GUBANOV, A.G., dotsent

Development of segmental pulmonary resection in tuberculosis [with summary in French] Probl.tub. 34 no.6:31-37 N-D '56. (MLRA 10:2)

1. Iz Ukrainskogo nauchno-issledovatel'skogo instituta tuberkuleza imeni F.G.Yanovskogo (dir. A.S.Mamolat)
(PNEUMONECTOMY, in various diseases,
tuberc., segmental technic (Rus))

GUBANOV, A.,dotsent (Kiyev)

"Surgical anatomy of the vessels at the root of the lung" by V.M. Sergeev. Reviewed by A. Gubanov. Khirurgiia, 33 no.1:131-133 Ja '57 (MLRA 10:4)

(LUNGS--BLOOD SUPPLY)

GUBANOV, A.G., dots.

Intersegmental connective tissue borders of the lungs. Khirurgiia 33 no.8:48-53 Ag '57. (MIRA 11:4)

1. Iz Ukrainskogo nauchno-issledovatel'skogo instituta tuberkuleza im. akad. F.G. Yanovskogo (dir. A.S. Mamolat).
(LUNGS, anat. and histol.
intersegmental connective tissue borders, surg. anat. aspects)
(CONNECTIVE TISSUE, anat. & histol.
intersegmental of lungs, surg. aspects)

DRABKINA, R.O., professor; GUBANOV, A.G., dotsent

Characteristics of pathological changes of pulmonary braches of the vagus nerve in tuberculosis [with summary in French]. Probl.tub. 35 no.3:82-86 '57. (MLRA 10:10)

1. Iz Ukrainskogo nauchno-issledovatel'skogo instituta tuberkuleza imeni F.G.Yanovskogo (dir. A.S.Mamolat)
(TUBERCULOSIS, PULMONARY, pathology,
vagus nerve (Rus))
(NERVES, VAGUS, pathology,
in tuberc., pulm. (Rus))

GUBANOV, A.G., dotsent (Kiyev, 54, ul.Chkalova, d.74, kv.7)

So-called new method of bronchial closure in pulmonary resection for tuberculosis. Nov.khir.arkh. no.1:41-45 Ja-F '59. (MIRA 12:6)

1. Ukrainskiy nauchno-issledovatel'skiy institut tuberkuleza.
(BRONCHI--SURGERY) (SUTURES)

GUBANOV, A.G., dotsent

Simplified methods for resection of lung tissue. Pat.,klin.i terap.tub. no.8:333-338 '58. (MIRA 13:7)

1. Iz Ukrainskogo nauchno-issledovatel'skogo instituta tuberkuleza im. akad. F.G. Yanovskogo.
(LUNGS--SURGERY)

GUBANOV, A.G., dotsent (Kiyev, ul. Chkalova,d.74/7); GOROVENKO, G.G.; BEREZOVSKIY, K.K., starshiy nauchnyy sotrudnik

First experience in using porolon for plombage of the chest cavity in an experiment and in the clinic. Nov. khir. arkh. no.3:65-72 My-Je '60. (MIRA 15:2)

1. Pervoye khirurgicheskoye otdeleniye (zav. - dotsent G.G.Gorovenko) i 2-ye khirurgicheskoye otdeleniye (zav. - prof. N.M.Amosov) Ukrainskogo nauchno-issledovatel'skogo instituta tuberkuleza imeni akademika F.G.Yanovskogo.

(PLASTICS IN MEDICINE) (PLOMBAGE (SURGERY))
(CHEST--SURGERY)

GUBANOV, A. G.; LITVINOV, V. V.; SMIRNOV, A. A.; KHMELEVSKAYA, G. A.

Experimental data on the use of porolon for alloplasty. Grud. khir. no.4:66-71 '61. (MIRA 14:12)

1. Iz Kiyevskogo nauchno-issledovatel'skogo instituta tuberkuleza imeni akademika F. G. Yanovskogo i Nauchno-issledovatel'skogo instituta meditsinskoy klimatologii i klimatoterapii imeni I. M. Sechenova (Yalta). Adres avtorov: Krym, Yalta, ul. Dzerzhinskogo, d. 48. Institut imeni I. M. Sechnova, korp. 12

(PLASTICS--THERAPEUTIC USE)
(LUNGS--SURGERY)

GUBANOV, A.G., dotsent; FEDOTOV, A.F.

Intrapleural plombage with porolon in accociation with pulmonary resection. Probl.tub. 39 no.3:44-49 '61. (MIRA 14:5)

1. Iz Ukrainskogo nauchno-issledovatel'skogo instituta tuberkuleza imeni F.G. Yanovskogo (dir. - kand.med.nauk A.S. Mamolat).
(LUNGS—SURGERY) (LUNGS—COLLAPSE)

GUBANOV, Aleksey Gavrilovich; UMOVIST, M.N., red.; POTOTSKAYA, L.A., tekhn. red.

[Partial pulmonary resections in tuberculosis; anatomical and experimental materials] Chastichnye rezektsii legkikh pri tuberkuleze; anatomicheskie i eksperimental'nye materialy. Kiev, Gosmedizdat USSR, 1961. 303 p. (MIRA 15:7)
(TUBERCULOSIS) (LUNGS--SURGERY)

GUBANOV, A.G.; SEVEROV, V.S.; OSINTSEVA, V.P.; FEDOTOV, A.F.

Use of porolon plombage in partial resections of the lungs in tuberculosis. Vest.khir. no.5:46-51 '61. (MIRA 15:1)

1. Iz Instituta tuberkuleza (dir. - prof. N.A. Shmelev) AMN SSSR i Ukrainskogo nauchno-issledovatel'skogo instituta tuberkuleza (dir. - kand.med.nauk A.S. Mamolat).
(LUNGS--SURGERY) (TUBERCULOSIS) (PLASTICS IN MEDICINE)

GOROVENKO, Grigoriy Gavrilovich, doktor med. nauk; GUBANOV, A.G., red.; CHUCHUPAK, V.D., tekhn. red.

[Pulmonary resections following ineffective collapse therapy]Rezektsii legkikh posle neeffektivnoi kollapsoterapii. Kiev, Gosmedizdat USSR, 1962. 277 p. (MIRA 16:1)
(TUBERCULOSIS) (PNEUMOTHORAX) (LUNGS—SURGERY)

GUBANOV, A.G., dotsent; NOVITSKIY, A.B.

Technic of extra-musculo-periosteal plombage of the thoracic cavity. Khirurgiia no.1:83-88 '62. (MIRA 15:11)

1. Iz Ukrainskogo nauchno-issledovatel'skogo instituta tuberkuleza imeni akad. F.G. Yanovskogo (dir. - dotsent A.S. Mamolat) i Simeizskogo khirurgicheskogo sanatoriya "Primor'ye" (glavnyy vrach I.T. Sokolova [deceased]).
(LUNGS--COLLAPSE)

BAYANDIN, P.A. (Murmansk); SHVETSOV, I.M.; TIMOFEYEVA, N.V.; KOVAL', V.P.; KOZLOVA, E.Z.; TRET'YAKOV, N.I. (Kaliningrad); MAMEDOV, E.Sh. (Poselok Martuni, AzerSSR); BOROVYY, Ye.M.; DULAYEV, S.G. (Grodno); GERASIMOV, B.A. (Lugansk); MEL'NIK, L.A. (Chernovtsy) ; MIGAL', L.A.; GUBANOV, A.G.; GOROVENKO, G.G. (Kiyev); SHAROV, B.K. (Chelyabinsk); SHUVALOVA, Z.A. (Sverdlovsk) NEYMARK, I.I.; ARYAYEV, L.N. (Odessa); KABANOV, A.N.; KONOVALOV, Yu.S.; ZAK, V.I. (Orenburg); MIKHAYLOV, M.M.; SEZ'KO, A.D. (Voronezh); SHALAYEV, M.I.; DONIN, V.I. (Saratov).

Abstracts. Grudn. khir. 5 no.3:110-126 My-Je'63 (MIRA 17:1)

1. Iz kafedry normal'noy anatomii Ryazanskogo meditsinskogo instituta imeni akademika I.P.Pavlova (for Shevtsov). 2. Iz Sochinskogo nauchno-issledovatel'skogo instituta kurortologii i fizioterapii Ministerstva zdravookhraneniya RSFSR (for Timofeyeva). 3. Iz khirurgicheskogo otdeleniya Ternopol'skoy klinicheskoy gorodskoy bol'nitsy (for Koval'). 4. Iz kafedry topograficheskoy anatomii i operativnoy khirurgii (zav. - prof. A.P. Sokolov). Permskogo meditsinskogo instituta (for Kozlova). 5. Iz khirurgicheskogo otdeleniya (zav. - Ye. M. Borovyy) Rovenskoy oblastnoy bol'nitsy (glavnyy vrach - UkrSSR V.N. Vel'skiy) (for Borovyy).

(Continued on next card)

BAYANDIN, P.A.—— (continued) Card 2.

6.Iz fakul'tetskoy khirurgicheskoy kliniki (dir. - prof. I.M. Popov'yan) i gospital noy terapevticheskoy kliniki (dir. - prof. L.S.Shvarts) lechebnogo fakul'teta Saratovskogo meditsinskogo instituta (for Migal'). 7. Iz kafedry fakul'tetskoy khirurgii (zav. - prof. I.I.Neymark) Altayskogo meditsinskogo instituta (for Neymark). 8. Iz Novosibirskogo gorodskogo protivotuberkuleznogo dispansera (for Kabanov). 9. Iz kafedry fakul'tetskoy khirurgii (zav. - prof. I.A.Ivanov) Permskogo meditsinskogo instituta (for Shalayev).

GUBANOV, A.G., dotsent (Kiyev, ul. Chkalova, d.74, kv.7); FURMANOV, Yu.A.; MARULIN, B.A.

Soft elastic porous polymers as plastic material in surgery. Vest. khir. 89 no.10:65-72 O '62. (MIRA 17:10)

1. Iz Ukrainskogo nauchno-issledovatel'skogo instituta tuberkuleza i grudnoy khirurgii imeni akademika F.G. Yanovskogo (dir. - dotsent A.S. Mamolat).

GUBANOV, A.G., dotsent (Kiyev, ul. Fuchika, d.1, kv.[illegible])

Prevention of infection of the pleural cavity in alloplasty of the esophagus. Vest. khir. 91 no.11:21-25 N '63. (MIRA 17:12)

1. Iz otdela polimerov (rukovoditel' - dotsent A.G.Gubanov) Ukrainskogo instituta tuberkuleza i grudnoy khirurgii (direktor - dotsent A.S. Mumolat).

GUBANOV, A.G., doktor med. nauk; GOLOVINA, G.T., red.

[Alloplasty; methodology for the implantation of material] Alloplastika; metodika vzhivleniia materiala. Kievm Zdorov'ia, 1965. 212 p. (MIRA 18:7)

KUVAYEV, V.B.; VLASOV, M.I.; GUBANOV, I.A.

Larkspur Delphinium confusum M. Pop., a new medicinal plant. Bot. zhur. 49 no.7:997-1002 Jl '64 (MIRA 17:8)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut lekarstvennykh i aromaticheskikh rasteniy, Moskovskaya oblast'.

1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

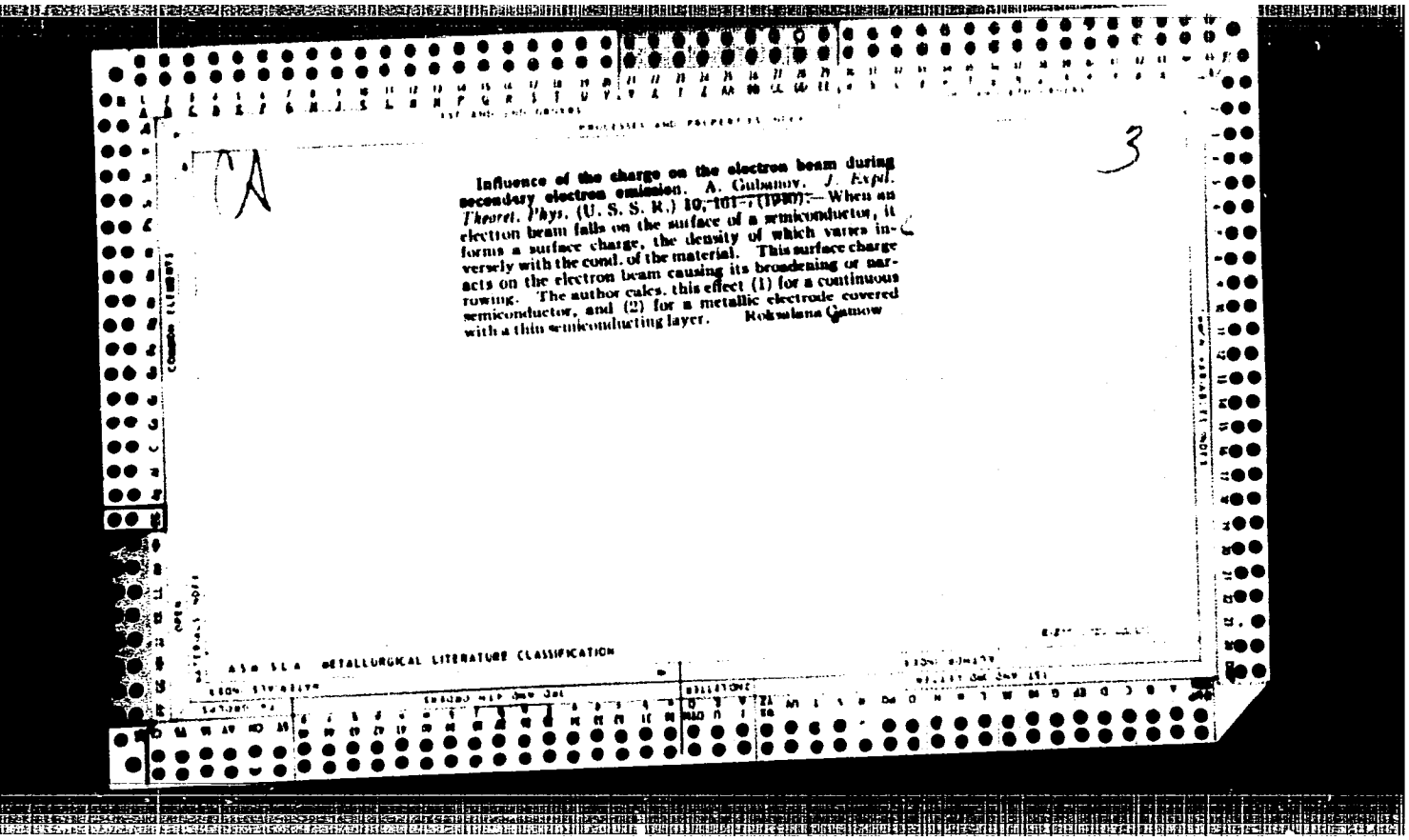
Ca

2

Optical properties related to the orientation of long particles in a streaming liquid. A. Golomnov.—*Uspekhi Fiz. Nauk* 23, 33-67(1940).—Theoretical. After a math. discussion of the motion and orientation of variously shaped particles in a flowing liquid, the optical properties, dipole moments, polarization and double refraction are considered. On the basis of exptl. data on colloidal particles taken from the literature it is shown that considerable information as to the optical nature of the particles themselves can be obtained by these methods.

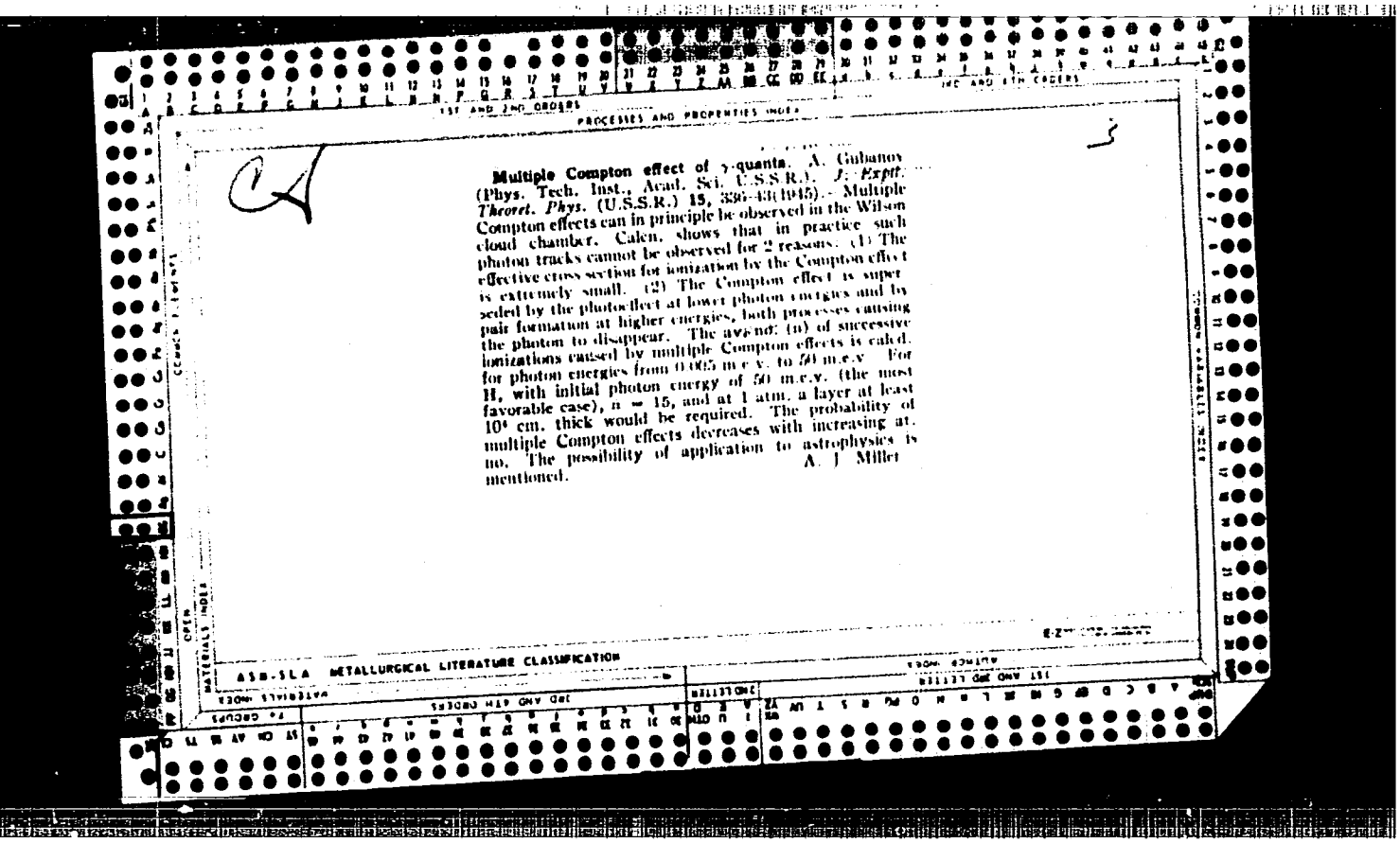
F. H. Rathmann

ASB-SLA METALLURGICAL LITERATURE CLASSIFICATION



Influence of the charge on the electron beam during secondary electron emission. A. Gubanov. *J. Exptl. Theoret. Phys.* (U. S. S. R.) 10, 101–7 (1940).—When an electron beam falls on the surface of a semiconductor, it forms a surface charge, the density of which varies inversely with the cond. of the material. This surface charge acts on the electron beam causing its broadening or narrowing. The author calcs. this effect (1) for a continuous semiconductor, and (2) for a metallic electrode covered with a thin semiconducting layer. Roksalana Gamow

A5a 51A METALLURGICAL LITERATURE CLASSIFICATION



Multiple Compton effect of γ-quanta. A. Gubanov (Phys. Tech. Inst., Acad. Sci. U.S.S.R.). *J. Exptl. Theoret. Phys.* (U.S.S.R.) **15**, 336–43 (1945).—Multiple Compton effects can in principle be observed in the Wilson cloud chamber. Calcn. shows that in practice such photon tracks cannot be observed for 2 reasons. (1) The effective cross section for ionization by the Compton effect is extremely small. (2) The Compton effect is superseded by the photoeffect at lower photon energies and by pair formation at higher energies, both processes causing the photon to disappear. The average (n) of successive ionizations caused by multiple Compton effects is calcd. for photon energies from 0.005 m.e.v. to 50 m.e.v. For H, with initial photon energy of 50 m.e.v. (the most favorable case), $n = 15$, and at 1 atm. a layer at least 10^4 cm. thick would be required. The probability of multiple Compton effects decreases with increasing at. no. The possibility of application to astrophysics is mentioned.

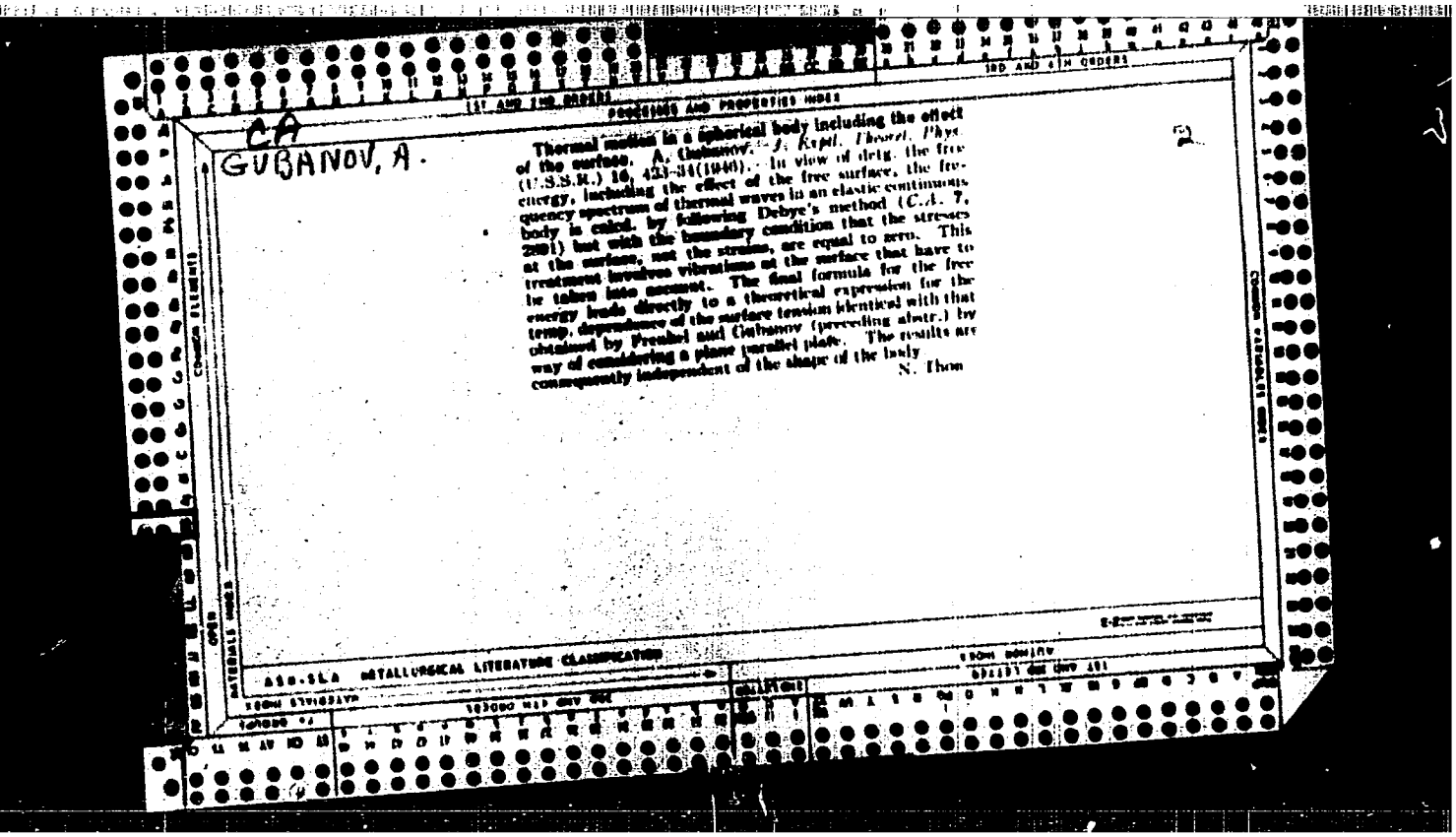
A. J. Miller

GUBANOV, A.

Gubanov, A. Rayleigh waves at the solid-liquid boundary. Akad. Nauk SSSR. Zhurnal Eksper. Teoret. Fiz. 15, 497–502 (1945). (Russian. English summary) [MF 15384]

The author investigates surface waves of the Rayleigh type on the boundary of a solid half-space under the assumption that the complementary half-space is filled by (i) moving perfect fluid, (ii) viscous fluid at rest. In the first case he concludes that the effect of the fluid on the Rayleigh waves becomes appreciable only if the velocity of the fluid becomes comparable with that of the Rayleigh waves. In the second case he shows that the damping effect of viscosity is too insignificant to be of interest for the theory of seismic waves at the bottom of the ocean. *L. Bers.*

Source: Mathematical Reviews, Vol 8, No. 2



CA

GUBANOV, A.

Thermal motion in a spherical body including the effect of the surface. A. Gubanov. *J. Exptl. Theoret. Phys.* (U.S.S.R.) 10, 423-34(1940). In view of defig. the free energy, including the effect of the free surface, the frequency spectrum of thermal waves in an elastic continuum body is calcd. by following Debye's method (*C.A.* 7, 2001) but with the boundary condition that the stresses at the surface, not the strains, are equal to zero. This treatment involves vibrations at the surface that have to be taken into account. The final formula for the free energy leads directly to a theoretical expression for the temp. dependence of the surface tension identical with that obtained by Frenkel and Gubanov (preceding abstr.) by way of considering a plane parallel plate. The results are consequently independent of the shape of the body.

N. Thon

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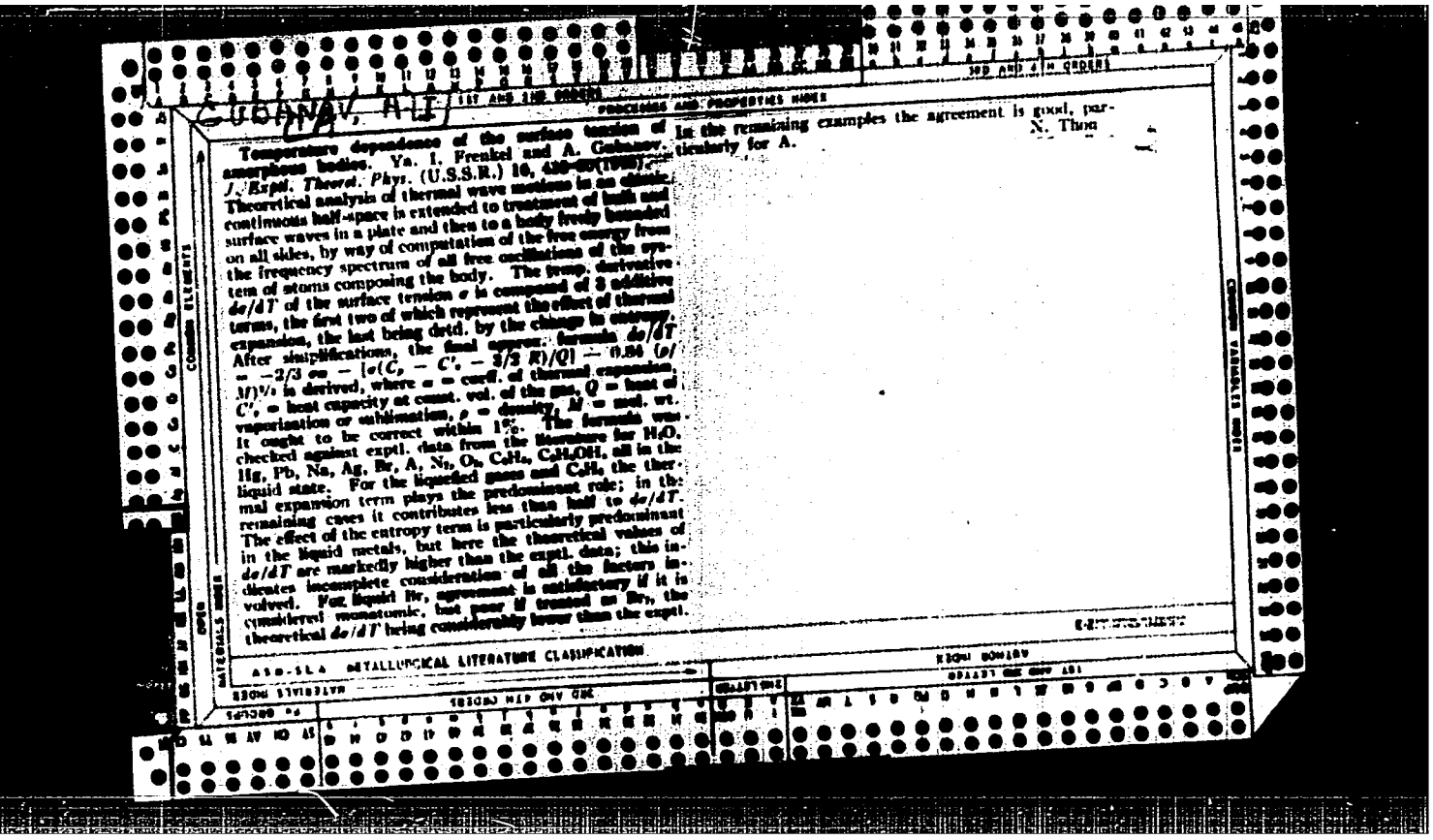
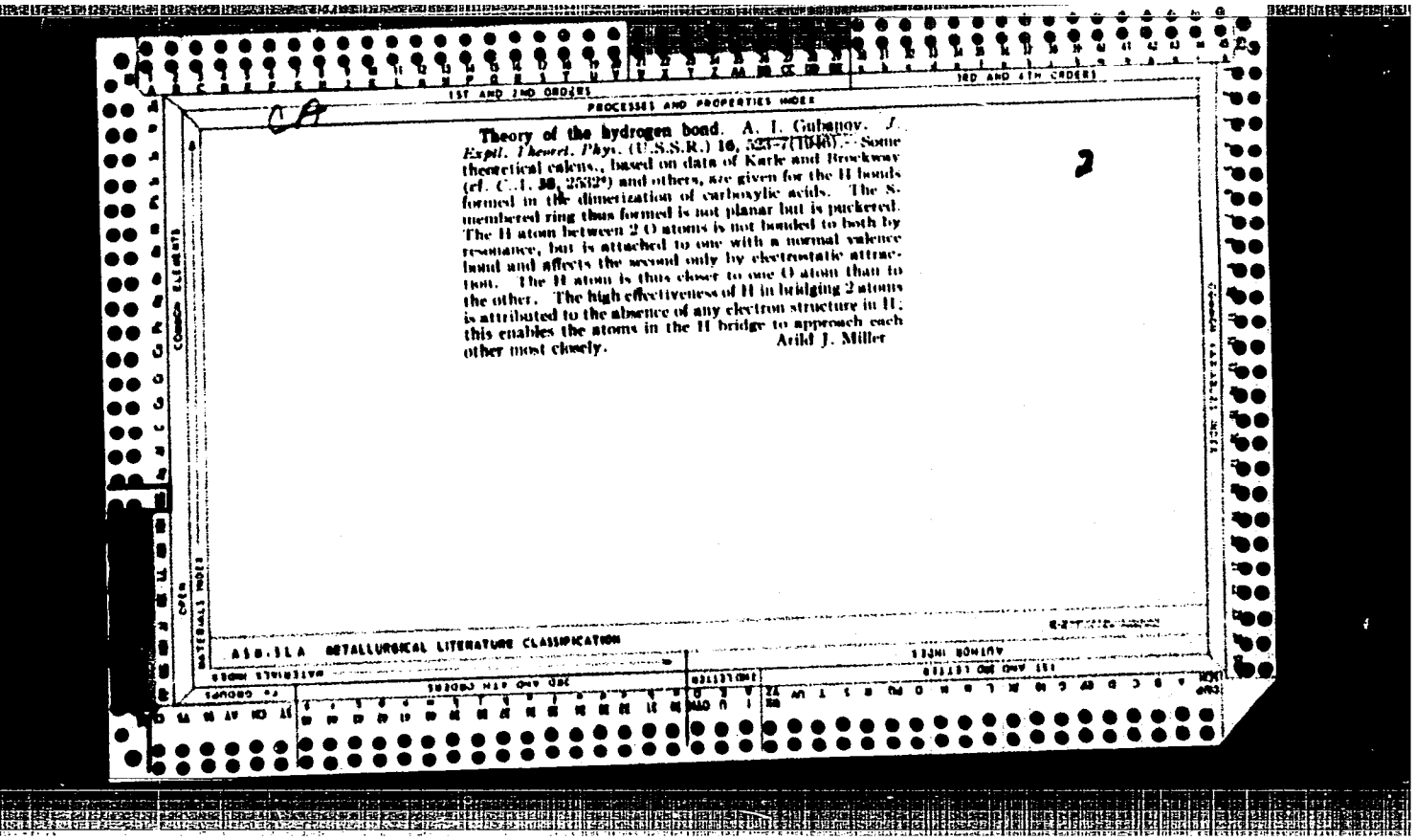


Temperature dependence of the surface tension of amorphous bodies. Ya. I. Frenkel and A. Gubanov. *J. Expt. Theoret. Phys.* (U.S.S.R.) 16, 469-80(1946). Theoretical analysis of thermal wave motions in an elastic continuous half-space is extended to treatment of bulk and surface waves in a plate and then to a body freely bounded on all sides, by way of computation of the free energy from the frequency spectrum of all free oscillations of the system of atoms composing the body. The temp. derivative $d\sigma/dT$ of the surface tension σ is composed of 3 additive terms, the first two of which represent the effect of thermal expansion, the last being detd. by the change in entropy. After simplifications, the final approx. formula $d\sigma/dT = -2/3\ \sigma\alpha - [\sigma(C_p - C'_v - 3/2\ R)/Q] - 0.86\ (\sigma/M)^{1/3}$ is derived, where α = coeff. of thermal expansion, C'_v = heat capacity at const. vol. of the gas, Q = heat of vaporization or sublimation, ρ = density, M = mol. wt. It ought to be correct within 1%. The formula was checked against expt. data from the literature for H_2O, Hg, Pb, Na, Ag, Br, A, N_2, O_2, C_6H_{12}, C_2H_5OH, all in the liquid state. For the liquefied gases and C_6H_6, the thermal expansion term plays the predominant role; in the remaining cases it contributes less than half to $d\sigma/dT$. The effect of the entropy term is particularly predominant in the liquid metals, but here the theoretical values of $d\sigma/dT$ are markedly higher than the expt. data; this indicates incomplete consideration of all the factors involved. For liquid Br, agreement is satisfactory if it is considered monatomic, but poor if treated as Br_2, the theoretical $d\sigma/dT$ being considerably lower than the expt. In the remaining examples the agreement is good, particularly for A. N. Thon



Theory of the hydrogen bond. A. I. Gubanov. *J. Expil. Theoret. Phys.* (U.S.S.R.) **16**, 521-7(1946).—Some theoretical calcns., based on data of Karle and Brockway (*cf.* C.A. **38**, 2532⁸) and others, are given for the H bonds formed in the dimerization of carboxylic acids. The 8-membered ring thus formed is not planar but is puckered. The H atom between 2 O atoms is not bonded to both by resonance, but is attached to one with a normal valence bond and affects the second only by electrostatic attraction. The H atom is thus closer to one O atom than to the other. The high effectiveness of H in bridging 2 atoms is attributed to the absence of any electron structure in H; this enables the atoms in the H bridge to approach each other most closely.

Arild J. Miller

GUBANOV, A.

PA 57T94

USSR/Phys Feb 1947
Waves, Surface
Wave Propagation

"Elastic Capillary Gravitational Surface Waves," A. Gubanov, Leningrad Physicotech Inst, Acad Sci USSR, 8 pp

"Zhur Eksper i Teoret Fiz" Vol XVII, No 2

Deduces equation for velocity of propagation of waves on surface of elastic-viscous body. In the limiting case of small frequencies this equation gives velocity of capillary gravitational waves on liquid surface. For high frequencies, as another limiting case, it gives velocity of Rayleigh waves

57T94

USSR/Phys (Contd) Feb 1947

at surface of solid body. Uses method of successive approximations to study cases coming close to above two limits.

57T94

PA 11T17

GUBANOV, A.

USSR/Mathematics, Applied Feb 1947
Wave propagation

"Dipping of a Cylinder into an Elastic-viscous Medium," A. Gubanov, 10 pp

"Zhur Tekh Fiz" Vol XVII, No 2

Solution of Frenkel's equation of propagation of a disturbance by the method of operators (Laplacian transformations).

11T17

457. A. I. Gubanov, "Elementary deformations of elasto-viscous bodies" (in Russian), J. tech. Phys (Zh. tekh. Fiz.), 1947, vol. 17, no 4, pp. 475–490.

The hydrodynamics of viscous fluids on the one hand and the theory of elasticity on the other, are regarded as the extremes of the general case of the elasto-viscous material. For the latter, both the shear modulus and the coefficient of viscosity must be considered. The principles of the mechanics of such bodies were developed by Y. I. Frenkel ["Kinetic Theory of Fluids" publ. by Acad. of Sci., USSR, 1945, chap. 4]. The corresponding equations can be obtained by substituting for the shear modulus G in elastic theory the operator

$$\frac{\eta \frac{d}{dt}}{1 + \tau \frac{d}{dt}}$$

where η is the coefficient of viscosity, and $\tau = \eta/G$ is the relaxation time.

On this basis the cases of elastic shear, torsion, and tension are generalized in this paper for elasto-viscous material. The elasto-viscous properties appear only in periodic or nonstationary regimes. Under stationary conditions simple viscous behavior obtains.

The following cases are treated in detail: (1) shear in an infinite layer of finite thickness under (a) imposed displacements, (b) imposed forces, (c) tangential impact; (2) torsion of a cylindrical rod for (a) and (b) above; (3) uniform tension for (a) and (b) above.

The general equations take account of inertia effects. It is shown, however, that in most cases the magnitude of these effects is negligible, making simplifications possible. Numerical illustrations apply the theory to the behavior of a soil layer under shear, and to that of heated glass in various forming processes. It is stated that practical applications of this method are of interest in the field of polymers, plastics and glasses, and in geology, astrophysics, and the investigation of motion in highly viscous media.

George Winter, USA

Vibrations. Balancing

A 11k

706. A. I. Gubanov, "Vibrations of solid bodies in an elastic viscous medium" (In Russian), *J. Tech. Phys. (Zh. tekh. Fiz.)*, 1947, vol. 17, no. 5, pp. 525-536.

The author considers a continuous medium possessing both viscosity and rigidity. The equations of motion for the medium which are used by the author are due to J. I. Frenkel ["Kinetic theory of liquids," Moscow, 1945]. They are

$$\mu\nabla^2 v = \rho\left(1 + \tau\frac{\partial}{\partial t}\right)\frac{\partial v}{\partial t} + \left(1 + \tau\frac{\partial}{\partial t}\right)\nabla p$$

where $\tau = \mu/G$, μ being the viscosity and G the shear modulus, and the other symbols have their customary significance. The boundary conditions are the same as those for a viscous fluid. By assuming $v = v_0 \exp(i\omega t)$, the author is able to solve several problems: (1) Fluid bounded on one side by an oscillating plane, on the other by a fixed plane; (2) fluid bounded by an oscillating disk; (3) by concentric cylinders, one fixed, one oscillating. He then discusses experiments based on such solutions which could be used to verify the theory, or, if this is accepted, to evaluate μ and G.

J. V. Wehausen, USA

May 48

Ca 1901

The theory of structurally viscous solutions. A. I. Gubanov. *Zhur. Tekh. Fiz.* 17, [illegible]-40(1947); *Chem. Zentr.* (Russian Zone Ed.) 1948, II, 1160.—For the explanation of the exptl. results of Rehbinder and Trapeznikova, according to which relaxation with superimposed damped oscillations was observed, the scheme according to Prandtl is assumed, which considers the combination of a Maxwell body (G_1, η_1) with a parallel connection of elasticity G_2 and viscosity η_2. The propagation of longitudinal and transverse waves is calcd. after introduction of the differential operator () into the wave equation $\rho(\partial^2u/\partial t^2) = O\Delta^2u$, where u is the deformation. The resulting complicated expressions give various velocities of propagation and dampings for both kinds of waves. The treatment of a level plate against a plane leads likewise to complicated expressions. The explicit calcn. of the relaxation by means of the Laplace transformation and of the Mellin integral gives, with some simplifications, the above-mentioned relaxation with superimposed damped oscillations.

F. W. Hoffmann

GUBANOV, A. I.

Gubanov, A. I. The mechanics of elastic-viscous-plastic bodies. I. Generalized equations of motion. Akad. Nauk SSSR. Zurnal Tehn. Fiz. 19, 34–42 (1949). (Russian)

The behavior of homogeneous isotropic deformable bodies is discussed in terms of lumped-parameter mechanical models. The models are composed of series and parallel combinations of springs, dashpots, and "dry friction" elements which are introduced to account for the yield point in plastic behavior. Linear relations between the stress and strain deviators are assumed for all of these elementary deformation mechanisms. It is shown that under this assumption the most general model leads to a linear relation of the type (1) $\Delta_1 S = S_0 + \Delta_2 E$, where $\Delta_i = \alpha_i + \tau_i d/dt + \nu_i d^2/dt^2 + \cdots$, S and E are the stress and strain deviators, respectively, and S_0 is the value of S at the yield point. For purposes of the present discussion only terms through the second order are retained in Δ_i. It is shown that, by assigning appropriate values to α_i, τ_i, ν_i $(i = 1, 2)$, and S_0, equation (1) can be made to describe six useful types of behavior in deformation: (a) Maxwell's liquid (viscosity η and stiffness G in series); (b) Kelvin's body (viscosity and stiffness in parallel); (c) Frenkel's body (a series pair of η and G in parallel with a G); (d) Frenkel's liquid (the previous combination in series with an η); (e) plastic body with hardening (no viscosity); (f) Bingham body (a parallel pair of η and dry friction element in series with a G).

In discussion of models exhibiting plastic behavior with hardening, no provision is made to distinguish between loading and unloading conditions. Equation (1) is next used to derive a modified Navier-Stokes equation which introduces time operators on the divergence and the Laplacian terms. The Hencky-Mises yield condition is assumed for the determination of S_0. *H. L. Ansoff.*

Source: Mathematical Reviews, Vol 12 No. 6

GUBANOV, A. I.

Gubanov, A. I. The mechanics of elastic-viscous-plastic bodies. II. Shear. Akad. Nauk SSSR. Zurnal Tehn. Fiz. 19, 43-61 (1949). (Russian)

A generalized linear equation relating the deviators of stress and strain in viscous-plastic-elastic bodies was obtained by the author [see the preceding review]. The present paper presents an application of this equation to a study of pure shear of a layer of thickness h. The boundary values are: (a) displacement zero at $z=0$; and (b) either displacement or stress prescribed at $z=h$. Four types of boundary values at $z=h$ are considered. The first three are: $p=$a constant; $p=At$; $p=A\sin\omega t$; where p is the stress (or the displacement) and A and ω are constants. The fourth is produced by a sudden adhesion of the top surface $z=h$ to a mass m per unit area moving initially with a velocity v_0. The equations are solved by means of Laplace transforms and the resulting expressions are reduced to descriptions of five distinct modes of behavior of deformable bodies described in the paper reviewed above. The reader is advised to take the solution for the case of a plastic body with reservations, since it appears to this reviewer that the unloading conditions are improperly accounted for [cf., for example, the expression following equation 57].

H. I. Ansoff (Santa Monica, Calif.).

Source: Mathematical Reviews, Vol 12 No. 6

GUBANOV, A. I

3

Gubanov, A. I. The mechanics of elastic-viscous-plastic bodies. III. Torsion of a circular cylinder. Akad. Nauk SSSR. Žurnal Tehn. Fiz. 19, 773–781 (1949). (Russian)

The present paper [see the two preceding reviews] considers torsion of a circular cylinder with prescribed time-dependent angle of torsion θ. Denote the differential operator $\alpha_1+\beta_1\partial/\partial t+\gamma_1\partial^2/\partial t^2$ by Δ_1; then the stress-strain relation is given by $\Delta_1\sigma=S_0+\Delta_2\epsilon$, where S_0 is constant and σ and ϵ are the stress and the strain, respectively. Laplace transforms are used to obtain general formulas for the resulting stress distribution in the plastic and the elastic zone for the following cases: $\theta=$constant; $\theta=At$; $\theta=A\sin\omega t$. By assigning special values to the constants characterizing the body the author reduces the formulas to the six cases described in the second preceding review. *H. L. Anisoff.*

Source: Mathematical Reviews, Vol 12 No. 6

GUBANOV, A. I.

Gubanov, A. I. The mechanics of elastic-viscous-plastic bodies. IV. Stretching and compression of cylinders. Akad. Nauk SSSR. Žurnal Tekn. Fiz. 19, 892-910 (1949). (Russian)

This is the fourth and last in a series of papers dealing with what the author calls "equations of motion of a generalized elastic-viscous-plastic body" [see the three preceding reviews]. The present paper deals with a uniaxial uniform state of stress in a cylindrical body. The boundary values, the method of solution, and the final results are similar to those obtained in the previous papers. M. A. Biot.

Source: Mathematical Reviews, Vol. 12 No. 6

USSR/Physics Jan 49
Sound, High-Frequency
Sound, Focusing

"Calculations for Focusing Ultrasound," A. I. Gubanov, Leningrad Physicotech Inst, Acad Sci USSR, 4 pp

"Zhur Tekh Fiz" Vol XIX, No 1

The desideratum in ultrasonics is maximum intensity. Since intensity is limited by the surface of sound generator, Gubanov considers Grentzmacher's experiment with a spherical sound generator which will permit focusing to obtain greater intensity at a distance from the generator. Gubanov gives theoretical computation of such focusing, and identifies factors influencing value of intensification during focusing.

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GUBANOV, A. I.

JOURNAL, 4-1.

CA

2

Theory of the contact of two semiconductors with different types of conductivity. A. I. Gubanov (Leningrad Phys. Tech. Inst.). *Zhur. Tekh. Fiz.* 20, 1287–1301(1950).—The contact of a pair of an electronic (I) and a hole semiconductor (II), e.g. Cu_2O-TiO_2, has rectifying properties, and the resistance R_p of the pair at a low applied voltage V is considerably greater than the sum ΣR of the resistances of the individual semiconductors even in the transmitting direction. With V tending to zero, R_p in either direction tends to the same limit; with V increasing in the transmitting direction, R_p falls rapidly to ΣR, whereas in the blocking direction it mostly also decreases but much more slowly, if at all. These phenomena may be general in solid rectifiers where rectification possibly takes place actually at the boundary of 2 semiconductors of different types, rather than on a metal/semiconductor boundary. The usual zone scheme of the contact shows that passage of electrons or holes across the boundary of 2 semiconductors is difficult. Only a very small fraction $e^{-\Delta\varphi/kT}$ (where e = electronic charge, $\Delta\varphi$ = distance between the bottoms of the cond. zones of the 2 semiconductors) of electrons can pass from I to II, and only an insignificant fraction of holes can pass from II to I. Recombination of electrons and holes at the boundary is also very slightly probable. With the neg. voltage applied to I, electrons and holes rather accumulate at the boundary, producing space charges ρ which cause curving of the zones under an applied voltage; in I, $\rho < 0$, and the zones curve downwards, whereas in II, $\rho > 0$, and the zones curve upwards, also in the absence of a contact potential difference V_c. With the pos. voltage applied to I, the effects are reversed, and the zones curve in the opposite direction. Impoverishment of the boundary region in carriers of current blocks the passage of current. In zero approxn. (i.e. in the absence of current), the chem. potential μ_0 of I lies above μ_0 of II in the transmitting direction ($V > 0$), and below μ_0 in the blocking direction ($V < 0$). Calcns. based on these schemes are made for a model involving a gap (adsorbed layer) between I and II. Zeroth approxn. gives the relation between V and the concns. n_1 and n_2 of electrons and holes in I and II, resp. First approxn. then gives the relation between the current i and n_1 and n_2, and hence, with the aid of the 1st approxn., the relation between i and V, i.e. the current-voltage curve. Of the 2 possible mechanisms for the passage of the electrons through the contact, passage of electrons into the conduction zone of II and of holes into the filled zone of I gave no satisfactory quant. agreement with the data for Cu_2O-TiO_2. Use was made of recombination at the boundary, with inclusion of capture of electrons from I on local levels of II with subsequent recombination with holes of II, and capture of holes from II on local levels of I and subsequent recombination with electrons of I. An exact expression for the current across the contact is derived, including all these contributions. Although the contact potential difference V_c is not a primary factor, it does play a definite role. At $V_c < 0$, direct recombination is predominant, and i is proportional

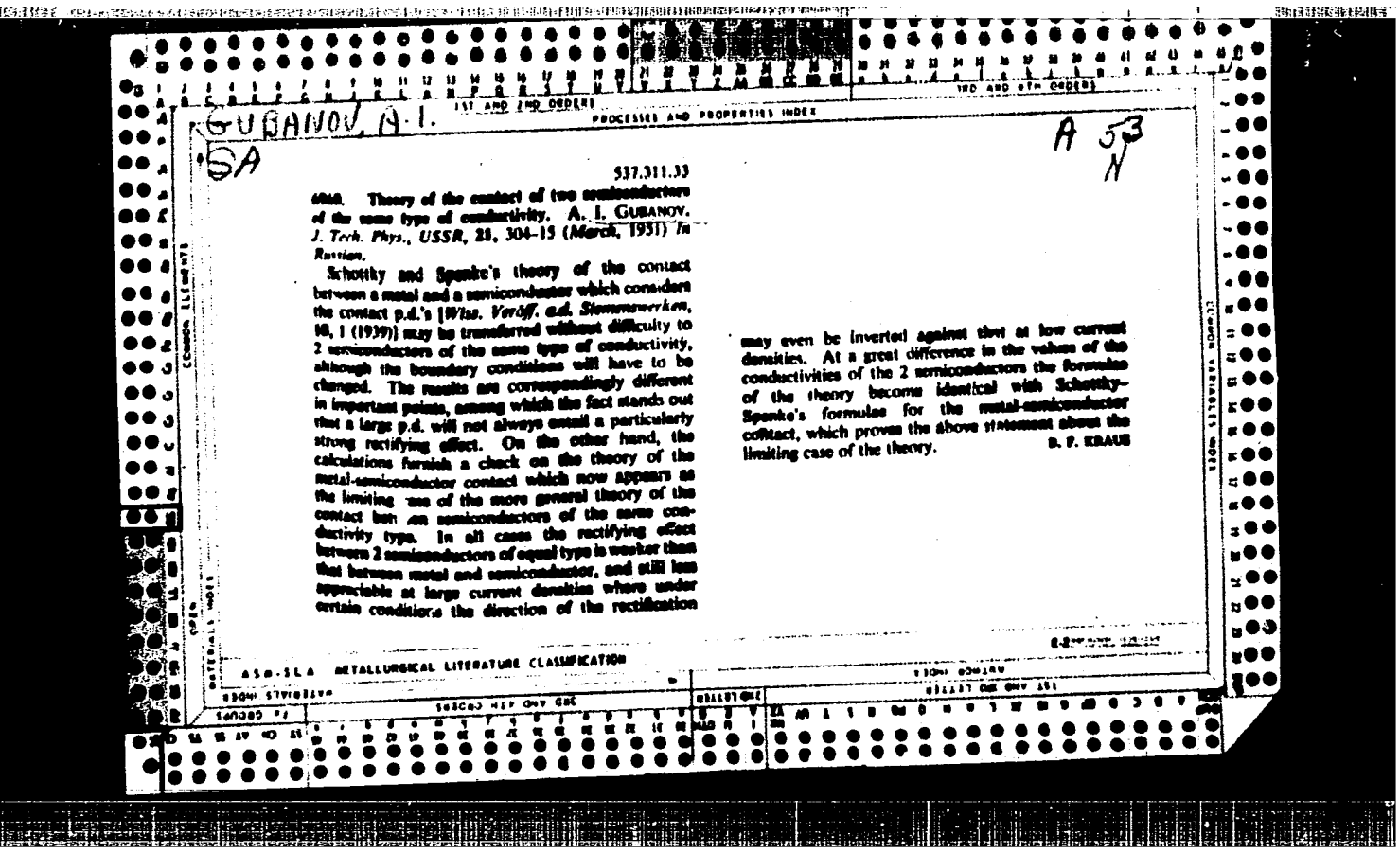
GUBANOV, A. I.

CA

2

Theory of semiconductors with mixed conductivity. A. I. Gubanov (Leningrad Phys. Tech. Inst.). *Zhur. Eksptl. Teoret. Fiz.* **21**, 79-87(1951).—The general system of equations is set up for a semiconductor in which both types of carriers of current, electrons and holes, are present simultaneously. The treatment differs from that of Davydov (*Zhur. Tekh. Fiz.* **7**, 2212(1937); *Doklady Akad. Nauk U.S.S.R.* **20**, 79(1938); *C.A.* **32**, 6943[9]) in that it takes into account the space charge and the zone curving produced by it at the boundary; also, the life of an electron or hole is not taken to be const., but to depend on the concn. The essential difference from the case of a semiconductor with one single kind of carrier consists in the divergence of the flux of each kind of carriers separately not being zero, and therefore the diffusion equations being not of the 1st but of the 2nd order. Equations of the chem. equil. between the electrons at different energy levels are replaced by equations of the kinetics of electron transitions from one level to another. The boundary conditions depend on whether the semiconductor under consideration is bounded by a metal, an insulator, or air, or another semiconductor. In contact with a metal, the difference of the thermal flows across the boundary should be equal to the normal component of the resultant of the flow of electrons or holes. Against an insulator or air, the normal component is zero. At the boundary of 2 semiconductors, the tangential components of the elec. field and the normal components of the elec. induction should be equal, and the passages of electrons and holes from one semiconductor into the other (cf. preceding abstr.) should be taken into account. Approx. methods of solution of the equations are given. At the limit of one type of carrier being strongly predominant over the other, the theory goes over into the known theory of semiconductors with carriers of one type only. For the latter, the diffusional potential drop V_d is equal to the contact potential difference between the electrodes and does not enter the external voltage applied. Not so in the case of a semiconductor with 2 types of carriers. Here, V_d may play the main role, with the ohmic potential drop becoming unimportant.

N. Thon



GUBANOV, A. I.

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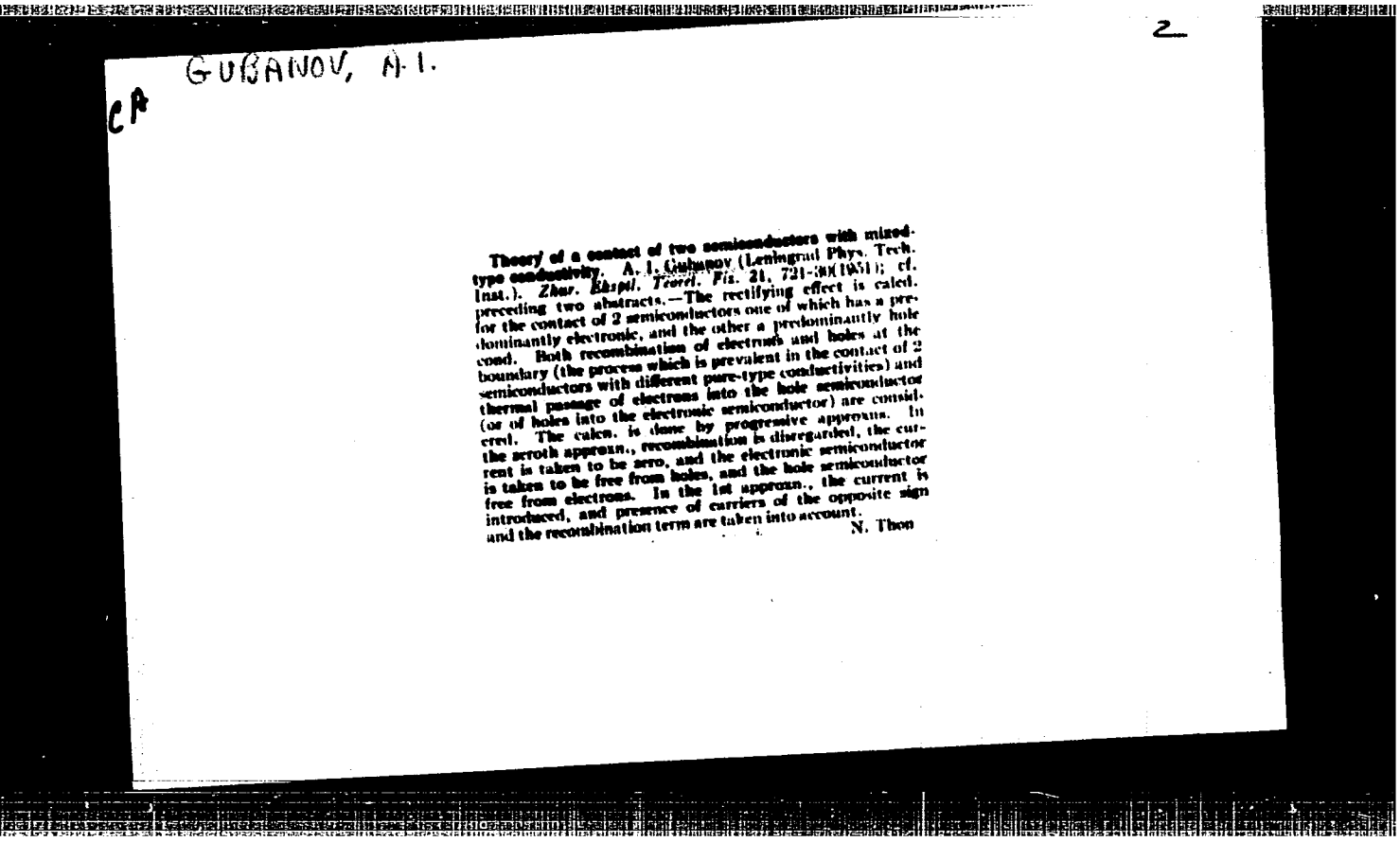
6048. **Theory of the contact of two semiconductors of the same type of conductivity.** A. I. GUBANOV. *J. Tech. Phys., USSR*, 21, 304–15 (March, 1951) *In Russian.*

Schottky and Spenke's theory of the contact between a metal and a semiconductor which considers the contact p.d.'s [*Wiss. Veröff. a.d. Siemenswerken*, 18, 1 (1939)] may be transferred without difficulty to 2 semiconductors of the same type of conductivity, although the boundary conditions will have to be changed. The results are correspondingly different in important points, among which the fact stands out that a large p.d. will not always entail a particularly strong rectifying effect. On the other hand, the calculations furnish a check on the theory of the metal-semiconductor contact which now appears as the limiting case of the more general theory of the contact between semiconductors of the same conductivity type. In all cases the rectifying effect between 2 semiconductors of equal type is weaker than that between metal and semiconductor, and still less appreciable at large current densities where under certain conditions the direction of the rectification may even be inverted against that at low current densities. At a great difference in the values of the conductivities of the 2 semiconductors the formulae of the theory become identical with Schottky-Spenke's formulae for the metal-semiconductor contact, which proves the above statement about the limiting case of the theory.

B. F. KRAUS

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION



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GUBANOV, A. I.

CA

Theory of a contact of two semiconductors with mixed-type conductivity. A. I. Gubanov (Leningrad Phys. Tech. Inst.). *Zhur. Eksptl. Teoret. Fiz.* 21, 731-8(1951); cf. preceding two abstracts.—The rectifying effect is calcd. for the contact of 2 semiconductors one of which has a predominantly electronic, and the other a predominantly hole cond. Both recombination of electrons and holes at the boundary (the process which is prevalent in the contact of 2 semiconductors with different pure-type conductivities) and thermal passage of electrons into the hole semiconductor (or of holes into the electronic semiconductor) are considered. The calcn. is done by progressive approxns. In the zeroth approxn., recombination is disregarded, the current is taken to be zero, and the electronic semiconductor is taken to be free from holes, and the hole semiconductor free from electrons. In the 1st approxn., the current is introduced, and presence of carriers of the opposite sign and the recombination term are taken into account.

N. Thon

GUBANOV, A. I.

USSR/Physics - Semiconductors Feb 52

"Theory of Contact of Metal With Semiconductors in the Case of Great Contact Difference of Potentials," A.I. Gubanov, Leningrad Phys Tech Inst, Acad Sci USSR

"Zhur Eksper i Teoret Fiz" Vol XXII, No 2, pp 204-213

Calculates the theoretical v-amp characteristic of contact of metal with semiconductor with a potential difference on contact great enough to modify close to the contact the cond type of the semiconductor (electron to hole). Computation is performed for flat, knife, and point contacts. Received 3 May 52.

207T81

GUBANOV, A. I.

USSR/Physics - Semi-Conductors; Rectifiers, Solid Mar 52

"The Theory of Solid Rectifiers," A. I. Gubanov, Leningrad Physico-Tech Inst

"Zhur Tekh Fiz" Vol 22, No 3, pp 381-394

Proposes that the rectifying action of solid rectifiers is not the result of the formation of a metal-semi-conductor contact blocking layer at the metal-semi-conductor contact but instead is caused by the formation of this layer at the boundary formed by the main body of the semi-conductor, having one type of conductivity, and a thin layer of the semi-conductor at the metal contact, having the other type of conductivity. Solves diffusion equation and Poisson's equation to obtain v-a characteristic for this rectifier model; the characteristic agrees well with a numerical example for a copper-oxide rectifier. Submitted 20 Sep 51.

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GUBANOV, A. I.

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USSR/Electronics - Rectifiers Nov 52

"Dynamic Theory of Solid Rectifiers. I. Limits of Applicability of the Statistical Theory," A. I. Gubanov

"Zhur Tekh Fiz" Vol 22, No 11, pp 1803-1813

By way of an analysis of the nonstationary diffusion equations the author determines the limits of applicability of statistical theory of solid rectifiers. He establishes that frequency influences first of all the establishment of equilibrium between number of

236T59

mobile and immobile charges, which begins to be noticeable at 50 cps. Notes that redistribution of mobile charges in blocking layer is independent of frequency up to 10^6 cps.

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GUBANOV, A. I.

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USSR/Electronics - Rectifiers Nov 52

"Dynamic Theory of Solid Rectifiers. II. Frequency Characteristics," A. I. Gubanov

"Zhur Tekh Fiz" Vol 22, No 11, pp 1814-1826

Studies the influence of frequency of alternating voltage with amplitude of several volts, imposed on a solid rectifier, on the distribution of the immobile charges in the blocking layer. Calculates the distribution of potential, and also the conduction and displacement currents as functions of the frequency. Gives numerical examples for case of Cu_2O.

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GUBANOV, A. I.

USSR.

Theory for the origin of the rectifying electromotive force in semiconductors. A. I. Gubanov (Phys.-Tech. Inst., Leningrad). *Zhur. Eksptl. i Teoret. Fiz.* 25, 307–12(1953); cf. *C.A.* 46, 9371a; Lashkarev, *C.A.* 44, 4771g.—The e.m.f. set up due to the rectifying effect in a perforated semiconductor is calcd. for the case when the intensity of introducing electrons into the conducting zone (the ionization intensity) is an arbitrary function of x, the distance of the semiconductor from the electrode. J. Rovtar Leach

GUBANOV, A. I. FD-605

USSR/Physics - Semiconductor strong-field effect

Card 1/1 : Pub 153-17/22

Author : Gubanov, A. I.

Title : Theory of the strong-field effect in semiconductors

Periodical : Zhur. tekh. fiz. 24, 308-319, Feb 1954

Abstract : Reviews the general theory. Discusses ionization by thermal electrons and by collisions. Derives corresponding formulas taking under consideration the image forces of transistor theory. Indebted to A. I. Anselm. 28 references, including 9 foreign.

Submitted : July 20, 1953

GUBANOV, A.I.

2

2678

537.311.33 : 535.215

Diffusion and Drift of Photoelectrons in Partly Illuminated Semiconductor. A. I. Gubanov. (*Zh. tekh. Fiz.*, May 1954, Vol. 24, No. 5, pp. 833-840.) A calculation is made of the effects at the dark/light boundary, assuming one kind of charge carrier, and an external field perpendicular to the boundary. Cases of low and of high photoconductivity are considered, the electron distribution is calculated and the voltage/current characteristics are obtained for cases when one of the electrodes or the middle region of the specimen is illuminated.

GUBANOV, A. I.

FD-612

USSR/Physics - Fluid Dynamics

Card 1/1 : Pub. 146-2/18

Author : Gubanov, A. I.

Title : Zonal theory of a one-dimensional model of a fluid

Periodical : Zhur. eksp. i teor. fiz. 26, 139-149, February 1954

Abstract : Examines the behavior of an electron in the field of a one-dimensional chain of atoms by means of the methods of quantum mechanics. Using the solution of the Schroedinger equation in a deformed coordinate scale the author shows that when the distant order in the disposition of the atoms disappears, i.e. when the chain "melts," the energy spectrum of the electron preserves its zonal structure, and only the regions of the zones are slightly displaced. This is in accord with experimental results on conductivity. The author thanks A. I. Ansel'm and O. B. Firsov for having assisted him in the preparation of the article.

Institution : Leningrad Physicotechnical Institute, Acad Sci USSR

Submitted : July 18, 1953

GUBANOV, A.I.

532.7

8541. Theory of the zone structure of a three-dimensional model of a liquid. A. I. GUBANOV. *Zh. eksper. teor. Fiz.*, 28, *No.* 4, 401–8 (1955) In Russian.

The perturbation method previously applied to a one-dimensional disordered chain of atoms [Abstr. 8087 (1954)] is now applied to a distorted crystal lattice, specified by a non-Euclidean metric, the metric tensor being a random function of the lattice points. There is no essential difference between the present and the previous paper with regard to method of deduction and result. R. EISENSCHITZ

GUBANOV, Aleksandr Ivanovich; NOVOZHILOV, Yu.V., redaktor; VOLCHOK, K.M., tekhnicheskiy redaktor

[A theory of the rectifying activity of semiconductors] Teoriia vypriamliaiushchego deistviia poluprovodnikov. Moskva, Gos. izd-vo tekhniko-teoret. lit-ry, 1956. 348 p. (MLRA 9:10)
(Semiconductors)

GUBANOV, A I

CARD 1 / 2 PA - 1264

SUBJECT USSR / PHYSICS
AUTHOR GUBANOW, A.I.
TITLE The Length of the Free Path of an Electron in Liquid and in Amorphous Concuctors.
PERIODICAL Žurn. techn. fis, 26, fasc.8, 1651-1656 (1956)
Publ. 8 / 1956 reviewed 9 / 1956

Apart from the reasons enumerated in some of the author's previous works for the diffusion of electrons in liquids, the following may still be mentioned: 1.) On the occasion of the displacement of atoms also the maximum and the minimum of the potential may change. 2.) In all cases even greater deformations of structure than those already found exist. All this tends to show that the potential of the field is not a strictly periodic function of the deformed coordinates as was previously believed. The character of these deviations remains the same as in the case of admixtures and other defects in crystal. The existence of defects causes an additional diffusion of the electrons. In the course of the present work diffusion was computed with the help of the method applied when computing alloy resistances. Next, the total reciprocal of the free path of the electron in amorphous bodies was computed and its dependence on the electron energy and on temperature is explained. Like in the case of the theory of alloy resistances the potential was divided into a periodic part and into a part deviating from it. Formulae taken from the author's previous works were used in order finally to obtain the free path:

PA - 1264

Žurn.techn.fis, 26, fasc.8, 1651-1656 (1956)

$$\frac{1}{l_D} = \frac{\pi}{a^3 k^2} \left(\frac{dE}{dk}\right)^2 \frac{1}{\left|\overline{V'_n}\right|^2 \left(1 - \frac{2}{9} a^2 k^2\right)}$$

The lower cross bar above the V'_n denotes the average value after the n-th elementary cell, the upper one that after all elementary cells. In order to be able to take account of all different kinds of diffusion of the electron in a liquid, the reciprocal free paths must be added. According to the formulae developed in previous works the corresponding free paths for metals, atomic semiconductors, and ion semiconductors were computed. For these cases also the dependence of the length of the free path on the energy of the electron and on temperature was computed. In the case of temperature dependence it is necessary to distinguish between two cases. In the case of real liquids the exponent depends on the temperature and decreases without interruption during the process of heating the liquid from melting- to critical temperature. At present it is not possible to interpret this dependence theoretically, but it may be obtained, in the most favorable of cases, as the result of radiographical or electrographical investigations.
Glasslike or amorphous semiconductors present a more simple problem. Here the exponent is "frozen" and no longer dependent on temperature. Temperature dependence is clearly expressed by the formulae.
INSTITUTION:

GUBANOV, A.I.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1384
AUTHOR GUBANOW, A.I., MAKOWSKIJ, L.L.
TITLE On the Article by K.B.TOLPYGO and I.G.SASLAWSKAJA on "Bipolar Diffusion in Semiconductors in the Case of Strong Currents".
PERIODICAL Žurn.techn.fis, 26, fasc. 9, 2126-2127 (1956)
Issued: 10 / 1956 reviewed: 10 / 1956

On the occasion of the solution of the system of differential equations in the work by K.B.TOLPYGO and I.G.SASLAWSKAJA(Zurn.techn.fis, 25, 955 (1955) the method of successive approximation was incorrectly used. The authors investigated the system of equations (11a), (11b), (11w') and (11g'). They attempt to find the solution of (16) by exploiting the smallness of the parameter A which takes the recombination of the electrons and holes into account. The function $\xi(\theta)$, however, must necessarily appear in the following form according to the equation (11g'):

$$\xi(\theta) = \frac{\xi^{-1}(\theta)}{A} + \xi_0(\theta) + A\,\xi_1(\theta) + \dots \qquad (a)$$

Let us now investigate the equation (11a). By inserting the unknown functions which are expressed in series according to A-powers, we obtain:

$$\frac{1}{\lambda}\left[\frac{dN_0(\xi)}{d\xi} + A\,\frac{dN_1(\xi)}{d\xi} + \dots\right] = \theta + N_0 y_0 + A(N_0 y_1 + y_0 N_1) + \dots$$

It should be noted that on the occasion of approximation towards zero, the

Žurn.tech.fis, 26, fasc.9, 2126-2127 (1956) CARD 2 / 2 PA - 1384

equation obtained in the special case coincides with the initial equation. By dividing the equation (11a) by the equation (11g'), as was done by the authors (the parameter b is neglected in this equation), we obtain the equation (15a).

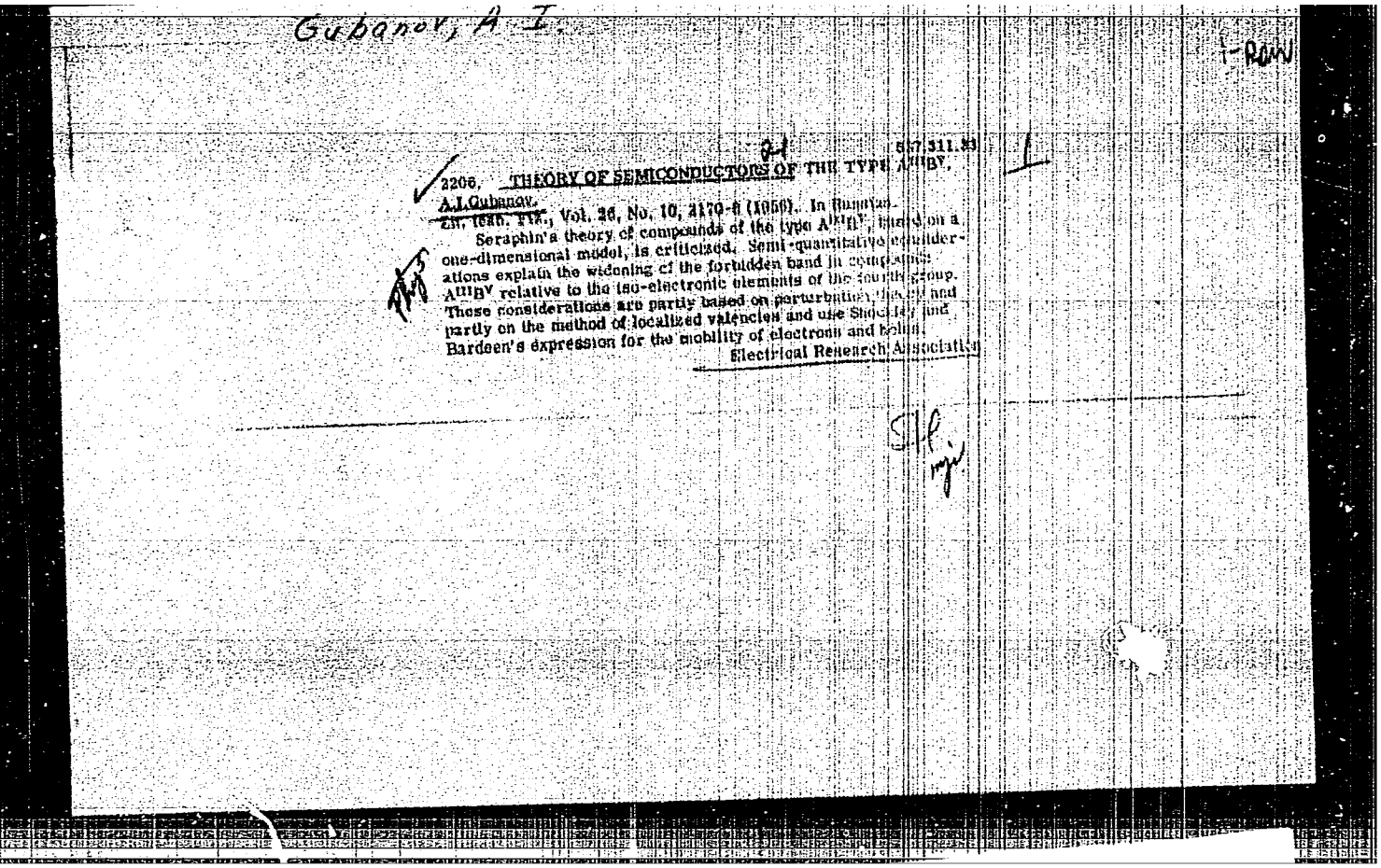
In order to prove that such an operation contributes absolutely nothing towards solving the task we represent both parts of the equation (11g') in form of a series with respect to the powers A:

$$\frac{1}{A}\frac{d\xi_{-1}}{d\theta} + \frac{d\xi_0}{d\theta} + A\frac{d\xi}{d\theta} + \ldots = \frac{\lambda}{A}\left[\frac{1}{N_0 z_0} + A(\ldots) + \ldots\right], \quad (b)$$

where $\frac{d\xi_{-1}}{d\theta} = \frac{\lambda}{N_0 z_0}$ etc.

It is clear that, by multiplying both parts of the equation (11a) by one and the same series, the equation (11a) is again obtained by approximation towards zero. The error committed by the authors consists in having failed to consider the fact that the quantity on the left side of the equation (15a) is proportional to the parameter A as follows from the equation (11g'), and from physical deliberations. Actually, θ is the relative density of the electron current which, in the flat case and with lacking recombination (with A=0) is constant. - Therefore θ is proportinal to A in first approximation. In view of the fact that the results obtained by K.B.TOLPYGO and I.G.SASLAWSKAJA are based upon an incorrect solution of equations they are of doubtful value.

INSTITUTION:



Gubanov, A. I.

1-RDW

537.311.33

2206. THEORY OF SEMICONDUCTORS OF THE TYPE $A^{III}B^{V}$.

A.I.Gubanov.

Zh. tekh. Fiz., Vol. 26, No. 10, 2170-8 (1956). In Russian.

Seraphin's theory of compounds of the type $A^{III}B^{V}$, based on a one-dimensional model, is criticized. Semi-quantitative considerations explain the widening of the forbidden band in compounds $A^{III}B^{V}$ relative to the iso-electronic elements of the fourth group. These considerations are partly based on perturbation theory and partly on the method of localized valencies and use Shockley and Bardeen's expression for the mobility of electrons and holes.

Electrical Research Association

GUBANOV, A. I.

B-6

USSR/Physical Chemistry. Liquids and Amorphous Bodies. Gases.

Abs Jour: Ref Zhur-Khimiya, No 5, 1957, 14560

Author : A. I. Gubanov
Inst :
Title : Electron Scattering in Liquid in Consequence of Disturbance of Long Range Order

Orig Pub: Zh. eksperim. i teor. fiziki, 1956, 30, No 5, 862-872

Abstract: With a view to evolve the zonal theory of liquids proposed by the author (RZhKhim, 1956, 35216, 38904), the motion of electrons in a liquid was considered using Cartesian co-ordinates. Wave functions of zero approximation were proposed; these functions are analogous to Bloch's functions for a crystal and satisfy equations differing from Schrödinger's equation by minor terms. The electron scattering in liquid in consequence of the disturbance of the long range order of atom arrangement was computed and the dependence of the free path length

Card 1/2

USSR/Physical Chemistry. Liquids and Amorphous Bodies. Gases. B-6

Abs Jour: Ref Zhur-Khimiya, No 5, 1957, 14560

Abstract: of an electron, corresponding to this scattering, on its wave number was obtained in the region of small figures.

Card 2/2

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1662

tron by phonons which does not satisfy the momentum conservation theorem within the electron-phonon system, is possible, for, because of the destruction of the distant order on the occasion of the emission or absorption of a phonon by an electron, the lattice is able to absorb a certain additional momentum. This additional scattering of electrons is here called "phonon liquid scattering".

There follows the computation of the free length of path which is due to this phonon-liquid scattering. Also generalization for the case that, besides the electric field, there exists a temperature gradient or a concentration gradient, is not difficult. In most cases it is possible to disregard phonon liquid scattering in semiconductors; only at high temperatures does it make a slight correction to ordinary thermal scattering.
In conclusion the case of optic oscillations (and in what it differs from acoustic oscillations) is discussed. The usual thermal scattering of electrons in liquids can, with the exception of slight corrections, be computed by means of the same formulae that are employed in the case of solids. However, in liquids there is an additional phonon-liquid scattering, which is able to play an important part in liquid metals but not in semiconductors.

INSTITUTION: Leningrad Physical Technical Institute of the Academy of Science in the USSR

GUBANOV, A.I.

3901

SCATTERING OF ELECTRONS IN A LIQUID DUE TO VIOLATION OF LONG RANGE ORDER. A. I. Gubanov (Academy of Sciences, USSR). Soviet Phys. JETP 3, 851-61(1957) Jan.

Further development of the zone theory of liquids is given by the investigation of the motion of electrons in a liquid in terms of Cartesian coordinates. The assumed zero approximation wave functions are similar to the Bloch functions for crystals and satisfy equations which differ from the Schrödinger equation by small terms. Scattering of the electrons in a liquid due to violation of long range order in the atomic arrangement has been calculated and the dependence of the corresponding electron mean free path on wave number has been determined for small values of the wave number. (auth)

GUBANOV, A I

PA - 2353

AUTHOR: GUBANOV,A.I.

Title: Free Path of an Electron in Liquid and Amorphous Conductors (Dlina svobodnogo probega v zhidkikh i amorfnyk provodnikakh, Russian).

PERIODICAL: Izvestiia Akad. Nauk SSSR, Ser. Fiz., 1957, Vol 21, Nr 1, pp 104 - 104 (U.S.S.R.)

Received: 4 / 1957 Reviewed: 5 / 1957

ABSTRACT: In previous works the authors were able to show the following by solving the Schrödinger equation in the deformed system of the coordinates ξ (in which the self-consisting-field for the electron is approximately periodic): The energy-spectrum has, as in the case of crystals, a zone-structure. The electrons are described by Bloch-functions in the system of the coordinates ξ i.e. the electrons are quasi-free.

The destruction of the distant order in the liquid, however, leads to a specific "liquid scattering" of electrons. On the occasion of the computation of this scattering, the following was shown: The quasi-Bloch-functions of the form $\psi = u(\xi)e^{ikr}$ (where u is a periodic function of the coordinates ξ) satisfy an equation which differs from the Schrödinger equation by small terms of the order of magnitude ε. Here ε denotes the order of magnitude of the small deformation of elementary cells in the case of the melting of the crystal. The author considered the aforementioned function as zero-th approximation and the aforementioned small terms as per-

Card 1/3

Free Path of an Electron in Liquid and Amorphous Conductors.

turbation; by this method he computed the free path l_{fl} of the electron on the occasion of "liquid-scattering". If the aforementioned quasi-Bloch-functions are used, the scattering of electrons in the liquid by thermal phonons is computed as in the case of crystals; this kind of computation has, however, also certain peculiarities. For the maintainance-law of momentum is not bound to apply in the case of the electron-phonon system because of the lack of a distant order in the liquid. Therefore, also electrons of an additional phonon-liquid scattering occur besides ordinary phonon-scattering. On the occasion of the computation of the free length of path l_{Ph-fl} in the case of this scattering for metals as well as for atomic and ion semiconductors it was found that in the case of metals l_{Ph-fl} is comparable to l_{Ph}. l_{Ph} corresponds to the ordinary scattering by phonons. In the case of semiconductors, $l_{Ph-fl} \gg l_{Ph}$ applies. Finally also the free length of path l_d for scattering by the defects and deviations from periodicity was computed. For the resulting free path $(1/l) = (1/l_{fl}) + (1/l_{Ph}) +$

Card 2/3 $+ (1/l_{Ph-fl}) + (1/l_d)$ applies. In the case of atomic semiconductors

PA - 2353

Free Path of an Electron in Liquid and Amorphous Conductors.

e.g. the dependence (1/l) = A + Bu applies. Here u denotes the energy of the electron, A and B are functions of temperature. (No illustrations).

ASSOCIATION: Leningrad Physical-Technical Institute of the Academy of Science of the U.S.S.R.
PRESENTED BY:
SUBMITTED:
AVAILABLE: Library of Congress.

Card 3/3

CARD 1 / 2 PA - 1990

SUBJECT USSR / PHYSICS
AUTHOR GUBANOV,A.I.
TITLE The Electric Conductivity, the Heat Conductivity, the Thermo-electromotoric Force, HALL'S Constant, and the NERNST Constant for Amorphous Bodies with Electronic Conductivity
PERIODICAL Zurn.techn.fis. 27, fasc.1, 3-11 (1957)
Issued: 2 / 1957

In the course of this work the temperature dependence of various kinetic coefficients for amorphous conductors is computed in consideration of the scattering of electrons which is characteristic of this case and is connected with the lack of a remote order. If we investigate the scattering of electrons by thermal oscillations, we find that in semiconductors a universal free length of path of the electron exists at any temperature T, which holds good in the case of all kinetic processes. The approximation of the effective mass which is amply sufficient for semiconductors is here considered as being all that is necessary. On this assumption it is possible to compute the kinetic coefficients by means of the formulae of the theory of free electrons. Formulae are given for the following kinetic coefficients: electric conductivity, heat conductivity, THOMSON'S coefficient, PELTRIER'S effect, differential thermoelectromotoric force, isothermal electric conductivity in the magnetic field, isothermal HALL'S constant, isothermal NERNST'S constant. The author carried out computations separately for metals at high temperatures of atmic semiconductors and for ion semiconductors with weak binding between the oscillations of the lattice and the motion of the electrons. The case with strong binding

(polarones) in amorphous ion semiconductors can be investigated separately. At first liquid metals are computed at $T \gg \Theta$ in consideration of the complete formulae by L.BRILLOUIN, Quantum Statistics (here the author quotes the Russian translation).
The author then computes the kinetic coefficients (more accurately expressed the explicit temperature dependence of these kinetic coefficients) for amorphous atomic semiconductors.
In conclusion amorphous semiconductors with ion bindings are studied. In this case various expressions hold for the free length of path of the electron at high as well as at low temperatures. Because of the very complicated nature of the expressions for this free length of path computation must be carried out in a rougher manner than in the case of atomic semiconductors. Computations are carried out separately for high and for low temperatures. At high temperatures the temperature dependence of the kinetic coefficients has a simple form. In the case of the approximation investigated here this is the same form as in the case of crystalline ion semiconductors. However, in the case of genuine liquids the temperature dependence of the kinetic coefficients has a very complicated character and can be represented only graphically for the individual concrete substances.

INSTITUTION: Physical-Technical Institute, LENINGRAD

Gubanov, A. I.

57-11-13/33

AUTHOR: Gubanov, A. I.

TITLE: On the Alteration of Semiconductor Properties with Fusion (Ob izmenenii svoystv poluprovodnikov pri plavlenii)

PERIODICAL: Zhurnal Tekhn. Fiz., 1957, Vol. 27, Nr 11, pp. 2510-2516 (USSR)

ABSTRACT: With regard to the fact that in the earlier work of the author (ZhETF, 26, 139, 1954) in the case of the classification of the width of the forbidden zone not even the sign of the alteration of width with fusion could be given the whole investigation is carried out again here. The relatively small alterations of the energy level, of effective masses etc. with the fusion of crystals or with their transition to amorphous state are calculated the coordination number being maintained. The alteration of the zone width as well as of the effective masses of current carriers with fusion is brought into connection with the change of crystals with deformation. In the end the remarks on the alteration with the fusion of the free length of path of the "movability-current-carriers" as well as of electric conductivity are given. The author shows that the free length of path of the current carriers with fusion must decrease for two reasons. In the case of an admixture-conductivity the matter is more complicated, and the problem of the admixture-level in liquid or amorphous bodies can, at

Card 1/2

On the Alteration of Semiconductor Properties with Fusion. 57-11-13/33

present, not be regarded solved.There are 8 Slavic references.

ASSOCIATION: Leningrad Physical-Technical Institute AN USSR (Leningradskiy fiziko-tekhnicheskiy institut AN SSSR)

SUBMITTED: May 27, 1957

AVAILABLE: Library of Congress

Card 2/2

Gubanov, A. I.

57-11-25/33

AUTHORS: Gubanov, A. I., Lun'kin, Yu. P.

TITLE: Kinetics Equationsof Gas Dissociation with Account of Diffusion (Uravneniya kinetiki dissotsiatsii gaza s uchetom diffuzii)

PERIODICAL: Zhurnal Tekh. Fiz., 1957, Vol. 27, Nr 11, pp. 2631-2639,(USSR)

ABSTRACT: A system of equations is deduced which describe the behavior of the gas in non-equilibrium diffusion and dissociation. The cases for a diatomic gas and for air as a five-components-mixture are investigated. The temperature dependence of the kinetic coefficients in the equations obtained is evaluated. However, as it is based on a series of approximations it requires an additional examination by experiments as well as a precision. It is shown that the specific velocities of the dissociation reaction in the case of air will essentially differ only by the exponential multiplicands that depend on the dissociation. It is shown that the thermo-diffusion coefficient is a very comprehensive expression and not a function of the binary thermo-diffusion coefficient, but that it is determined by the conduct of the whole multi-components-system. If a turbulent diffusion occurs in a multi-components-mixture it is difficult to put down the expression for the flow of particles in a general form. In this case it is difficult to approach from the point of view of the statistical theory of turbulency and it is more reasonable to base on the semi-empirical phemenological theory There are 2 Slavic references.

Card 1/2

Kinetics Equations of Gas Dissociation with Account of Diffusion. 57-11-25/33

ASSOCIATION: Leningrad Physical-Technical Institute AN USSR (Leningradskiy fiziko-tekhnicheskiy institut AN SSSR)

SUBMITTED: May 3, 1957

AVAILABLE: Library of Congress

Card 2/2

SOV/57-28-9-26/33

AUTHOR: Gubanov, A. I.

TITLE: Reflection and Refraction of Shock Waves at the Boundary of Two Media (Otrazheniye i prelomleniye udarnykh voln na granitse dvukh sred) I. Normal Incidence (I. Sluchay normal'nogo padeniya)

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1958, Vol 28, Nr 9, pp. 2035-2040 (USSR)

ABSTRACT: The reflection and the refraction of shock waves of high intensity are essentially different from the reflection and the refraction of acoustic waves. This is a study of the reflection and the refraction of plane shock waves at the plane boundary of two media. This is done in a manner similar to that found in references 1 - 5 for sonic waves without a linear approximation. This investigation is limited to the most simple case, that of normal incidence. The next paper will deal with the more complicated case of a sloped incidence. It is assumed that the laws of the propagation of the shock waves in each of the homogeneous and contacting media are known and that the basic conditions prevailing at the front of the incident, of the reflected, and of the transmitted wave can be written down. A general equation is derived. This equation makes it possible to

Card 1/2

SOV/57-28-9-26/33

Reflection and Refraction of Shock Waves at the Boundary of Two Media. I. Normal Incidence

find the equation describing the pressure in the reflected shock wave which is generated by the normal incidence of a plane shock wave upon the plane boundary of two arbitrary media. Approximate solutions are derived for this equation: 1) For two perfect gases. 2) For a shock wave of small intensity. 3) For two slightly differing media. 4) For two greatly differing media. The subject was suggested by N. S. Levchen'. There are 1 figure and 7 references, 7 of which are Soviet.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN SSSR, Leningrad (Physical and Technical Institute, AS USSR, Leningrad)

Card 2/2

AUTHORS: Gordeyev, G. V., Gubanov, A. I. SOV/57-28-9-28/33

TITLE: On the Problem of Plasma Acceleration in a Magnetic Field (K voprosu uskoreniya plazmy v magnitnom pole)

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1958, Vol 28, Nr 9, pp. 2046-2054 (USSR)

ABSTRACT: This report covers the investigation of a partly ionized plasma contained between two co-axial cylindrical electrodes to which a potential V is applied. It is assumed that a constant and uniform magnetic field is imposed on the plasma. The field strength H_0 is at a direction parallel to the axis of the cylinder (z-axis). Let the current I_0 through the plasma be considered constant independently of whether the magnetic field is applied or not (this is achieved by a suitable choice of the voltage U). The electric and the magnetic field arranged cross-wise effect a motion of the charged particles in the same direction at right angles to the fields. They carry away the neutral gas atoms effecting a circular motion of the gas about the inner cylinder. The acceleration of the plasma by the external magnetic field is examined. The steady plasma flow is computed taking into account the friction between the plasma

Card 1/2

On the Problem of Plasma Acceleration in a Magnetic Field

and the electrodes. The dependence of the stream velocity upon the magnetic flux and upon the electrode radii and the energy necessary for the maintenance of the current is computed. The computations showed that at realizable dimensions of the apparatus supersonic velocities can be attained in the plasma flow. There are 2 references, 1 of which is Soviet.

ASSOCIATION: Leningradskiy fiziko-tekhnicheskiy institut AN SSSR (Leningrad Physical and Technical Institute, AS USSR)

CV-7-28-60-2/40

24(6)

AUTHOR: Gubanov, A. I.

TITLE: Dependency of the Zonal Structure of an Alloy of an AB_3 Type Upon Regularity (Zavisimost' zonnoy struktury splava tipa AB_3 ot uporyadochennosti)

PERIODICAL: Zhurnal tekhnicheskoy fiziki, Vol. 28, Nr 10, pp 2109-2114 (USSR) 1958

ABSTRACT: Starting from the method of rigidly bound electrons and utilizing the averaged node potentials Smirnov (Ref 1) carried out an approximate computation of the electronspectrum in a partially ordered solution. The general equation for the computation of the energy of an electron in the alloy, which is a function of the wave vector k, takes the shape of equation (1). In the case of a binary alloy with an atomic concentration of the first component c, with a node concentration of first kind ν, and with the degree of ordering η the mean potentials produced by the nodes of first and second kind are, according to Smirnov, specified by equations (5). In combination with the experimental investigations by Komar (Ref 2) these formulae are applied to an alloy of an AB_3 type (which crystallizes in the cubic face-

Card 1/3

Dependency of the Zonal Structure of an Alloy of an AB_3 Type Upon Regularity

centered lattice with the edge length a). $AuCu_3$ is the alloy the investigation of which has been driven to the farthest point. In this case the elementary cell possesses 4 sites (one of first and three of second kind), $\nu = \frac{1}{4}$ and equation (1) is transformed into equation (6). This equation (6) can easily be solved for three cases: 1) The alloy is completely disordered ($\eta = 0$) as all sites are, on the average, equivalent. 2) k (wave vector) coincides with the cube diagonal. 3) k coincides with the surface of the Brillouin-(Brillyuen)-zone with a cube shape. From the formulae (7), (10), and (11) the electron energy can immediately be determined for a stoichiometrically ($c = \nu = \frac{1}{4}$) absolutely ordered ($\eta = 1$) alloy. It is shown that the zonal structure is dependent upon a parameter : Formula (16). This parameter is distinctive of the influence of the degree of ordering in the alloy. In the paper by Komar (Ref 2) the hypothesis was advanced, that when the alloy $AuCu_3$ is ordered a corresponding re-arrangement of the zones takes place. The com-

Dependency of the Zonal Structure of an Alloy of an AB_5 Type Upon Regularity

relations presented in this paper offer a definite substantiation of this hypothesis and a theoretical explanation for the change in sign of the carriers during ordering of the alloy. I. F. Komar, Member of the Academy of Sciences Ukrainskaya S.R. suggested the subject and discussed it with the author. There are 1 figure and 5 references, 5 of which are Soviet.

SUBMITTED: February 28, 1958

Card 3/3

S/169/61/000/010/037/053
D228/D304

AUTHORS: Gordeyev, G. V., and Gubanov, A. I.

TITLE: The question of plasma acceleration in a magnetic field

PERIODICAL: Referativnyy zhurnal, Geofizika, no. 10, 1961, 12, abstract 10G66 (V sb. Vopr. magn. gidrodinamiki i dinamiki plazmy, Riga, AN LatvSSR, 1959, 73, diskus., 74-75)

TEXT: The movement of plasma between two infinite, coaxial, cylindrical electrodes in an external, axial magnetic field is considered in the stationary case. The calculation was made in the hydrodynamic approximation--disregarding the Hall current, but with due allowance for the plasma's viscosity. [Abstracter's note: Complete translation.]

Card 1/1

GUBANOV, A. I.

15(0), 15(2)

AUTHOR: Kolomiyets, B. T., Doctor of Technical Sciences — SOV/30-59-2-45/60

TITLE: The Investigation of Vitreous Semi-Conductors (Izucheniye stekloobraznykh poluprovodnikov)

PERIODICAL: Vestnik Akademii nauk SSSR, 1959, Nr 2, pp 103-104 (USSR)

ABSTRACT: From December 1 to 2, 1958 a conference took place on this problem at the Fiziko-tekhnicheskiy institut Akademii nauk SSSR (Physicotechnical Institute of the Academy of Sciences, USSR). It dealt with the discussion of the experiments carried out, mutual information on the course of experiments and their general coordination. Representatives from 11 scientific institutions attended the conference. The following lectures were heard: V. V. Tarasov, Moskovskiy khimiko-tekhnologicheskiy institut (Moscow Chemicotechnological Institute) spoke of experimental results connected with the investigation of heat capacity at low temperatures of As_2S_3 and As_2Se_3. His second report dealt with the polymeric concept of glass formation and semiconductors in general.

Card 1/4

R. L. Myuller, Gosudarstvennyy opticheskiy institut (State Optical Institute) emphasized the decisive role played by the covalent bond in glass formation.

A. A. Vaypolin, Institut khimii silikatov Akademii nauk SSSR (Institute of Silicate Chemistry of the AS USSR) described the investigation of the structure of the system As_2Se_3-As_2Te_3 by X-ray methods.

L. I. Tatarinova, Institut kristallografii Akademii nauk SSSR (Crystallographical Institute of the AS USSR) reported on the structural investigation of some chalcogenids by electron-diffraction.

A. I. Gubanov and Y. Ya. Khartsiyev, Fiziko-tekhnicheskiy institut (Physicotechnical Institute) reported on theoretical problems of the semiconductor properties of glass types.

V. P. Zhile discussed working results in the determination of boundaries in glass formation in the As_2S_3 and As_2Se_3 systems.

N. A. Goryunova compared the boundaries of vitreous state in these systems with the criteria of glass formation obtained by Zakhariasen and Vinter-Kleyn and found that there exists no correlation between them.

T. F. Nazarova investigated the electric properties of semiconductor glass types in the TlSe - As_2Se_3 system.

B. T. Kolomiyets spoke of research work in the field of inner photoelectric effect done by T. N. Mamontova.

B. V. Pavlov discussed experimental results of the position of the absorption boundary as dependent on the change of composition of glass types.

V. P. Pozdnev reported on material he obtained in the investigation of the viscosity of glass types in the As_2Se_3 - As_2Te_3 system.

B. T. Kolomiyets summarised the working results obtained by the Physicotechnical Institute and found that in the materials investigated the short-range order is not changed in the transition from the vitreous into the crystalline state.

O. V. Mazurin, Leningradskiy khimiko-tekhnologicheskiy institut (Leningrad Chemicotechnical Institute) described the investigation of the semiconductor properties of silicate and borosilicate glass types with the addition of iron-cobalt and titanium oxides.

N. V. Patrovykh, Moskovskiy institut elektrotekhnicheskogo stekla (Moscow Institute of Electrotechnical Glass) outlined the investigation results of the boundaries of glass formation and the electric properties of contiguous semiconductor glass types of the composition V_2O_5 - P_2O_5 - R_xO_y (R- elements of the I, II, III, IV and V groups of the periodic system).

The next conference on semi-conductor glass types will probably be held in 1959.

GUBANOV, A.I.

Approximate wave functions for valence electrons of some atoms.
Fiz. tver. tela 1 no.2:203-207 F. '59. (MIRA 12:5)

1. Leningradskiy fiziko-tekhnicheskiy institut.
(Electrons) (Wave mechanics)

~~24(6)~~ 24,7700 66250

AUTHORS: Gubanov, A.I., Nran'yan, A.A. SOV/181-1-7-6/21

TITLE: Application of the Method of Equivalent Orbits to the Investigation of Zone Structure in Compounds of Type $A^{III}B^{V}$

PERIODICAL: Fizika tverdogo tela, 1959, Vol 1, Nr 7, pp 1044-1052 (USSR)

ABSTRACT: The present paper compares the method of strong coupling with the method of equivalent orbits. After mentioning that in the method of strong coupling the electron is described by Bloch sums, the author proceeds to explain the essence of the other method. It is based on the fact that the orbits of the molecular type (crystal or molecule) are formed by orbits which are localized in various parts of the system. If there are symmetries in the system considered, the localized orbits separate into groups in such a way that all orbits of one group convey the same character of charge distribution in the space, and differ only in position and orientation. These orbits are said to be equivalent. Molecular and equivalent orbits have a unitary transformation (1) in common. This unitary matrix is set up according to G.G. Hall. The authors do not agree with the opinion expressed by Slater and Koster (Ref 10) that the method of equivalent orbits be of no advantage. The authors claim, instead, that it permits a linear combination

Card 1/3

of the functions of free atoms, that the order of the secular equation becomes lower, etc. They agree with the above-mentioned authors, however, in defining the method of equivalent orbits as an approximation to the general method of strong coupling. In opposition to Hall, the authors believe that the method of equivalent orbits offers the possibility of computing conduction bands. An analytical formula for the dependence of energy on the wave vector is then derived by the method described, and finally, an analytical survey of the results obtained is given. The purpose of the computations made by the authors was that of determining the rules governing the change in the zone structure in transitions from one substance to another in the group of compounds $A^{III}B^{V}$ and in transitions from elements of the 4th group to $A^{III}B^{V}$. Such a compound was found to exhibit four valency bands and four conduction bands, and it is further stated

66250

Application of the Method of Equivalent Orbits to the Investigation of Zone Structure in Compounds of Type $A^{III}B^{V}$ SOV/181-1-7-6/21

that in the transition from 4th group elements to $A^{III}B^{IV}$ compounds within 4-valency bands as well as within the conduction bands an additional forbidden zone appears which does not occur in elements of the 4th group. There are 17 references, 3 of which are Soviet.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN SSSR, Leningrad
(Physical and Technical Institute of the AS USSR, Leningrad)

SUBMITTED: June 26, 1958

4

Card 3/3

24(2), 24(3) SOV/181-1-9-15/31

AUTHORS: Gubanov, A. I., Gashimzade, F. M.

TITLE: Investigation of the Symmetry of the Energy Bands of Electrons in the Type Crystals $CdIn_2Se_4$

PERIODICAL: Fizika tverdogo tela, 1959, Vol 1, Nr 9, pp 1411 - 1416 (USSR)

ABSTRACT: The purpose of the present paper is that of investigating the energy spectrum of the electrons in semiconductors of the $CdIn_2Se_4$ type by means of a group-theoretical method; this compound crystallizes in tetragonal syngony in the D^1_{2d} space group, while most other such compounds exhibit a S^2_4 structure. First, the symmetric properties of these structural groups investigated here (D^1_{2d} - $P\bar{4}2m$) are carefully analyzed in order to obtain provisional data of the type of energy bands. For the symmetric points of the Brillouin zone given in a figure, table 1 show the characteristic values for single space groups, and table 2 for double ones. Table 3 likewise offers representations of single and double groups. The conditions

Card 1/2

Investigation of the Symmetry of the Energy Bands of Electrons in the Type Crystals $CdIn_2Se_4$ SOV/181-1-9-15/31

of consistency for single and double groups are compiled in table 4 and 5, respectively. The band structure is investigated by means of these data and those given in tables 6 and 7. It is shown that without considering the spin, the energy limit is in the center of the Brillouin zone. On principle, the limits can be situated in the points (000), $(\frac{\pi}{a}\ \frac{\pi}{a}\ 0)$, $(00\ \frac{\pi}{b})$, $(\frac{\pi}{a}\ \frac{\pi}{a}\ \frac{\pi}{b})$, $(0\ \frac{\pi}{a}\ 0)$, and $(0\ \frac{\pi}{a}\ \frac{\pi}{b})$. Theoretical considerations (Ref 7) and experiments with the cyclotron resonance showed the edge valence band to be situated in the point K = (000) and to be triply degenerated. All this holds without consideration of the spin. It is shown that the group theory may not be employed to determine, which of the bands (T_2) lie higher than others. Yu. Firsov is mentioned in the text. There are 1 figure, 7 tables, and 7 references, 2 of which are Soviet.

ASSOCIATION: Leningradskiy fiziko-tekhnicheskiy institut AN SSSR (Leningrad Institute of Physics and Technology of the AS USSR)

SUBMITTED: January 19, 1959

Card 2/2

S/181/60/002/02/11/033
B006/B067

AUTHORS: Gubanov, A. I., Gashimzade, F. M.

TITLE: The Structure of the Energy Bands in Semiconductors of the $CdIn_2Se_4$-Type

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 2, pp. 255-260

TEXT: In continuation of a previous paper (Ref. 1) the authors investigate the energy spectrum of $CdIn_2Se_4$ crystals by means of the method of localized valences. $E(\vec{k})$ in the range of the energy extremes at $\vec{k} = 0$ was obtained by a perturbation-theoretical method developed by Shockley and Dresselhaus; spin-orbit interaction was taken into account in first approximation. The possible forms of the equipotential surfaces near the extremes were investigated by taking the spin into account. The possible positions of the energy extremes of the electrons in $CdIn_2Se_4$ had been investigated in the paper of Ref. 1. In the method of localized valences molecular functions composed of hybridized atomic functions were used as zero approximation. It can be well applied to $CdIn_2Se_4$ which shows mainly

a covalent bond, and has 8 atoms and 16 valence lines per unit cell. The 16th order secular equation for the energy was obtained in the approximation of the second neighbors. The equations were treated by the group theory, and the 16 solutions were classified into four subgroups each of which is transformed according to one of the irreducible representations Γ_1, Γ_4, and Γ_5 of the point-symmetry groups of the crystal. It was found that, as in the case of diamond and sphalerite, roots exist in the approximation of the first neighbors which are independent of k and are transformed according to the irreducible representation of Γ_5 with $\vec{k}=0$. In this approximation, Γ_4 and Γ_5 appear degenerate. The band edge is found at $\vec{k} = 0$, and is triply degenerate as is the case with sphalerite. Fig. 1 shows the approximate structure of the valence band. The effective hole mass in this doubly degenerate band is determined by the interaction integral of the second neighbors. There are 4 figures and 13 references: 6 Soviet, 3 American, 2 British, 1 German, and 1 Japanese.

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The Structure of the Energy Bands in Semiconductors of the $CdIn_2Se_4$-Type

S/181/60/002/02/11/033
B006/B067

ASSOCIATION: Fiziko-tekhnicheskiy institut AN SSSR Leningrad
(Physicotechnical Institute of the AS USSR, Leningrad)

SUBMITTED: May 11, 1959

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Card 3/3

81362
S/181/60/002/03/20/028
B006/B017

24.7900

AUTHOR: Gubanov, A. I.

TITLE: Quasiclassical Theory of Amorphous Ferromagnetics

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 3, pp. 502-505

TEXT: Up to now, theoretical and experimental investigations of the ferromagnetism of crystalline bodies only have been known from publications, and a possible existence of amorphous ferromagnetics has not been investigated. Liquid ferromagnetics have not been investigated - as was said in the introduction - because their melting point is above the Curie point; hence, amorphous or vitreous ferromagnetics exist if these substances contain the corresponding elements, and if they have sufficiently low temperatures. Since amorphous vitreous ferromagnetics should be preferred to crystalline ones for many purposes, the author theoretically investigates in this paper their possible existence. It is supposed that the vitreous substance investigated contains only one type of atom which causes ferromagnetism (hence, the exchange integrals of

these atoms must be positive, and their amount must be high compared to that of the exchange integrals between the other atoms and between other atoms and the "ferromagnetic" ones). The system may then be regarded as a one-component system in first approximation; it contains only one type of atom, the others play the role of a neutral medium whose concentration determines the distances between the "ferromagnetic atoms". Furthermore, it is assumed that the distances between neighboring "ferromagnetic atoms" obey statistical laws. The computations were made by the so-called quasi-chemical method (Fouler and Gugenheim, Ref. 1). L. S. Stil'bans, S. V. Vonsovskiy, and Ya. S. Shur (Refs. 2 and 3) used this method for investigating alloys and ferromagnetism. The results show that the formulas obtained for an amorphous body are, in principle, the same as those obtained for a crystal. A quantitative difference is only found in the dependence of the exchange integral A on the distance of the "ferromagnetic atoms" r; however, A remains positive with increasing r. Hence, it was found that certain bodies can be ferromagnetic also in the amorphous state. In the amorphous state, however, the Curie point will be much lower. In conclusion, the author thanks A. P. Komar, Academician

81362

Quasiclassical Theory of Amorphous Ferromagnetics

S/181/60/002/03/20/028
B006/B017

of the Ukrainskaya Akademiya nauk (Ukrainian Academy of Sciences) for having suggested the subject and for critical remarks. There are 4 references: 3 Soviet and 1 British.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN SSSR Leningrad (Institute of Physics and Technology, AS USSR, Leningrad)

SUBMITTED: May 26, 1959

Card 3/3

Gubanov, A. I.

81956
S/181/60/002/04/16/034
B002/B063

24.2100

AUTHOR: Gubanov, A. I.

TITLE: The Theory of Amorphous Conductors

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 4, pp. 651-655

TEXT: In contrast with the preceding papers of the author (Refs. 1 and 2), a rigorous proof is given in the present paper for the band structure of the energy spectrum of electrons in liquid or amorphous bodies. A new wave function describing the motion of an electron in an amorphous body is suggested in zero approximation:

$$\psi_k = \frac{1}{\sqrt{G}} u_k(\xi) \exp\left[i \sum_{\alpha=1}^{3} k_\alpha \lambda_\alpha \right];$$

λ_α are the coordinates of the electron in the system concerned, and k_α are constants. The exponential factor yields the progressive motion of the electron, and the

Card 1/2

factor $u_k(\xi)$ which is periodic with respect to ξ gives the effect of the potential barrier. G. S. Gantsevich is mentioned. There are 3 Soviet references.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN SSSR, Leningrad
(Physicotechnical Institute of the AS USSR, Leningrad)

SUBMITTED: July 14, 1959

Card 2/2

Gubanov, A. I.

82531

S/181/60/002/007/003/042
B006/B070

24.7100
24.6200

AUTHORS: Gubanov, A. I., Chevychelov, A. D.

TITLE: Calculation of the Energy Spectrum of Strongly Anisotropic Crystals

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 7, pp. 1379-1389

TEXT: The purpose of the present work is to make a quantum-mechanical calculation of the energy spectrum of the electrons for two different models of an anisotropic crystal. In their theory of galvanomagnetic phenomena in metals I. M. Lifshits, M. Ye. Azbel', and M. I. Kaganov (Ref. 1) have assumed the existence of open isoenergetic surfaces in the k-space. The authors of the present paper have succeeded in establishing similar surfaces theoretically by investigating two models of a strongly anisotropic crystal: layer model and chain model. In a crystal with layer-model structure, for example, zinc, such planes appear since the valence forces are mainly acting between the atoms that lie in these planes; the binding between the planes is considerably weaker, and the

Card 1/4

Calculation of the Energy Spectrum of Strongly Anisotropic Crystals

S/181/60/002/007/003/042
B006/B070

interatomic distance in the directions perpendicular to the layers are correspondingly large. In the direction of this crystallographic axis (z-direction), the motion of the electrons (in the single-electron crystal model) is assumed to be almost free, and in the other two directions strongly inhibited. Analogous assumptions are made for the chain model: A number of crystals have chain structure, that is, they have long spiral chains coiled round the hexagonal axis (selenium, tellurium), and the valence forces act along these chains; the binding between these chains is relatively weak, and the interatomic distances are large. The expressions for the potential of the electron is the same in both cases, with the difference only that in the first case the component $V(\vec{r})$ occurs, which is a two-dimensional periodic function, and in the second case the function $V(z)$ occurs which is periodic only in the z-direction. For both models, the spectrum is investigated by starting from the Schrödinger equations for these potentials. Later, the authors consider the shapes of the isoenergetic surfaces, first for the hexagonal lattice both for the layer and the chain models (Fig. 1). Fig. 2 shows the functions $\varepsilon_1(\vec{q})$ and $\varepsilon_2(p)$; $\vec{q} = (k_x, k_y)$ being the two-

Card 2/4

Calculation of the Energy Spectrum of Strongly Anisotropic Crystals

S/181/60/002/007/003/042
B006/B070

dimensional k-vector and p its z-component. $\varepsilon_1(\vec{q})$ has a band shape, and for the first, third, and generally for odd bands $\varepsilon_1(\vec{q})$ has a minimum in $\vec{q} = 0$ and a maximum in $\vec{q} = \vec{Q}$ ($\vec{Q}$ is a vector that lies in the boundary for the first Brillouin zone). For even bands $\varepsilon_1(\vec{q})$ has a minimum in $\vec{q} = \vec{Q}$ and a maximum in $\vec{q} = 0$. Later, the isoenergetic curves for the planes formed by p and $\vec{Q}$ are investigated. Fig. 3 shows some possible odd bands. It is seen that the topology of the isoenergetic surfaces for the two models are opposite to each other. For sufficiently large depths of potential both models have open surfaces of only one kind: corrugated cylinders in the case of layer structure, and corrugated planes in the case of chain structure. The theoretical results agree with the experimental ones. It is further shown that for lattices with the same crystallographic symmetry, but different chemical binding characteristics different laws hold for the dispersion of electrons. There are 3 figures and 4 Soviet references.

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Calculation of the Energy Spectrum of Strongly Anisotropic Crystals

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Card 4/4

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24.4500
AUTHORS: Gubanov, A. I., Pushkarev, O. Ye.

TITLE: Wave Functions of Valence Binding in Some Crystals

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 8, pp. 1776-1782

TEXT: The aim of the authors was to derive a more accurate (approximate) wave function of the valence electrons (localized along the valence lines) than was possible in a previous paper (Ref. 2). They use a variational method for this purpose. They consider the valence line of a diatomic molecule and choose a trial function which is analogous to that used in Ref. 3 for the hydrogen ion molecule. When the interatomic distance is increased, the trial function breaks into two atomic functions which, in the present case, are two sp^3 functions of the neighboring atoms. To determine the trial function more conveniently, the atomic functions must be obtained first. The following approximate atomic function is assumed in §1: $R = ar[\exp(-2r/r_k)-b\exp(-4r/r_i)]$, where r_k is the covalent radius, and r_i is the ion radius. a and b are determined from the orthogonality

Card 1/3

Wave Functions of Valence Binding in Some Crystals

S/181/60/002/008/048/052/XX
B006/B070

and normalization conditions, respectively, $\int_0^{r_i} r^2 R dr = 0$, $\int_0^{\infty} r^2 R^2 dr = 1$.

b and a are explicitly given by (5) and (6). For a number of elements, numerical values of r_k, r_i, b, and a are given in a table. The atomic functions for carbon, gallium, germanium, and arsenic are represented in Figs. 1-4. In the following, the authors determine the single-electron wave functions of the valence lines of diamond-type crystals by the method of variation. A numerical computation is made for germanium, and its results are given. The numerical example shows that in the approximation given here the wave function obtained by the variational method considered here is not much different from a linear combination of the atomic functions. In the present case, the maximum is shifted somewhat away from the atom, i.e., the electron density forms a cluster between the nearest atoms. There are 4 figures, 1 table, and 5 references: 2 Soviet, 1 US, 1 German, and 1 British.

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Wave Functions of Valence Binding in Some Crystals

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Card 3/3

8444

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B019/B054

26.1410

AUTHORS: Gubanov, A. I. and Lun'kin, Yu. P.

TITLE: The Equations of Magnetoplasmadynamics

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1960, Vol. 30, No. 9, pp. 1046-1052

TEXT: It is usual in investigations of magnetic hydrodynamics to assume $\omega\tau \ll 1$ (ω is the Larmor frequency, τ the mean free time of charged particles). These assumptions are fulfilled in dense media and with weak magnetic fields in the plasma. Calculations in one- and two-liquid approximations were carried out for any $\omega\tau$. The introduction deals with a combination of the one-liquid approximation developed by Chapman et al. (Ref. 1) and the two-liquid theory developed by S. I. Braginskiy (Ref. 2). The relations (1) for pressure, temperature, the tensor of viscous tensions, and the heat flow are given. It is shown in the second part of the paper that expressions for the tensor of viscous tensions and the heat flow in one-liquid approximations can be easily obtained with the aid

Card 1/2

The Equations of Magnetoplasmadynamics

S/057/60/030/009/007/021
B019/B054

of relations (1) from the formulas found by Braginskiy. When the resulting expressions are introduced into the motion- and energy equations of the one-liquid approximation, the equations of magnetoplasmadynamics are obtained after allowing for some transformations. The equations found are similar to those used in magnetohydrodynamics ($\omega\tau \ll 1$), and the same methods as in magnetohydrodynamics can be used for their solution. The existence of additional terms in the equations leads, however, to new physical effects which do not follow from magnetohydrodynamics. There are 3 references: 2 Soviet and 1 British.

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Card 2/2

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26.1410
24.2120

AUTHORS: Gubanov, A. I. and Lun'kin, Yu. P.

TITLE: The Cuettov Flow in Magnetoplasmadynamics

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1960, Vol. 30, No. 9, pp. 1053-1060

TEXT: The authors investigated the flow between two parallel infinite plates, one of which is at rest while the other moves in its plane. It is assumed that a magnetic field $\vec{H}_0$ exists in various directions with respect to the plates and the motion $\vec{u}$ of one plate. First, the case is studied where $\vec{H}_0$ is perpendicular to the plane of the plates. The authors show in a very long expansion that a flow originates here which is perpendicular to $\vec{u}$. This is called a specific effect of magnetoplasmadynamics. Further, the case is studied where $\vec{H}_0$ lies in the plane of the plates. Here, the authors show that the magnetic field generates not only currents in the plasma but also currents running in the plates. The distribution of currents can only be given if the shape and dimension of

Card 1/2

The Cuettov Flow in Magnetoplasmadynamics

S/057/60/030/009/008/021
B019/B054

the plates and the position of the current-carrying conductors are given. Finally, the case is investigated where H_0 has any direction. It appears that in all cases investigated, properties are found which do not follow from magnetohydrodynamics ($\omega\tau \ll 1$). $\vec{H_0}$ always shows an influence on flow and viscosity. There are 3 references: 1 Soviet and 2 US.

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