE: PH NO REF SOV: 001 OTHER: 000

Card 2/2

S/020/63/148/001/013/032
B102/B186

AUTHORS: Sirota, N. N., Member of AS BSSR, Olekhnovich, N. M.

TITLE: Roentgenographic determination of the diamagnetic susceptibility of certain ion and semiconductor compounds

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 148, no. 1, 1963, 71 - 73

TEXT: The lattice magnetic susceptibility

$$\chi = \chi_d + \chi_p = -\frac{Ne^2}{6mc^2}\sum_i \overline{r_i^2} + \frac{2}{3}N\sum_{j\neq i}\frac{|M(j,i)|^2}{E_j - E_i}, \qquad (1)$$

is represented as the sum of the diamagnetic (Langevin) component and the paramagnetic (Van Vleck) component; M(j, i) is an off-diagonal element of the magnetic moment, $E_j - E_i$ the forbidden-band width, and $\sum_i r_i^2$ the sum of the mean squares of the electron orbit radii. The first term can be determined experimentally from the electron density of the lattice, the second from the amount that the electron density distribution deviates from spherical distribution. These terms were determined for the arsen-

Card 1/3

Roentgenographic determination ...

obviously a certain law. There are 2 tables.

ASSOCIATION: Otdel fiziki tverdogo tela i poluprovodnikov Akademii nauk BSSR (Department of Solid State and Semiconductor Physics of the Academy of Sciences BSSR)

SUBMITTED: July 27, 1962

Card 3/3

L 12410-63 EWT(l)/EWG(k)/EEC(b)-2/ES(s)-2/BDS AFFTC/ASD/ESD-3/SSD
Pz-4/Pt-4 AT/IJP(C)
ACCESSION NR: AP3001399 S/0020/63/150/004/0781/0783 13 10

AUTHOR: Sirota, N. N.

TITLE: Paramagnetic component of magnetic susceptibility of semiconductor crystals, evaluated from experimental data on electron density distribution

SOURCE: AN SSSR. Doklady, v. 150, no. 4, 1963, 781-783

TOPIC TAGS: paramagnetic component, magnetic susceptibility, semiconductor crystal, electron density distribution, diamagnetic component, neutron diffraction pattern, X-ray diffraction pattern

ABSTRACT: It was shown in a previous paper by the author (DAN, vol. 142, no. 6, 1962, page 1278) that the diamagnetic component of the magnetic susceptibility of semiconductor crystals can be determined by using electron density data found experimentally by X-ray or neutron diffraction patterns. However, it is known that the absolute value of the paramagnetic component in these crystals may be of the same order of magnitude as the diamagnetic one. Present work shows that it is also possible to determine the paramagnetic component in a similar manner. Since the square of the wave function is proportional to the electron density, the

Card 1/2

L 12410-63

ACCESSION NR: AP3001399

3

latter, experimentally determined, gives the expression of the wave function. The latter, in an analytical approximation, is to be used in the Van Flock paramagnetic term of susceptibility. "The author expresses his gratitude to N. M. Olekhnovitch and A. U. Sheleg for valuable discussions." Orig. art. has: 1 equation.

ASSOCIATION: Otdel fiziki tverdogo tela i polyprovodnikov, Akademii nauk BSSR (Division of Solid State Physics and Semiconductors, Academy of Sciences, BSSR)

SUBMITTED: 21Dec62 DATE ACQ: 01Jul63 ENCL: 00

SUB CODE: 00 NO REF SOV: 006 OTHER: 006

Card 2/2

L 15466-63 EWT(1)/BDS AFFTC/IJP(C)/ASD S/0020/63/151/005/1079/1080
ACCESSION NR: AP3005435

54
53

AUTHORS: Sirota, N. N. (Academician); Glekhnovich, N. M.

TITLE: Paramagnetic component of the magnetic susceptibility of semiconductor compounds A sup 3 B sup 4 determined by X-ray diffraction analysis

SOURCE: AN SSSR. Doklady*, v. 151, no. 5, 1963, 1079-1080

TOPIC TAGS: paramagnetic component of magnetic susceptibility, semiconductor, X-ray diffraction analysis, aluminum, gallium, indium, Al, Ga, In, paramagnetic component, magnetic susceptibility

ABSTRACT: An experimental method for determining the paramagnetic component of magnetic susceptibility by X-ray diffraction is developed further in this paper. It was applied for determination of the shape and deviation from spherical symmetry of the covalent "bridges" formed by Sp^3-electrons. The computational results for the paramagnetic component for arsenides and antimonides of aluminum, gallium, indium are given. Authors showed that X-ray diffraction method permits an independent determination of the dia- and paramagnetic moments. Orig.

ASSOCIATION: Department of solid state physics and semiconductors, Academy of Sci. BSSR

Card 1/2

SIROTA, N.N., akademik; SHELEG, A.U.

Magnetic susceptibility of semiconducting elements of the 4th group as determined by X-ray diffraction analysis. Dokl. AN SSSR 152 no.1:81-83 S '63. (MIRA 16:9)

1. Otdel fiziki tverdogo tela i poluprovodnikov AN BSSR. 2. AN BSSR (for Sirota).

(Semiconductors--Magnetic properties)
(X-ray diffraction examination)

GORSKIY, F.K., dots., otv. red.; VARIKASH, V.M., otv. red.;
SIROTA, N.N., akademik, red.

[Mechanism and kinetics of crystallization] Mekhanizm i kinetika kristallizatsii. Minsk, Nauka i tekhnika. 1964. 460 p. (MIRA 17:11)

1. Akademiya navuk BSSR, Minsk. Addzel fiziki tsverdaha tsela i paupravadnikoi. Nauchnyy sovet po fizike tverdogo tela.
2. Akademiya nauk Belorusskoy SSR (for Sirota).

S/0181/64/006/005/1267/1269

ACCESSION NR: AP4034901

AUTHORS: Pavlov, V. I.; Sirota, N. N.

TITLE: Time development of the impulsive reverse magnetization process in magnesium nickel manganese ferrite with rectangular hysteresis loop

SOURCE: Fizika tverdogo tela, v. 6, no. 5, 1964, 1267-1269

TOPIC TAGS: ferrite, magnetic property, magnetization, hysteresis loop

ABSTRACT: The characteristics of impulsive reverse magnetization as a function of time was investigated with the ferrite $(MgO)_{0.9}(NiO)_{0.3}(MnO)_{0.4}Fe_2O_3$, which has a rectangular hysteresis loop, a coercive force H_c = 1.1 oersted, and a maximum induction B_m = 2500 gauss. The time rate of change of the induction $\left(\frac{dB}{dt}\right)$ was measured as a function of time in fields of 2.56, 3.54, 4.20, 5.92, 6.88 oersteds. The change in time of the induction was found to be well described by the expression $\Delta B = (B_r + B_m)(1 - e^{-k\tau^m})$, where $k = \frac{\omega_s}{m}\left(\frac{k_s\sigma}{m-1}\right)^{m-1}$; k_s is

Card 1/2

ACCESSION NR: AP4011696 S/0250/64/008/001/0024/0025

AUTHORS: Sirota, N. N.; Shimanskaya, V. P.

TITLE: Lattice constant of zinc sulfide-cadmium sulfide solid solution films

SOURCE: AN BSSR. Doklady*, v. 8, no. 1, 24-25 1964

TOPIC TAGS: zinc sulfide, cadmium sulfide, ZnS CdS solid solution, lattice constant, ZnS CdS phase composition, ZnS CdS structure, vaporized coating, x ray apparatus URS 50I

ABSTRACT: Films of the binary system ZnS-CdS have been subjected to x-ray analysis in order to determine its phase composition, its structure, and its crystal lattice constant. Experiments were conducted directly after film deposition and also after a heat treatment of films which were produced by sublimating a pressed mixture of ZnS and CdS of a definite composition onto glass and quartz plates. The process was carried out in a vacuum of no less than 10^{-4} mm Hg. For CdS the temperature of the plates was held at 90C and for ZnS at 200C. After the deposition the samples were held in vacuum at 300C. Microscope inspection and x-ray analysis proved that the films were either polycrystalline or monocrystalline, the latter ranging from 0.5 to 1.6μ in thickness. They were monophase in type and

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ACCESSION NR: AP4014696

sphaleritic in structure. Lattice constant was calculated from x-ray photographs taken with apparatus URS-50I. Figure 1 of the Enclosure shows the relation of this constant to the composition of the solid solution. Lower rates of coating in vacuum and in hydrogen sulfide tended to produce monocrystalline film, while faster rates favored the polycrystalline ones. Orig. art. has: 1 graph and 2 micrographs.

ASSOCIATION: Institut fiziki tverdogo tela i poluprovodnikov AN BSSR (Institute of Solid State Physics and Semiconductors AN BSSR)

SUBMITTED: 01Aug63 DATE ACQ: 26Feb64 ENCL: 01

SUB CODE: PH NO REF SOV: 000 OTHER: 002

Card 2/2

S/0250/64/008/002/0087/0089

ACCESSION NR: AP4020379

AUTHORS: Danil'kevich, M. I.; Sirota, N. N.

TITLE: Electrical resistivity and the activation energy of nickel manganese zinc ferrites

SOURCE: AN BSSR. Doklady*, v. 8, no. 2, 1964, 87-89

TOPIC TAGS: electric conductivity, electric resistivity, ferrite, activation energy

ABSTRACT: The authors have studied the system $NiFe_2O_4$ - $MnFe_2O_4$ - $ZnFe_2O_4$ to determine the resistivity and activation energy in relation to composition and temperature. The samples were prepared from oxide powders and $MnCO_3$ by ordinary ceramic techniques. Resistivity was measured by the compensation method on cylindrical samples 20-30 mm long and about 8.5 mm in diameter in the temperature interval from 40 to 100C. Heating was maintained at each temperature for about 30 minutes. The activation energy was determined graphically by measuring the log of the resistivity in relation to the temperature, 1/T. The highest resistivity, about

Card 1/2

ACCESSION NR: AP4040920 S/0250/64/008/005/0289/0291

AUTHORS: Makovetskiy, G. I.; Sirota, N. N. (Academician)

TITLE: X-ray study of quasi-binary systems MnSe-MnTe

SOURCE: AN BSSR. Doklady*, v. 8, no. 5, 1964, 289-291

TOPIC TAGS: solid solution, lattice charge, single phase, quasi binary system, electrolytic manganese, oxide film, microhardness, tellurium, selenium, x ray instrument URS 50I, PMT 3 device

ABSTRACT: Propagation domains of solid solutions and laws governing lattice charges as a function of the state and single phase domains in quasi-binary systems were investigated by x-irradiation of MnSe-MnTe specimens. Electrolytic manganese was used, and its surface was kept clean of oxide films by heating in vacuum. Twice distilled (99.99 Te) Te and Se specimens were prepared by sintering in evacuated vials, under careful mixing. The x-ray instrument was a URS-50I device with K_{α} - copper radiation with a Geiger-Müller counter. The experimental results were depicted graphically in terms of lattice constants a(Å) and c(Å) versus mol% MnSe-MnTe. By increasing the Te content the lattice constant grows up

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ACCESSION NR: AP4040920

to a = 5.614 Å at 30% MnTe. On the other hand, increasing the MnSe content causes a linear drop in both c and a, down to c = 6.552 Å, a = 4.005 Å at MnSe content of 40%, whereas c/a grows to 1.636 in the same interval. Microhardness H measurements on the PMT-3 device indicate a sharp rise in the solid solution hardness from 90 kg/mm^2 at 0 MnTe to 223 kg/mm^2 at 30 mol% MnTe. On the other hand, H rises with MnSe content from 100 kg/mm^2 at 0 MnSe to 208 kg/mm^2 at 40% MnSe. These results show the presence of a wide range of solid solutions with selenide and telluride bases. Orig. art. has: 2 figures.

ASSOCIATION: Institut fiziki tverdogo tela i poluprovodnikov AN BSSR (Institute of Solid State Physics and Semiconductors AN BSSR)

SUBMITTED: 17Jan64 ENCL: 00

SUB CODE: SS NO REF SOV: 002 OTHER: 006

Card 2/2

ACCESSION NR: AP4042724 S/0250/64/008/006/0369/0371

AUTHOR: Danil'kevich, M. I.; Sirota, N. N.

TITLE: Dielectric permeability and conductivity activation energy of nickel-manganese-zinc ferrites

SOURCE: AN BSSR. Doklady*, v. 8, no. 6, 1964, 369-371

TOPIC TAGS: ferrite, nickel manganese zinc ferrite, semiconductor, dielectric permeability, electrical conductivity, conductivity activation energy

ABSTRACT: Disk-shaped samples of $NiFe_2O_4$ -$MnFe_2O_4$ -$ZnFe_2O_4$, 3.5-4.5 mm thick and 21 mm in diameter, with a constant manganese ferrite content of 20 wt.%, were used in a study of the relationship between electrical permeability, specific electrical resistance and temperature in ferrites. The dielectric permeability and the tangent of the angle of loss were determined at a frequency of 10^8 cps with the use of a Q-meter. The actual and apparent dielectric permeability were found from the total permeability and the tangent. When the activation energy of the ferrite systems was graphed against the square of the reciprocal of the dielectric permeability, a straight line relationship was obtained with a slope of about 46 $\pm$ 2 eV. The relationship between activation energy and zinc ferrite

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ACCESSION NR: AP4042724

content is shown in Fig. 1 of the Enclosure. As indicated, the experimental data agree with the results calculated from the formula

$$\Delta E = \frac{a^3 m^* e^4}{2\hbar^2 (\varepsilon')^2}$$

Orig. art. has: 2 figures, 1 formula and 1 table.

ASSOCIATION: Institut fiziki tverdogo tela i poluprovodnikov AN BSSR (Institute of solid state and semiconductor Physics, AN BSSR)

SUBMITTED: 23Jan64 ENCL: 01

SUB CODE: SS, EM NO REF SOV: 005 OTHER: 000

Card 2/3

ACCESSION NR: AP4042724

Enclosure 01

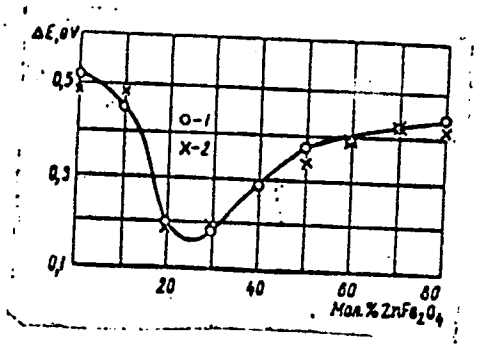

Fig. 1. Relationship between the activation energy of nickel-manganese-zinc ferrites and their zinc ferrite content: 1 - experimental data; 2 - values of ΔE calculated from the formula. Abscissa = mol. % $ZnFe_2O_4$.

Card 3/3

L 11470-65 EWT(1)/EWT(m)/T/EWP(t)/EEC(b)-2/EWP(b) IJP(c)/ASD(a)-5/AFWL/BSD/AS(mp)-2/APGC(b)/ESD(gs) GG/JD

ACCESSION NR: AP4044253 S/0250/64/008/007/0436/0437

AUTHOR: Sirota, N. N.; Shimanskaya, V. P. 8

TITLE: The width of the energy gap according to the absorption spectra of thin films of the ZnS-CdS system

SOURCE: AN BSSR. Doklady*, v. 8, no. 7, 1964, 436-437

TOPIC TAGS: zinc sulfide base compound, cadmium sulfide containing compound, zinc sulfide, cadmium sulfide, sulfide, zinc blende, sphalerite, energy gap, absorption coefficient, film, spectroscopy, semiconductor, optical filter, photoresistor

ABSTRACT: The width of the energy gap in ZnS-CdS systems with zinc blende structure was determined from measurements of the absorption on the the long-wavelength side of the edge. The values averaged from numerous experiments show that the gap width changes linearly, depending on the composition, from 3.6 ev for ZnS to 2.4 ev for CdS. The above data apply to 0.1- to 1-μ films of the investigated sulfides and their solid solutions vacuum deposited on glass or quartz substrata. Spectrophotometric measurements of the absorption spectra

Card 1/2

L 11470-65
ACCESSION NR: AP4044253

produced figures close to those obtained by other researchers (Gross, Ye. F., and B. S. Razbirin, FTTp 2, 1960, 11; Khansevarov, R. Yu., S. M. Ryvkin, and V. N. Ageyeva, ZhTF, 28, 1958, 480. The study has been prompted by the applicability of ZnS, CdS, and some intermediate compounds of thisquasi-binary system to various semiconductor techniques, including optical filters and photoresistors. Orig. art. has: 2 figures.

ASSOCIATION: Institut fiziki tverdogo tela i poluprovodnikov AN BSSR (Institute of Solid State Physics and Semiconductors, AN BSSR)

SUBMITTED: 12Feb64 ENCL: 00

SUB CODE: SS, IC NO REF SOV: 004 OTHER: 001

Card 2/2

L 15308-65 EWT(1)/EED-2 ESD(dp)
ACCESSION NR: AP4045690 S/0250/64/008/008/0505/0508

AUTHOR: Pavlov, V.I.; Sirota, N.N. B

TITLE: Some pulse characteristics of magnesium-nickel-manganese ferrites

SOURCE: ANBSSR. Doklady*, v. 8, no. 8, 1964, 505-508

TOPIC TAGS: ferrite, ferrite pulse property, ferrite magnetization, magnesium nickel manganese ferrite, remagnetization time

ABSTRACT: The authors present the basic results of an experimental determination of the remagnetization time τ, the output signal E_{out}, the ratio E_{int}/E_{out} of interface to output signals, and the threshold field H_0 for magnesium-nickel-manganese ferrites of the general formula $Mg_xNi_yMn_{1-x-y}Fe_2O_4$ with $x = 0.0 - 0.7$, $y = 0.0 - 0.3$. The experimental unit consisted of two rectangular-pulse generators which produced predetermined magnetizing and remagnetizing 10,000 cps pulses with a 0.1 μsec. front length and a 4 μsec. width, and a UO-1M oscillator as the indicator of the results. Ferrite toroids, 1.5 mm high and 2 (in) or 3 (out) mm in diameter, were the object of a study in which a remagnetizing pulse of 6.9, 5.9, 5.1, 4.2, 3.6, 2.6, or 1.8 e followed equal magnetizing pulses of 6.9 e. Value of E_{out} and E_{int}/E_{out} vs variations in ferrite composition, and

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L 15308-65
ACCESSION NR: AP4045690

values of $\frac{1}{\tau}$ for H = 6 e and H_0 vs variations in composition of ferrites with a rectangular hysteresis loop are shown in the Enclosure. The results show that the higher the manganese content, the greater E_{out} and $\frac{1}{\tau}$, and the lower the threshold field. Orig. art. has: 2 tables and 2 figures.

ASSOCIATION: Institut fiziki tverdogo tela i poluprovodnikov AN BSSR (Institute of Solid State Physics and Semiconductors, AN BSSR)

SUBMITTED: 17Mar64 ENCL: 02 SUB CODE: EM, SS

NO REF SOV: 004 OTHER: 000

Card 2/4

L 15308-65
ACCESSION NR: AP4045690

ENCLOSURE: 01

D

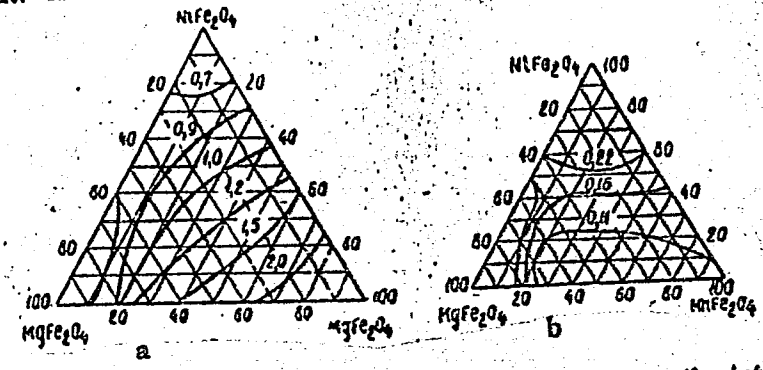

Fig. 1. Dependence of the output signal (a) and the ratio between the interference and output signals (b) on the ferrite composition in the ternary system $Mg_xNi_yMn_{1-x-y}Fe_2O_4$ (H = 6 e).

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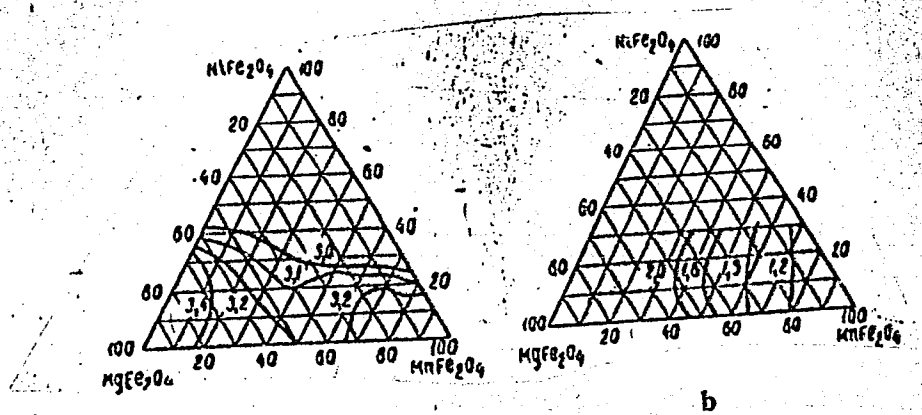
L 15308-65
ACCESSION NR: AP4045690

ENCLSOURE: 02



a b

Fig. 2. Dependence of the reciprocal of the remagnetization time for H = 6 e (a) and the threshold field H_0 (b) on the ferrite composition in the ternary system $Mg_xNi_yMn_{1-x-y}Fe_2O_4$, having a rectangular hysteresis loop.

Card 4/4

L 13806-65 EWT(m)/EWP(t)/EWP(b) IJP(c)/AFMD(t)/AFWL/ASD(a)-5/SSD/RAEM(a)/ESD(t) JD

ACCESSION NR: AP4047006 S/0250/64/008/009/0572/0574

B

AUTHOR: Makovetskaya, L. A.; Sirota, N. N.

TITLE: Width of the forbidden band in solid solutions of indium phosphide and gallium arsenide, determined by the edge of the main optical absorption band

SOURCE: AN BSSR. Doklady*, v. 8, no. 9, 1964, 572-574

TOPIC TAGS: absorption band, optical density, solid solution, forbidden band width, indium phosphide, gallium arsenide

ABSTRACT: The authors made a systematic study of the variation in optical density of samples (10 compositions) of InP-GaAs solid solutions as a function of wavelength from 0.2 to 2 μ. Slices were cut from polycrystalline ingots of InP-GaAs, obtained by synthesis in a two-temperature oven and zone-equalizing, and optically polished to 10.35 μ. Curves of optical density as a function of wavelength are given for various proportions of the raw materials as well as a derived curve showing the width of the forbidden band. Deviations of the lattice constant, from a straight line in the direction of compression, agreed with the deviation of width of the forbidden band from the additive straight line in an increasing direction, and were proportional thereto in the first approximation. A table shows the optical trans-

Card 1/2

L 13805-65
ACCESSION NR: AP4047006

mission and wavelength at the edge of the absorption band for various proportions of the materials, and sample thicknesses. This shows that the forbidden band of such solid solutions may be wider than that of the constituent materials when pure, and that the solid solution is formed with a negative heat effect. These widths are in agreement with those obtained by previous workers. Orig. art. has: 1 table and 2 figures.

ASSOCIATION: Institut fiziki tverdogo tela i poluprovodnikov (Institute of Solid State and Semiconductor Physics)

SUBMITTED: 12Apr64 ENCL: 00

SUB CODE: SS NO REF SOV: 004 OTHER: 003

Card 2/2

L 23465-65 EWT(1)/EWG(k)/EWT(m)/T/EWP(t)/EWP(b)/EWA(h) Pz-6/Peb IJP(c)
JD/AT
ACCESSION NR: AP5001198 S/0250/64/008/010/0632/0633

AUTHOR: Sirota, N. N.; Makovetskaya, L. A.

TITLE: Electric conductivity and the width of the forbidden zone in solid solutions of indium phosphide-gallium arsenide semiconductor compounds

SOURCE: AN BSSR. Doklady, v. 8, no. 10, 1964, 632-633

TOPIC TAGS: semiconductor compound, indium phosphide, forbidden zone width, gallium arsenide, electric conductivity, solid solution compound, solid solution, compound forbidden zone

ABSTRACT: A study has been made of the temperature dependence of the electric conductivity of InP-GaAs alloy at temperatures from -170 to 750C in an attempt to determine the width of the forbidden zone on the basis of the temperature dependence of intrinsic conductivity. It was found that in the range of temperatures from that of liquid nitrogen up to about 500C the conductivity is extrinsic, and only above 500—600C does it become intrinsic. The width of the forbidden

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L 23465-65

ACCESSION NR: AP5001198

zone of InP-GaAs alloys depends upon its composition (see Fig. 1 of the Enclosure); the maximum width of the zone is observed in the alloy with 50—60% GaAs content. Thus, in the quasi-binary InP-GaAs system there is a substantial deviation from the additivity principle in relation to the forbidden zone, which is apparently associated with a similar deviation in relation to the energy of the solid-solution lattice. Orig. art. has: 2 figures and 1 table. [ND]

ASSOCIATION: Institut fiziki tverdogo tela i poluprovodnikov AN BSSR (Institute of Solid-State Physics and semiconductors, AN BSSR)

SUBMITTED: 15Jul64 ENCL: 01 SUB CODE: SS, EM

NO REF SOV: 003 OTHER: 002 ATD PRESS: 3174

Card 2/3

L 23465-65
ACCESSION NR: AP5001198

ENCLOSURE: 01

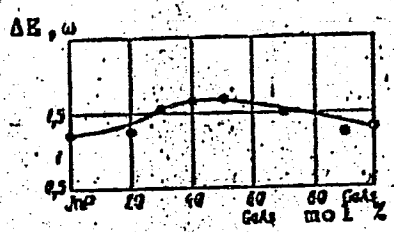

Fig. 1. Composition dependence of the activation energy on the width of the forbidden zone in indium phosphide-gallium arsenide alloys

Card 3/3

L 30061-65 EPA(s)-2/EWT(m)/EPF(n)-2/T/EWP(t)/EWP(b) Pt-10/Pu-4 IJP(c)
JD/WW/JG

ACCESSION NR: AP5002538 S/0250/64/008/011/0702/0704

44
43
B

AUTHOR: Koren', N.N.; Sirota, N.N.

TITLE: Reactive diffusion of cadmium from the vapor phase into antimony

SOURCE: AN BSSR. Doklady, v. 8, no. 11, 1964, 702-704

TOPIC TAGS: diffusion layer, single crystal, crystal microstructure, isotropic layer growth, antimony, cadmium diffusion, cadmium antimonide

ABSTRACT: Results of the diffusion impregnation of antimony single crystals by cadmium in the vapor phase are presented. Experiments were carried out by a method previously described by the authors. Heating of the single crystal resulted in the formation of a close, compact, single-phase compound layer on the surface of the sample. This layer consisted of large crystalline grains elongated perpendicular to the surface. Radiograms of the diffusion layers did not distinguish them from the sample and were comparable to radiograms of polycrystalline cadmium antimonide. The average hardness of the cadmium-antimony system was 210 kg/mm^2. A plot of the square of the measured layer thickness against time shows a linear dependence for temperatures from 300 to 430C. To study layer growth, the antimony sample thickness was measured before diffusion,

Card 1/2

L 30061-65
ACCESSION NR: AP5002538

the diffusion period was timed, and the thickness of the formed layer and of the pure metal remaining was measured. A mutual diffusion of both elements was revealed, cadmium diffusion producing a greater layer thickness. An evaluation of the partial diffusion coefficient showed that this layer growth limits the interaction of the elements through the compound formed. Layer growth appeared to be isotropic. Orig. art. has: 1 table, 2 figures and 3 formulas.

ASSOCIATION: Institut fiziki tverdogo tela i poluprovodnikov AN BSSR (Solid body and semiconductor physics institute, AN BSSR)

SUBMITTED: 15Jul64 ENCL: 00 SUB CODE: SS

NO REF SOV: 006 OTHER: 001

Card 2/2

S/0048/64/028/004/0666/0668

ACCESSION NR: AP4030640

AUTHOR: Sirota, N.N.; Varikash, V.M.; Ovseychuk, E.A.

TITLE: Changes in the intensity of x-ray scattering by triglycine sulfate at the Curie point /Report, Symposium on Ferromagnetism and Ferroelectricity held in Leningrad 30 May to 5 June 1963/

SOURCE: AN SSSR. Izv. Ser.fiz., v.28, no.4, 1964, 666-668

TOPIC TAGS: Triglycine sulfate, triglycine sulfate Curie point anisotropy, triglycine sulfate x-ray reflection

ABSTRACT: The intensity of a number of x-ray reflections from triglycine sulfate was measured at temperatures from 0° to 90°C. Copper Kα radiation was employed. After it was ground to a powder, the sample was annealed for 24 hours at 70°C. The temperature was held constant to within ±0.3°C during measurement. The intensity of the reflections was determined from the number of counts recorded by a mechanical counter during the exposure, and also from the area under the curve traced by a recording galvanometer. The intensity of some reflections (including (024) and (344)) decreased monotonically with increasing temperature over the full range investigated.

Card 1/2

ACCESSION NR: AP4040949 S/0020/64/156/005/1075/1078

AUTHOR: Sirota, N. N. (Academician, AN BSSR); Gololobov, Ye. M.

TITLE: Experimental determination of magnitude of effective ion charges in A sup III B sup V compounds by X-ray data

SOURCE: AN SSR. Doklady*, v. 156, no. 5, 1964, 1075-1078

TOPIC TAGS: ion charge, effective ion charge, solid state physics, solid state circuitry, A sup III B sup V compound, semiconductor

ABSTRACT: The authors attempted an experimental determination of the magnitude and sign of the effective ion charge in A ^{III} B ^{V} compounds of a sphalerite structure by X-ray analysis data. The absolute values of F_{200} for this type of compound were thoroughly defined. The experimentally defined values of the structural amplitudes of the line (200) correspond to a true difference of the atom scattering factors of the ions in an A ^{III} B ^{V} compound under an actually existing degree of ionization. Compounds in this series included AlP, GaP, InP, AlAs, GaAs, InAs, AlSb, GaSb and InSb. The authors found that the third group elements--metals--lose electrons and become positively charged ions. The B ^{V} elements accept electrons and become negatively charged ions. "Authors express

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ACCESSION NR: AP4040949

their thanks to N. M. Olekhovich for valuable discussions." Orig. art. has: 1 figure and 2 tables.

ASSOCIATION: Institut fiziki tverdogo tela i poluprovodnikov Akademii nauk BSSR (Institute of Solid State Physics and Semiconductors, Academy of Sciences, BSSR)

SUBMITTED: 12Mar64

ENCL: 00

SUB CODE: SS, NP

NO REF SOV: 004

OTHER: 008

Card 2/2

SIROTA, N.N., akademik, otv. red.; DORFMAN, Ya.G., prof., red.; OLEKHNOVICH, N.M., kand. fiz.-matem. nauk, red.; GOLODUSHKO, V.Z., red.

[Chemical bonds in semiconductors and solids] Khimicheskaia sviaz' v poluprovodnikakh i tverdykh telakh. Minsk, Nauka i tekhnika, 1965. 366 p. (MIRA 18:7)

1. Akademiya nauk BSSR, Minsk. Institut fiziki tverdogo tela i poluprovodnikov.

L 44353-65 EWT(1)/EWT(m)/EWG(m)/EWP(t)/EWP(b) IJP(c) RDW/JD
ACCESSION NR: AP5006351 S/0250/65/009/001/0015/0017

17
16
13

AUTHOR: Makovetskiy, G. I.; Sirota, N. N.

TITLE: Electrical conductivity and thermal emf of manganese selenide

SOURCE: AN BSSR. Doklady, v. 9, no. 1, 1965, 15-17

TOPIC TAGS: manganese compound, electric conductivity, thermal emf, polymorphic transformation

ABSTRACT: The temperature dependence of electric conductivity and thermal emf of manganese selenide was investigated in the temperature range 130 - 800K for the purpose of studying the transformation occurring in this temperature interval. The measurements were made on manganese selenide samples in the form of cylinders 5.2 mm in diameter and 25 - 30 mm long, sintered from powder in vacuum. The technology of sample preparation was described earlier (DAN BSSR no. 11, 1963). The electric conductivity was determined by measuring the voltage drop across a fixed section of the sample with a potentiometer. The thermal emf was measured relative to copper in vaccum for both rising and falling temperatures. Plots of the elec-

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L 44353-65
ACCESSION NR: AP5006861

tric conductivity, of the thermal emf, and of the temperature coefficient of electric resistivity against the temperature exhibit several kinks corresponding to a polymorphic transformation at 250 - 270K and two modifications occurring at 390 and 600 - 670K. A value of 0.68 - 0.70 eV is deduced for the width of the forbidden band of manganese selenide, and a value ~0.6 eV is obtained for the activation energy. Orig. art. has: 2 figures.

ASSOCIATION: Institut fiziki tverdogo tela i poluprovodnikov AN BSSR (Institute of Solid State and Semiconductor Physics, AN BSSR)

SUBMITTED: 29Jul64 ENCL: 00 SUB CODE: SS, EM

NR REF SOV: 002 OTHER: 002

Card 2/2

L 52234-65 EPR/EWG(c)/EWT(l)/EWT(m)/EWG(m)/EWP(b)/T/EWA(d)/EWP(w)/EWP(t) Ps-4/
Pz-6 IJP(c) RDW/AT/JD

ACCESSION NR: AP5009104 S/0250/65/009/002/0085/0087

37
36
B

AUTHOR: Makovetskiy, G. I.; Sirota, N. N.

TITLE: Electrical conductivity, thermoelectromotive force, and forbidden gap width of manganese selenide-manganese telluride alloys

SOURCE: AN BSSR. Doklady, v. 9, no. 2, 1965, 85-87

TOPIC TAGS: manganese selenide, manganese telluride, thermoelectromotive force, forbidden gap width, electrical conductivity

ABSTRACT: The authors investigated the effect of composition and temperature on the electric and thermoelectric properties of alloys of the MnSe-MnTe system. The electrical conductivity was measured between liquid nitrogen temperatures and 500-600°C, and curves showing conductivity (ln σ) as a function of temperature (see Fig. 1 of the Enclosure) and as a function of composition at five temperatures from 150 to 780°K (see Fig. 2 of the Enclosure) are given. Values of the forbidden gap width were obtained from the tangent to the slope for curves of $\ln \sigma = f(T)$ in the region of intrinsic conductivity (see Fig. 2 of the Enclosure). The thermo-emf of all the alloys was positive. The absolute values of the thermo-emf and electrical conductivity are considered: in alloys of the compositions 0.1 MnSe·0.9 MnTe and

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L 52234-65

ACCESSION NR: AP5009104

0.2 MnSe·0.8 MnTe, the thermo-emf at 700°K is of the order of 300-340 μV/deg at a conductivity of 20-30 $ohm^{-1} \cdot cm^{-1}$. This first study of the MnSe-MnTe system shows beyond any doubt the existence of a quasibinary section, a wide region of solubility, and semiconducting properties over the entire concentration range. Orig. art. has: 2 figures.

ASSOCIATION: Institut fiziki tverdogo tela i poluprovodnikov AN BSSR (Institute of Solid State Physics and Semiconductors, AN BSSR)

SUBMITTED: 31Jul64 ENCL: 02 SUB CODE: MM, EM

NO REF SOV: 003 OTHER: 005

Card 2/4

L 63825-65 EWT(l)/EWT(m)/EWP(t)/EWP(b) IJP(c) JD/JG

ACCESSION NR: AP5019324 UR/0250/65/009/007/0435/0437

25
24
B

AUTHOR: Sirota, N. N.; Makovetskaya, L. A.

TITLE: Thermal emf of the solid solutions of indium phosphide and gallium arsenide

SOURCE: AN BSSR. Doklady, v. 9, no. 7, 1965, 435-437

TOPIC TAGS: indium phosphide, gallium arsenide, indium phosphide alloy, gallium arsenide containing alloy, alloy thermal electromotive force, thermal emf composition dependence, thermal emf temperature dependence

ABSTRACT: The dependence of the thermal emf on the composition and temperature has been investigated in InP, GaAs, and 9 InP-GaAs alloys with a composition varying from 0.1 InP·0.9 GaAs to 0.9 InP·0.1 GaAs, and an impurity concentration within limits of $1.7 \cdot 10^{16}$—$3.0 \cdot 10^{19}$. The thermal emf was measured on polycrystalline n- and p-specimens in a vacuum or a helium atmosphere in the 120—600K range; the temperature difference at the hot and cold ends of the specimens was 10—12C. The differential thermal emf readings were practically identical during heating or cooling and increased with increasing temperature after passing through a small minimum below room temperature. At all test temperatures, the maximum value of $\alpha^2\sigma$ (where σ is the specific electric conductivity) was observed in an alloy con-

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L 63825-65

ACCESSION NR: AP5019324

taining 30% GaAs; with increasing temperature, the value of $\alpha^2\sigma$ increased. The magnitude of the thermal emf (α) below temperatures at which the intrinsic conductivity is reached depended mainly on the impurity concentration (n). For example, at T = 300K in 0.4 InP·0.6 GaAs alloy $n = 5.8 \cdot 10^{18}/cm^3$; $\alpha = -46$ μv/deg; in 0.7 InP·0.3 GaAs alloy $n = 1.7 \cdot 10^{18}/cm^3$, $\alpha = -280$ μv/deg; the corresponding figures for 0.8 InP·0.2 GaAs and 0.3 InP·0.7 GaAs were: $3.4 \cdot 10^{17}$ and $2.4 \cdot 10^{17}/cm^3$ and 294 and 370 μv/deg, respectively. The absolute values of α and σ in the investigated InP-GaAs system were of the same order as in alloys of the InP-InAs and InAs-GaAs systems. Orig. art. has: 2 figures and 2 tables. [MS]

ASSOCIATION: Institut fiziki tverdogo tela i poluprovodnikov AN BSSR (Institute of Solid State Physics and Semiconductors, AN BSSR)

SUBMITTED: 24Apr65 ENCL: 00 SUB CODE: SS, EM

NO REF SOV: 003 OTHER: 003 ATD PRESS: 4073

Card 2/2

L 7924-66 EWA(k)/EWT(1)/EWT(m)/EPF(n)-2/EPA(w)-2/EWA(m)-2/EWA(h) IJP(c) LHB/AT

ACC NR: AP5027929 SOURCE CODE: UR/0363/65/001/010/1673/1683

AUTHOR: Sirota, N. N.; Gololobov, Ye. M.; Sheleg, A. U.; Olekhnovich, N. M.

ORG: Institute of Solid State Physics and Semiconductors, Academy of Sciences, BSSR, Minsk (Institut fiziki tverdovo tela i poluprovodnikov Akademii nauk BSSR)

TITLE: Potential and limitations of the use of x-ray diffraction methods for studying the nature of chemical bonding in crystals

SOURCE: AN SSSR. Izvestiya. Neorganicheskiye materialy, v. 1, no. 10, 1965, 1673-1683

TOPIC TAGS: x-ray diffraction analysis, neutron diffraction, electron density, electron diffraction analysis, chemical bonding, crystal structure analysis

ABSTRACT: The experimental determination of electron density distribution in crystals involves measurement of the intensities of x-ray scattering peaks, finding of structural amplitudes, calculation of the form factors of ions, reduction of the values obtained to absolute zero temperature, and summation of three-dimensional Fourier series. Each of these operations is discussed in detail. X-ray diffraction methods make it possible to give quantitative experimental expressions to the wave functions of electrons in crystal lattices. Of great significance to the study of chemical bonding is the possibility of estimating the electron density distribution over the electron shells. For example, the use of form factors obtained by neutron and x-ray scattering has permitted the determination of the distribution of all electrons, including those with unpaired spins, in the 3d shell in the lattice of ferromagnetics and

UDC: 541.57:548.19

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L 7924-66

ACC NR: AP5027929

19

antiferromagnetics. However, X-ray-, electron-, and neutron-diffraction methods cannot as yet solve problems involving electron distribution at low densities or when the density changes are slight (not exceeding 0.02 – 0.05 e1/Å^3). For example, it is not possible at the present time to determine by x-ray diffraction the number of electrons which migrate from the valence band to the conduction band under the influence of thermal motion or photo-electric effects in semiconductor crystals. Despite such limitations, these methods are of paramount importance for studying electron density distributions in crystals. Orig. art. has: 7 figures.

SUB CODE: SS, GC, IC / SUBM DATE: 05Jul65 / ORIG REF: 019 / OTH REF: 011

PC

Card 2/2

MAKOVETSKIY, G.I.; SIROTA, N.N.

Electroconductivity and thermo-e.m.f. of manganese selenide. (MIRA 18:10)
Dokl. AN BSSR 9 no.1:15-17 Ja '65.

1. Institut fiziki tverdogo tela i poluprovodnikov AN BSSR.

BIROTA, N.N.; MAKOVETSKAYA, L.A.

Thermo- e.m.f. of solid solutions of indium phosphide and gallium arsenide. Dokl. AN BSSR 9 no.7:435-437 Jl '65. (MIRA 18:9)

1. Institut fiziki tverdogo tela i poluprovodnikov AN Belorusskoy SSR.

KOREN', N.V. [Koren', N.V.]; SIROTA, N.N. [Sirota, N.M.]

Kinetics of the growth of diffusion layers in the system niobium-tin. Vestsi AN BSSR. Ser.fiz.-mat.nav.no.2:43-46 '65. (MIRA 19:1)

SIROTA, N.N.; GOLOLOBOV, Ye.M.; SHELEG, A.U.; OLEKHNOVICH, M.M.

Possibilities and limits in the application of X-ray diffraction study of the nature of chemical bonds in crystals. Izv.AN SSSR. Neorg.mat. 1 no.10:1673-1683 O '65. (MIRA 18:12)

1. Institut fiziki tverdogo tela i poluprovodnikov AN BSSR, Minsk. Submitted July 5, 1965.

L 18483-66 EWT(1)/EPF(n)-2/ETC(m)-6 IJP(c) GS/AT
ACC NR: AT6006167 SOURCE CODE: UR/0000/65/000/000/0093/0096

89
B71

AUTHOR: Sirota, N. N. (Academician AN BSSR); Gologlogov, Ye. M.

ORG: none

TITLE: Heats of atomization and formation of $A^{III}B^{V}$ type compounds determined from experimental data on electron density distribution 21,44,55

SOURCE: Khimicheskaya svyaz' v poluprovodnikakh i tverdykh telakh (Chemical bond in semiconductors and solids). Minsk, Nauka i tekhnika, 1965, 93-96

TOPIC TAGS: x ray, electron density, heat of formation, heat of dissociation, heat of atomization, heat of sublimation, aluminum compound, gallium compound, indium compound, arsenic compound, antimony compound

ABSTRACT: The heats of atomization and formation of AlAs, GaAs, InAs, AlSb, GaSb, and InSb were calculated from the data on electron density distribution determined experimentally by x-ray technique. The x-ray measurements were made at 20°C and -100°C. The object of the work was to compare the heats of atomization and formation of $A^{III}B^{V}$ type compounds determined from x-ray data with data based on the

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calorimetric technique. The energy of interatomic interaction u was expressed as a sum: $u = u_c + u_k + u_a$; where u_c is a term relating to the coulombic interaction, u_k is a term expressing a change in the kinetic energy of electrons in the area of orbital overlapping of A^{III} and B^{V} atoms, and u_a is a term expressing a change in the exchangeable energy resulting from orbital overlapping. The sum of $U_c + U_k + U_a$ represents the heat of atomization of a compound U_{AB}. If the heats of sublimation of the individual components of a compound (U_A and U_B) are known, the heat of formation of a compound ΔH can be determined by the formula:

$$\Delta H = U_{AB} - (U_A + U_B).$$

The heats of atomization and formation for several $A^{III}B^{V}$ type compounds are presented in tabular form. Orig. art. has: 2 figures, 1 table, 8 formulas.

SUB CODE: 20, 11 SUBM DATE: 31May65/ ORIG REF: 008/ OTH REF: 001

L 18836-66 EWT(1) IJP(c) GS/AT
ACC NR: AT6006168 SOURCE CODE: UR/0000/65/000/000/0097/0102

AUTHOR: Gololobov, Ye. M.; Sirota, N. N. (Academician AN BSSR)

ORG: none

TITLE: Electron density distribution and bonding energies in $A^{III}B^{V}$ semiconductor compounds

SOURCE: Khimicheskaya svyaz' v poluprovodnikakh i tverdykh telakh (Chemical bond in semiconductors and solids). Minsk, Nauka i tekhnika, 1965, 97-102

TOPIC TAGS: electron density, semiconductor, aluminum compound, gallium compound, indium compound, arsenic compound, antimony compound, heat of atomization, heat of formation, Coulomb interaction, chemical bonding

ABSTRACT: The heats of atomization of AlAs, GaAs, InAs, AlSb, GaSb, and InSb were determined on the basis of electron density distribution (f-curves). Three cases were considered for calculating the energy of interatomic interaction u within the $A^{III}B^{V}$ type compounds according to equation: $u = u_c + u_k + u_a$, where u_c is a term relating to the Coulombic interaction, u_k is a term expressing a change in the

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kinetic energy of electrons in the area of orbital overlapping of A^{III} and B^{V} atoms, and u_a is a term expressing a change in the exchangeable energy resulting from orbital overlapping. In the first case the u_k is determined on the basis of Thomas-Fermi-Dirac statistics. In the second more approximate case, in addition to the Coulombic interaction, the electronic interaction between atom A and ion B in the area of orbital interaction for all elements of the orbital overlap was also considered. The third case is based on a more rigorous involvement of V_A and V_B potentials when considering the u_c energy contributions. The heats of atomization for several arsenides and antimonides are given in a table. The corresponding heats of formation can be readily computed using the values of heats of sublimation of the individual components of a compound (U_A and U_B). It was found that heats of atomization and formation of the $A^{III}B^{V}$ type compounds, determined on the basis of electron density distribution (f-curves), are somewhat less accurate but generally very close to the corresponding experimental data. Orig. art. has: 1 figure, 1 table, 12 formulas.

SUB CODE: 07/ SUBM DATE: 31May65/ ORIG REF: 004/ OTH REF: 000

L 18050-66 EWT(m)/EWP(t)/ETC(m)-6 IJP(c) JD/WW/JW/GS/RM

ACC NR: AT6006169 SOURCE CODE: UR/0000/65/000/000/0122/0124

AUTHOR: Sirota, N. N. (Academician AN BSSR); Yushkevich, N. N.

ORG: none

TITLE: Thermodynamic properties of indium antimonide, gallium antimonide, and gallium arsenide

SOURCE: Khimicheskaya svyaz' v poluprovodnikakh i tverdykh telakh (Chemical bond in semiconductors and solids). Minsk, Nauka i tekhnika, 1965, 122-124

TOPIC TAGS: entropy, free energy, thermal emf, thermodynamic function, indium compound, gallium arsenide, gallium compound, antimony compound, arsenic compound, enthalpy

ABSTRACT: Enthalpy, free energy, and entropy of formation of indium and gallium antimonides and gallium arsenide were determined by the emf method. The work was part of a systematic investigation of the thermodynamic properties of semiconductor compounds. An electrolytic cell consisting of:

$$-A^{III}_{liquid} \,|(KCl - LiCl) + \text{chloride } A|(ASb \text{ or } AAs)^{+}_{solid}$$

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either indium or gallium, was

ed for InSb, GaSb, and GaAs. The thermodynamic data calculated from the temperature dependence of the emf for InSb at 653-753°K, GaSb at 623-733°K, and GaAs at 673-823°K are also shown. The standard values of enthalpies (-ΔH°), entropies (-ΔS°), and free energies (-ΔG°) of formation at [illegible] compounds are given in table 1. Orig. art. has: 1 figure, 3 tables, 3 formulas.

TABLE 1

Compound	$-\Delta H^{\circ}_{298}$, kcal/mol	$-\Delta S^{\circ}_{298}$, kcal/degree × gmol	$-\Delta G^{\circ}_{298}$, kcal/mol	$-\Delta H^{at}_{298}$, kcal/mol	$-\Delta S^{at}_{298}$, kcal/degree × gmol	$-\Delta G^{at}_{298}$, kcal/mol
InSb	7.84	4.68	6.44	127.54	64.5	108.3
GaSb	9.79	1.34	9.39	137.5	64.1	118.4
GaAs	20.96	9.32	18.18	145.96	42.9	133.17

SUB CODE: 20/ SUBM DATE: 31May65/ ORIG REF: 004/ OTH REF: 004

Card 2/2 SM

L 18052-66 EWT(m)/EWP(t)/ETC(m)-6 IJP(c) JD/WW/JW/GS/RM
ACC NR: AT6006171 SOURCE CODE: UR/0000/65/000/000/0128/0129

AUTHOR: Yermolenko, Ye. N.; Sirota, N. N. (Academician AN BSSR)

ORG: none

TITLE: Determination of the heats of formation for indium phosphide and gallium phosphide by means of combustion in a calorimeter

SOURCE: Khimicheskaya svyaz' v poluprovodnikakh i tverdykh telakh (Chemical bond in semiconductors and solids). Minsk, Nauka i tekhnika, 1965, 128-129

TOPIC TAGS: heat of formation, indium compound, gallium compound, calorimeter, heat measurement

ABSTRACT: The present study was made in view of the lack of reliable data on the heats of formation for InP and GaP. High purity phosphides synthesized by the Institute of Solid State Physics and Semiconductors of the AN BSSR were burned under pressure of oxygen in the calorimeter. The respective heats of formation obtained in a series of combustion experiments are: ΔH^0_{298} = -29.1 ± 2.5 kcal/mol for GaP and ΔH^0_{298} = 21.5 ± 1.5 kcal/mol for InP. Orig. art. has: 5 formulas.

SUB CODE: 07/ SUBM DATE: 31May65/ ORIG REF: 004/ OTH REF: 002

1/1

L 18051-66 EWT(m)/T/EWP(t) IJP(c) JD/GS
ACC NR: AT6006170 SOURCE CODE: UR/0000/65/000/000/0125/0127

AUTHOR: Golodushko, V. Z.; Sirota, N. N. (Academician AN BSSR)

39
B+1

ORG: none

TITLE: Dissociation pressures of indium arsenide, gallium arsenide and gallium phosphide

SOURCE: Khimicheskaya svyaz' v poluprovodnikakh i tverdykh telakh (Chemical bond in semiconductors and solids). Minsk, Nauka i tekhnika, 1965, 125-127

TOPIC TAGS: gallium arsenide, gallium compound, indium compound, arsenic compound

ABSTRACT: Dissociation pressures of indium arsenide, gallium arsenide, and gallium phosphide were determined by Langmuir method using the setup shown in figure 1. Compounds under investigation were evaporated from a cell placed in a crucible by means of applying a 10^{-4} mm Hg vacuum. The vapor pressures (p) were calculated from the formula:

$$p = 17{,}14 \frac{m}{st\alpha} \sqrt{\frac{T}{M}},$$

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L 18051-66

ACC NR: AT6006170

where m is the weight of the compound, s is an apperture in the cell containing the compound under investigation (in the form of a powder), t is duration of evaporation, α is evaporation coefficient (assumed to be equal to 1), T is temperature in ^{o}K, M is mass spectroscopically determined molecular weight of the vapor. The

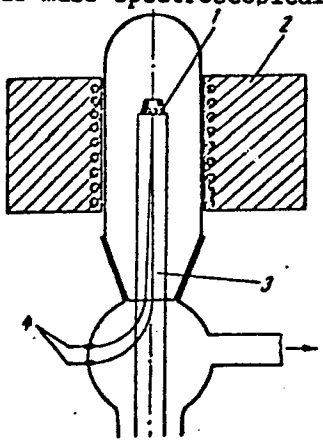

Fig. 1. 1--crucible containing the substance under investigation; 2--resistance furnace; 3--quartz tube; 4--thermocouple.

temperature dependence of the dissociation pressures is graphed. Orig. art. has: 2 figures, 4 formulas.

SUB CODE: 20,07/ SUBM DATE: 31May65/ ORIG REF: 001/ OTH REF: 007

Card 2/2 SMV

L 18054-66 EWT(m)/EWP(j)/EWP(t)/ETC(m)-6 IJP(c) JD/WW/JW/GS/RM

ACC NR: AT6006173 SOURCE CODE: UR/0000/65/000/000/0142/0145

AUTHOR: Koren', N. N.; Sirota, N. N. (Academician AN BSSR)

ORG: none

TITLE: Reactive diffusion of antimony and zinc with elements of the VI group and the energy of the chemical bond

SOURCE: Khimicheskaya svyaz' v poluprovodnikakh i tverdykh telakh (Chemical bond in semiconductors and solids). Minsk, Nauka i tekhnika, 1965, 142-145

TOPIC TAGS: forbidden zone width, crystal growth, antimony, zinc, selenium compound, tellurium compound, sulfur compound, heat of formation, crystal lattice energy

ABSTRACT: The process of reactive diffusion resulting in the formation of semiconductive layers of $A^{II}B^{VI}$-, $A^{V}B^{VI}$, and $A^{II}B^{V}$ type compounds on metal surfaces was studied using antimony and zinc with sulfur, selenium, and tellurium and antimony with zinc and cadmium as model systems. It was found that the mechanism of interaction of zinc with vapor of sulfur, selenium, and tellurium (in which a semiconduc-

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tor layer forms) involves diffusion of zinc across this layer. A similar mechanism of growth of the $A^{V}B^{VI}$ type semiconductor layer was found in the case of the interaction of antimony with the vapors of sulfur, selenium, and tellurium. In the zinc-antimony and cadmium-antimony systems, the growth of the interface layer involves countercurrent diffusion of both interacting components. The correlation between the activation energy of diffusion and the melting temperature of various compounds is graphed. The parameters of the reactive diffusion and the principal physical characteristics of the semiconductor compounds are shown in table 1. It is concluded that the rate of the reactive diffusion is dependent upon the type and the nature of interaction between the atoms in the process of compound formation. In general, the stronger the interatomic (or interionic) interaction within the crystal lattice, the greater is the diffusion activation energy and the smaller is the coefficient of the reactive diffusion. Orig. art. has: 2 tables.

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R001550820018-1"

L 18054-66
ACC NR: AT6006173

3

TABLE 1

Chemical Compound	Energy of activation diffusion, kcal/mol	Preexponential factor, cm^2/sec	Heat of formation, kcal/mol	Lattice energy, kcal/mol	Forbidden zone width, ev	Melting temperature, °K
ZnO	34	$6.2 \cdot 10^{3}$	63	977	3.2	2248
ZnS	32	$1.2 \cdot 10^{-2}$	48	912	3.7	2123
ZnSe	26	$8.3 \cdot 10^{-4}$	34	852	2.8	1513
ZnTe	25	$1.1 \cdot 10^{-4}$	28	844	2.2	1512
ZnSb	18	$(5.2\text{-}8.5) \cdot 10^{-5}$	3.6	-	0.6	819
Sb_2S_3	18	$2.6 \cdot 10^{-6}$	35.7	-	1.7	819
Sb_2Se_3	20	$3.1 \cdot 10^{-5}$	-	-	1.3	885
Sb_2Te_3	21	$1.3 \cdot 10^{-3}$	28	-	0.3	893
CdSb	11	$(2.1\text{-}4.2) \cdot 10^{-7}$	3	-	0.48	699

SUB CODE: 07,20/ SUBM DATE: 31May65/ ORIG REF: 005/ OTH REF: 001

Card 3/3 SLV

L 18057-66 EWT(l)/EWT(m)/T/EWP(t)/ETC(m)-6 IJP(c) JD/WW/JW/GS/RM

ACC NR: AT6006174 SOURCE CODE: UR/0000/65/000/000/0180/0183

79
76
B+1

AUTHOR: Rozov, V. V.; Sirota, N. N. (Academician AN BSSR)

ORG: none

TITLE: Dynamic dislocation of atoms in the lattices of indium and gallium phosphides

SOURCE: Khimicheskaya svyaz' v poluprovodnikakh i tverdykh telakh (Chemical bond in semiconductors and solids). Minsk, Nauka i tekhnika, 1965, 180-183

TOPIC TAGS: indium compound, gallium compound, crystal lattice dislocation, crystal lattice structure, x ray, heat of formation

21, 44, 55

ABSTRACT: Characteristic temperatures and dynamic dislocation of atoms in lattices of indium phosphide, gallium phosphide, and in a solid solution of 86% InP and 14% GaP were determined on the basis of x-ray analysis. The temperature dependence of the dynamic dislocations of phosphorus and indium atoms in indium phosphide expressed in terms of the square of atomic vibration amplitude u_d^2 is graphed. The physical properties of InP, GaP, and the solid solution of 86% InP + 14% GaP at 20°C are given in table 1. These data indicate high interaction energy between atoms of GaP

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ACC NR: AT6006174

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TABLE 1

Compound	u_d^2 of metal atoms, Å	θ of metal atoms, °K	u_d^2 of metal atoms, Å	θ of metal atoms, °K	coefficient of line broadening	microhardness	ΔE, ev	Lattice parameter
InP	$8.1 \cdot 10^{-2}$	120	$8.5 \cdot 10^{-2}$	230	$5.15 \cdot 10^{-6}$	530	1.25	5.8688
14% GaP	$4.15 \cdot 10^{-2}$	178	$5.45 \cdot 10^{-2}$	280	$7.94 \cdot 10^{-6}$	650	-	5.7970
GaP	$4.10 \cdot 10^{-2}$	240	$1.7 \cdot 10^{-2}$	600	$5.5 \cdot 10^{-6}$	840	2.24	5.4500

as reflected in high heat of formation and high melting temperature. Orig. art. has: 1 figure, 2 tables, 1 formula.

SUB CODE: 20,07/ SUBM DATE: 31May65/ ORIG REF: 001/ OTH REF: 001

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L 18056-66 EWT(1)/EWT(m)/ETC(f)/EWG(m)/T/EWP(t) IJP(c) RDW/JD/GS/AT
ACC NR: AT6006175 SOURCE CODE: UR/0000/65/000/000/0211/0215

AUTHOR: Sirota, N. N. (Academician AN BSSR); Yanovich, V. D.

ORG: none

TITLE: Changes in mean square dynamic ion dislocation in zinc and cadmium tellurides as a function of temperature

SOURCE: Khimicheskaya svyaz' v poluprovodnikakh i tverdykh telakh (Chemical bond in semiconductors and solids). Minsk, Nauka i tekhnika, 1965, 211-215

TOPIC TAGS: zinc alloy, cadmium telluride, cadmium, crystal lattice dislocation, crystal lattice structure, forbidden zone width, heat of formation

ABSTRACT: Dynamic ion dislocations, mean square ion dislocations u^2_{dyn}, and the temperature dependence of the characteristic temperature of ZnTe and CdTe were studied by x-ray technique. This study was made in order to learn more about the forces and the nature of the atomic interaction in $A^{II}B^{VI}$-type compounds. A URS-50I x-ray machine and compressed powder samples of tellurides were used in this study. The

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x-ray machine was adapted to simultaneous work at high and low temperatures. The mean square dynamic ion dislocations are given in tabular form. For ZnTe and CdTe, the respective heats of formation are 28 and 24.5 kcal/mol and the forbidden zone widths are 1260° and 1080°C. The changes in the characteristic temperatures of CdTe and Te- and Cd ions as a function of temperature and the temperature dependence of the characteristic temperature θ of Zn and Te ions in ZnTe and of the average characteristic temperature θ of ZnTe are graphed. Orig. art. has: 5 figures, 1 table, 8 formulas.

SUB CODE: 20/ SUBM DATE: 31May65/ ORIG REF: 001/ OTH REF: 002

Card 2/2 Sgn

SIROTA, N.N.; OSINSKIY, V.I.

Temperature dependence of the intensity of recombination radiation in n - p-junctions on indium phosphide. Dokl. AN BSSR 9 no. 11: 720-721 N '65 (MIRA 19:1)

1. Institut fiziki tverdogo tela i poluprovodnikov AN BSSR.

L 29680-66 EWT(1)/EWT(m)/T/EWP(t)/ETI IJP(c) AT/JD
ACC NR: AP6012853 SOURCE CODE: UR/0368/66/004/004/0313/0315

68
B

AUTHOR: Sirota, N. N.; Osinskiy, V. I.

ORG: none

TITLE: Effect of temperature on the recombination radiation spectrum of indium phosphide n-p junctions

SOURCE: Zhurnal prikladnoy spektroskopii, v. 4, no. 4, 1966, 313-315

TOPIC TAGS: recombination radiation, indium compound, phosphide, pn junction, junction diode, forbidden band, impurity level, temperature dependence, emission spectrum

ABSTRACT: The authors investigated the spectral distribution of the recombination radiation of diffusion n-p junctions in indium phosphide at 77, 138, 210, and 298K. The junction was prepared by a standard technology from n-type indium phosphide. The recombination radiation was measured with an ISP-51 spectrometer. The spectrum was registered with the photomultiplier (FEU-28) and an automatic potentiometer (EPP-09M). The resolution of the apparatus was approximately 15 Å in the 9000 Å wavelength region. The emission from the diodes was investigated in a pulsed mode using 5 μsec rectangular current pulses of amplitudes 0.5-2 a, with

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ACC NR: AP6012853

a repetition frequency of 50 cps. The diode emission in the n-p junction plane was measured. With increasing temperature, the maximum of the spectral intensity shifted toward larger wavelengths, and the width of the spectral line increased. The maximum of the recombination radiation decreased in temperature nearly linearly, in analogy with the temperature variation of the width of the forbidden band. The quantum energy at the maximum of the recombination radiation spectrum differed from the corresponding values of the width of the forbidden band by 0.01 ev. This difference is attributed to recombination at the impurity levels. The results indicate also that the variation of the wavelength of the recombination-radiation maximum of the indium phosphide can be used to measure the temperature remotely, without the use of wires, at relatively large distances from the emitting diode. Orig. art. has: 4 figures.

SUB CODE: 20/ SUBM DATE: 16Apr65/ ORIG REF: 003/ OTH REF: 004

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L 36977-66 EWT(m)/EWP(t)/ETI IJP(c) JD

ACC NR: AP6014346 SOURCE CODE: UR/0250/65/009/011/0720/0721

AUTHOR: Sirota, N. N.; Osinskiy, V. I.

ORG: Institute of Solid State Physics and Semiconductors, AN BSSR (Institut fiziki tverdogo tela i poluprovodnikov AN BSSR)

TITLE: Temperature dependence of the intensity of radiation of np recombination transitions in indium phosphide

SOURCE: AN BSSR. Doklady, v. 9, no. 11, 1965, 720-721

TOPIC TAGS: temperature dependence, indium compound, recombination radiation, forbidden zone width, pn junction

ABSTRACT: The test apparatus consisted of an optical dewar provided with a copper holder on which a radiating diode of indium phosphide was mounted. Specimen temperature was measured by means of a thermocouple and an electronic potentiometer. The characteristic radiation of indium phosphide is in the 8990 Å (77°K) to 9570 Å (300° K) wavelength range and the maximal values of the spectral distribution curves of energy are close to those of the forbidden zone width. Measurements of light fluxes were made by a photomultiplier. The measured magnitudes represented integrated functions of these spectral distributions. From the plots of the data on the integrated light fluxes (in arbitrary units) vs temperature in the 77-300°K range for 0.15, 1.00 and 5 am-

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ACC NR: AP6014346

peres, it appeared that the magnitudes of the recombination radiation light fluxes decrease almost exponentially with increasing temperature. This decrease is attributed to decrease in the probability of transitions responsible for recombination radiation. Data on power requirements of the diode at 0.15 amperes vs temperature show decrease in the former with increase in the latter. The plots of the data on the magnitudes of light fluxes vs current through the diode for 77, 178 and 300°K show that: at 77°K, the magnitude of the flux increases rapidly until intensity of the current reaches 0.12 amperes and linear dependence takes place for the larger currents; at 178°K the dependence is practically linear for all currents; at 300°K and at the currents larger than 0.12 amperes, the dependence is linear. However, for lower magnitude than 0.12 amperes the increase of the flux with temperature is smaller than in the range of linear dependence. These results indicate that the magnitude of the light flux of the np recombination transitions in indium phosphide is almost a linear function of the current and that it depends substantially on temperature. Orig. art. has: 2 figures.

SUB CODE: 20/ SUBM DATE: 05Aug65/ ORIG REF: 001

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