STEPANOV, A.S.; BURLAKOV, M.L.

Electrophysiological study of fatigue in muscular work. Fiziol. zhur. 47 no.6:735-740 Je '61. (MIRA 15:1)

1. From the Department of Human and Animal Physiology, N.L.Lobatchevski University, Gorki.
(EXERCISE) (FATIGUE) (ELECTROMYOGRAPHY)

ARTEMOV, N.M.; GORYACHEV, Yu.V.; LEBEDEV, O.N.; STEPANOV, A.S.

Effect of bee and cobra venom on the neuromuscular apparatus in cat. Nauch. dokl. vys. shkoly; biol. nauki no.5:54-61 '64 (MIRA 17:8)

1. Rekomendovana kafedroy fiziologii cheloveka i zhivotnykh Gor'kovskogo gosudarstvennogo universiteta imeni Lobachevskogo.

STEPANOV, A. S.

Priority of "Russian lock" in surgery. Khirurgiia, Moskva no. 11:66-68 Nov. 1951. (CLML 21:3)

1. Lt-Col, Medical Corps.

STEPANOV, A. S.

"Thrombosis and Thrombophlebitis in Gunshot Wounds of the Lower Extremities and the Pelvis." Leningrad Pediatric Medical Inst., Leningrad, 1955. (Dissertation for the Degree of Candidate in Medical Sciences)

SO: Knizhnaya Letopis', No. 22, 1955, pp 93-105

EXCERPTA MEDICA Sec 9 Vol 13/4 Surgery Apr 59

2168. THROMBOSIS AND THROMBOPHLEBITIS OF THE LEGS DUE TO GUNSHOT WOUNDS (Russian text) - Stepanov A. S. - VOES.-MED. ZH. 1957, 2 (15-19)

During World War II an extensive oedema was observed not infrequently in legs wounded by gunshot; this condition was regarded as the oedematous form of an anaerobic infection. Extensive incisions and administration of anti-gangrene serum were without influence on the oedema. Autopsies revealed that thrombosis of the main veins was responsible for the persistent oedema. This induced the author to regard thrombosis and thrombophlebitis of the legs as a complication of shot wounds. Study of 233 case histories, 33 patho-anatomical specimens and autopsy reports available led to the presumption that the endophlebitic route is the regular one for the development of thrombosis and thrombophlebitis, i.e. the development of thrombosis from the wounded zone to the main veins proceeds as a continuous process. The development of this process is facilitated and speeded up by a late and incomplete primary surgical treatment of the wound, as well as an unsatisfactory immobilization of the leg during transportation. In these conditions damage to the deep veins was observed in 90% of cases, and changes in lymphatic vessels and nodes in only 15.7%. Pain along the thrombosed vein was always present. Thickening of the vein was noted in 36% of cases, but persistent oedema of the leg was present in 80%. Also, a loss or a weakening of the peripheral pulse was noted in the damaged leg. Treatment was mainly conservative. Only 4.5% of the patients were treated surgically. Phlebectomy is regarded as the best operative procedure. In an evaluation of the methods of treatment of thrombosis and thrombophlebitis of the legs, the intra-osseous administration of antibiotics and the operative removal of the thrombosed vein are emphasized. (S)

L 26970-65 EWT(l)/EPA(sp)-2/EWT(m)/EWG(m)/T/EEC(t)/EPA(w)-2/EWA(m)-2 Pz-6/ Po-4/Pab-10/Pi-4 IJP(c) RWH/AT

ACCESSION NR: AP5003257 S/0057/65/035/001/0165/0167

AUTHOR: Pashchenko, V.P.; Stakhanov, I.P.; Stepanov, A.S.

TITLE: On the influence of the plasma density near the electrode on the conductivity in a transverse magnetic field

SOURCE: Zhurnal tekhnicheskoy fiziki, v.35, no.1, 1965, 165-167

TOPIC TAGS: plasma, plasma density, plasma diffusion, thermoelectric converter

ABSTRACT: A magnetic field affects the conductivity of a plasma not only by altering the diffusion constant but also by influencing the density of the plasma in the neighborhood of the electrode. This latter effect is calculated in the present paper. The electron distribution function in the electrode region is computed separate- ... the distribution function for intermediate fields,

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ACCESSION NR: AP5003257

were compared with measurements performed with a mock thermoelectric converter by plotting the ratio of the saturation current to the equilibrium current (obtained by extrapolation from the low temperature region) against the strength of the applied transverse magnetic field. The apparatus and experimental techniques are described elsewhere (Yu.K.Gus'kov, V.P.Pashchenko and Ye.Ye.Sibir,Izv.AN SSSR,Ser.fiz. 28,1537,1964). Moderately good agreement between theory and experiment was obtained. The differences between the theoretical and experimental values are ascribed to the ... temperature difference between the electrons and the cathode, and to

Card 2/3

L 26970-65
ACCESSION NR: AP5003257

ASSOCIATION: none

SUBMITTED: 15May64 ENCL: 00 SUB CODE: ME, EE

NR REF SOV: 006 OTHER: 000



Card 3/3

STEPANOV, A. S.; STAKHANOV, I. P.; GUS'KOV, Yu. K.; KASIKOV, I. I.; PASHCHENKO, V. P.; MAYEV, S. A.; LEBEDEV, M. A.

"State of the investigations into physical processes in thermionic converters."

report to be presented at Intl Conf on Thermionic Electrical Power Generation, London, 20-24 Sep 65.

USSR State Comm for Applications of Atomic Energy, Moscow.

APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001653130005-7"

STAKHANOV, I.P.; STEPANOV, A.S.

Current fluctuations in a thermoelectric energy converter. Zhur. tekh. fiz. 35 no.1:132-139 Ja '65. (MIRA 18:3)

APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001653130005-7"

PASHCHENKO, V.P.; STAKHANOV, I.P.; STEPANOV, A.S.

Effect of plasma density near the electrode on conductivity in a transverse magnetic field. Zhur. tekh. fiz. 35 no.1:165-167 Ja '65. (MIRA 18:3)

KUBASOV, N.V., assistent; STEPANOV, A.T., vetvrach

Syringe combined with an illuminator. Zhivotnovodstvo 21 no.11: 77-78 N '59 (MIRA 13:3)

1. Vitebskiy veterinarnyy institut.
(Artificial insemination) (Syringes)

STEPANOV A. V.

KAZARNOVSKIY, M. V., STEPANOV, A. V. and SHAPIRO, F. L.

"Thermalization and Diffusion of Neutrons in Heavy Media."

paper to be presented at 2nd UN Intl. Conf. on the peaceful uses of Atomic Energy, Gneva, 1 - 13 Sep 58.

STEPANOV, A.V.

21(4) PHASE I BOOK EXPLOITATION SOV/2583

International Conference on the Peaceful Uses of Atomic Engergy. 2nd, Geneva, 1958.

Doklady sovetskikh uchenykh; yadernyye reaktory i yadernaya energetika. (Reports of Soviet Scientists; Nuclear Reactors and Nuclear Power) Moscow, Atomizdat, 1959. 707 p. (Series: Its: Trudy, vol. 2) Errata slip inserted. 8,000 copies printed.

General Eds.: N.A. Dollezhal, Corresponding Member, USSR Academy of Sciences, A.K. Krasin, Doctor of Physical and Mathematical Sciences, A.I. Leypunskiy, Member, Ukrainian SSR Academy of Sciences, I.I. Novikov, Corresponding Member, USSR Academy of Sciences, and V.S. Fursov, Doctor of Physical and Mathematical Sciences; Ed.: A.P. Alyab'yev; Tech. Ed.: Ye. I. Mazel'.

PURPOSE: This book is intended for scientists and engineers engaged in reactor designing, as well as for professors and students of higher technical schools where reactor design is taught.

COVERAGE: This is the second volume of a six-volume collection on the peaceful use of atomic energy. The six volumes contain the reports presented by Soviet scientists at the Second International Conference on Peaceful Uses of Atomic Energy, held from September 1 to 13, 1958 in Geneva. Volume 2 consists of three parts. The first is devoted to atomic power plants under construction in the Soviet Union; the second to experimental and research reactors, the experiments carried out on them, and the work to improve them; and the third, which is predominantly theoretical, to problems of nuclear reactor physics and construction engineering. Yu. I. Koryakin is the science editor of this volume. See SOV/2081 for titles of all volumes of the set. References appear at the end of the articles.

STEPANOV, A. V.

21(0) PHASE I BOOK EXPLOITATION SOV/2081

International Conference on the Peaceful Uses of Atomic Energy, 2d., Geneva, 1958

Doklady sovetskikh uchenykh; yadernaya fizika (Reports of Soviet Scientists; Nuclear Physics) Moscow, Atomizdat, 1959. 552 p. (Series: Its: Trudy, Vol. 1) 8,000 copies printed.

Eds. (Title page): A.I. Alikhanov, Academician; V.I. Veksler, Academician; and N.A. Vlasov, Candidate of Physical and Mathematical Sciences; Ed. of this volume: S.I. Drozdov and B.P. Zaretskiy, Candidates of Physical and Mathematical Sciences; Ed. (Inside book): G.L. Smolyan; Tech. Ed.: Ye.I. Mazel'.

PURPOSE: This collection of articles is intended for scientific research workers and other persons interested in nuclear physics. The volume contains 43 papers presented by Soviet Scientists at the Second Conference on Peaceful Uses of Atomic Energy, held in Geneva in September 1958.

COVERAGE: It is divided into two parts. Part I contains 17 papers dealing with plasma physics and controlled thermonuclear Reactions, and Part II contains 26 papers on nuclear physics, including problems of particle acceleration and of cosmic ray physics. The first paper by L.A. Artsimovich presents a review of Soviet work on controlled thermonuclear reactions. The remaining papers in Part I deal with particular problems in this field. papers in Part II deal in detail with various problems in nuclear physics, such as the fission of heavy atoms and their isotopes, and with the study of cosmic radiation by means of artificial earth satellites and rockets, described in a paper by S.N. Vernov. The Russian-language edition of the proceedings of the conference is published in 16 volumes. The first 6 volumes contain all the papers presented by Soviet scientists as follows: Volume (1), Yadernaya fizika (Nuclear Physics); Volume (2), Yadernyye reaktory i yadernaya energetika (Nuclear Reactor and Nuclear Power); Volume (3), Yadernoye goryucheye i reaktornyye metally (Nuclear Fuel and Reactor Metals), Volume (4), Khimiya radioelementov i radiatsionnykh prevrashcheniy (Chemistry of Radioelements and of Radiation Transformations); Volume 5, Radiobiologiya i radiatsionnaya meditsina (Radiobiology and Radiation Medicine); Volume (6) Polucheniye i primeneniye izotopov (Production and Use of Isotopes). The other 10 volumes contain selected papers presented at the Conference by non-Soviet scientists. In the present volume discrepancies between the English and Russian language edition of the proceedings have been noted in three articles where the texts are not identical; Andrianov, et al, "High Current Pulsed Discharge"; Akhiyezer, et al, "High Frequency Plasma Oscillation"; and Bogolyubov, "Investigations of the Many-body Problem". The serial numbers of reports 2302 and 2504 are reversed in the English edition. Report 2211, by Sinelnikov, et al, is numbered 2536 in the English edition.

TABLE OF CONTENTS:

Reports of Soviet Scientists; Nuclear (Cont.) SOV/2081



AVAILABLE: Library of Congress (QC770. I53 1958)

15

STEPANOV, A. V., CAND PHYS-MATH SCI, "CERTAIN PROBLEMS OF THE THEORY OF INTERACTION OF SLOW NEUTRONS WITH MATTER." MOSCOW, 1960. (MOSCOW STATE UNIV IM M. V. LOMONOSOV. SCI RES INST OF NUCLEAR PHYS). (KL, 2-61, 199).

S/089/60/008/006/023/023/XX
B006/B063

26.2241

AUTHOR: Stepanov, A. V.

TITLE: Convergence of Series in the Multigroup Theory of Neutron Diffusion/19

PERIODICAL: Atomnaya energiya, 1960, Vol. 8, No. 6, pp. 550 - 551

TEXT: The author of the present paper shows that the convergence of several series appearing in the multigroup theory (when the temperature of the neutrons produced is much higher than $k\Theta$, where $\Theta$ is the moderator temperature) can be improved even without age approximation. This is illustrated by the example of the neutron flux distribution $N(\vec{r},x) = \psi(\vec{r},x) + \varphi(\vec{r},x)$, where $\psi(\vec{r},x)$ coincides with $N(\vec{r},x)$ when $E \gg k\Theta$ and $\varphi(\vec{r},x)$ is represented by an expansion with respect to Laguerre polynomials: $\varphi(\vec{r},x) = xe^{-x}\sum_{i=0}^{\infty}\frac{1}{i!(i+1)!}\cdot L_{(i)}^{(1)}(x)n_i(\vec{r})$. This series converges

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Convergence of Series in the Multigroup Theory of Neutron Diffusion

S/089/60/008/006/023/023/XX
B006/B063

much better than an expansion of $N(\vec{r},x)$. This is demonstrated by two special cases: 1) the distribution of neutrons in a heavy moderator (M > 1) which is a monatomic gas and has the form of a plate set containing uniformly distributed sources of monoenergetic neutrons. The neutrons are, however, inhomogeneously absorbed since part of the plates consist of a pure moderator and part of them of a homogeneous mixture. 2) The distribution function of neutrons emitted by a point source in a bounded volume of a homogeneous mixture of moderator nuclei and nuclei of superthermal resonance. The parameters of the expansion in three-group approximation were numerically calculated for three temperatures of the moderator. Results are collected in a Table. The author thanks M. V. Kazarnovskiy for suggesting the topic, and Z. P. Mukhin for numerical calculations. There are 1 table and 4 references: 3 Soviet and 1 US.

SUBMITTED: January 21, 1960

Card 2/2

84408

S/056/60/039/004/026/048
B006/B063

26.2240
24.6510

AUTHORS: Kazarnovskiy, M. V., Stepanov, A. V.

TITLE: Elastic Resonance Scattering of Slow Neutrons in Crystals

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 4(10), pp. 1039 - 1041

TEXT: The present paper gives formulas for differential elastic resonance scattering cross sections of slow neutrons in crystals. The authors confined themselves to nuclei having levels of resonance energies $\lesssim$ ev and a relatively high ratio of neutron width to total level width ($\gtrsim 0.1$), such as $Xe^{135}$, $Yb^{168}$, $Tm^{169}$, $Hf^{177}$, $Re^{185}$, $Au^{197}$, and $Pu^{240}$. First, a formula that is exact up to a trivial constant factor is given for the elastic resonance scattering probability of neutrons in a crystal, neglecting the total resonance level width $\Gamma$ of the quantum state of the lattice. Using the results of Lamb (Ref. 1), a few other expressions are given, which are further treated in Debye approximation.

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84408

Elastic Resonance Scattering of Slow Neutrons in Crystals S/056/60/039/004/026/048 B006/B063

Thus, $P = \int_0^{\infty} dt \exp\left\{it\left(\frac{p^2}{2m} - E_o\right) - \frac{1}{2}\Gamma t + g(t)\right\}$, and the mean square $\overline{|P|^2}$ in Debye approximation has the form $\overline{|P|^2} = 2\pi a^{-2}\exp\left\{2\mathrm{Re}f(t_o)\right\}$, $a^2 = \left|d^2g(t)/dt^2\right|_{t=t_o}$, where $t_o$ is the value of t corresponding to the maximum of the function $f(t) = g(t) + it(p^2/2m-E_o) - \Gamma t/2$. The two special cases $T \gg \theta$ ($\theta$ - Debye temperature) and $T = 0$ are considered. For the two cases, the authors give expressions for g(t) and determine $f(t_o)$.

F. L. Shapiro is thanked for discussions. There are 3 references: 1 Soviet, 1 US, and 1 German.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Institute of Physics imeni P. N. Lebedev of the Academy of Sciences USSR)

SUBMITTED: May 3, 1960 (initially) and July 28, 1960 (after revision)

Card 2/2

38148

S/058/62/000/004/029/160
A058/A101

26.2241

AUTHOR: Stepanov, A. V.

TITLE: On the theory of neutron thermalization in heavy crystalline moderators

PERIODICAL: Referativnyy zhurnal, Fizika, no. 4, 1962, 60, abstract 4B450 (V sb. "Neytron. fizika". Moscow, Gosatomizdat, 1961, 92 - 99)

TEXT: In the work of Kazarnovskiy et al. (RZhFiz, 1960, no. 10, 25988) a method was developed for investigating the thermalization and diffusion of neutrons in heavy media. In a diffusion approximation the transport equation was reduced to a system of diffusion equations by means of expansion of the neutron-distribution function in energy groups. The requisite information concerning the dynamic properties of the moderator was contained in the coefficient $\gamma_{ik}$. In the present work under some assumptions concerning the frequency spectrum of the natural vibrations of the crystal lattice of the moderator an expression is derived for $\gamma_{ik}$ in the form of rapidly converging series ($\sim n^{-4}$), and the dependence of $\gamma_{ik}$ on the form of the frequency spectrum of the crystal's natural vibrations is investigated.

O. Moskalev

[Abstracter's note: Complete translation]

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S/638/61/001/000/014/056
B101/B102

AUTHORS: Kazarnovskiy, M. V., Stepanov, A. V.

TITLE: Neutron thermalization. (A review paper)

SOURCE: Tashkentskaya konferentsiya po mirnomy ispol'zovaniyu atomnoy energii. Tashkent, 1959. Trudy. v. 1. Tashkent, 1961, 107-117

TEXT: This is a report on the development of research into the interaction of neutrons with matter since 1936 (Fermi). Such subjects as interactions between neutrons and atoms, molecules, crystals and liquids are briefly dealt with as well as the multiple scattering of neutrons in matter taking account of the chemical bond and of the atomic thermal motion, and also an approximate representation of neutron thermalization in a heavy gas. Experiments conducted at FIAN are mentioned. S. I. Drozdov, D. F. Zaretskiy, and F. L. Shapiro (Reports at the Second Geneva Conference on the Peaceful Uses of Atomic Energy) are referred to. There are 2 figures and 47 references: 6 Soviet and 41 non-Soviet. The four most recent

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Neutron thermalization. (A review paper) S/638/61/001/000/014/056
B101/B102

references to English-language publications read as follows: Brockhouse B. N.; Phys. Rev. Lett., 2, 256, 1959; Palevsky H., Hughes D. J., Kley W., Tunkelo E., Phys. Rev. Lett., 2, 258, 1959; Chose A., Palevsky H., Hughes D. J., Pelah I., Eisenhauer C. M., Phys. Rev., 113, 49, 1959; Brockhouse, B. N., Phys. Rev. Lett., 2, 287, 1959.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva AN SSSR (Physics Institute imeni P. N. Lebedev of the AS USSR)

Card 2/2

S/056/61/040/002/029/047
B112/B214

AUTHORS: Podgoretskiy, M. I., Stepanov, A. V.

TITLE: The problem of Doppler width of emission and absorption lines

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 40, no. 2, 1961, 561-566

TEXT: Classical and quantum-mechanical methods are used to study the consequence of the Doppler effect on the width of emission and absorption lines of gases and highly ideal liquids (very dense gases). The amplitude of the emitted radiation is $A \sim \exp[i\omega_0 t - \lambda t/2 + i\kappa x(t)]$, where $\omega_0$ is the frequency, $1/\lambda$ the mean lifetime, and $\kappa$ the wave number. The dependence of the spectral intensity I on $\Omega = \omega_0 - \omega$ is given by the formula: $I(\Omega) = \mathrm{Re}\int_0^\infty d\tau \exp\{-i\Omega\tau - 1/2\lambda\tau - 1/4\,\kappa^2\sigma^2(\tau)\}$.

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The function $\sigma^2(\tau)$ is characteristic of the motion causing the Doppler effect. Several expressions are given in the paper for this function, including one due to S. Chandrasekar, which holds for an absorbing system diffusing in a compressed gas or a liquid:

$\sigma^2(\tau) = 4D\left[\tau - (1 - e^{-\eta\tau})/\eta\right]$, $\eta = \frac{kT}{MD}$. Here, D is the diffusion coefficient, k the Boltzmann constant, T the temperature, and M the mass of the absorbing atom. If the condition

$kT/MD^2\varkappa^2 \approx (\Lambda/2\pi L)^2 \gg 1$ is satisfied ($\Lambda$ is the wavelength, L the mean free path), the following relation holds:

$I(\Omega) \sim \left[\Omega^2 + (\lambda/2 + \varkappa^2 D)^2\right]^{-1}$. In this case there is a narrowing of the line width of the order of $\varkappa^2 D$ as against the usual Doppler width $\varkappa(kT/M)$ for small $L/\Lambda$; a broadening of the line width results for large $L/\Lambda$. The paper is concluded by a discussion of the possibility of the experimental observation of the resonance absorption of gamma quanta and slow neutrons in liquids. F. L. Shapiro is thanked for discussions,

The problem of Doppler width... S/056/61/040/002/029/047
B112/B214

and M. V. Kazarnovskiy and I. I. Sobel'man for help. There are 12 references: 3 Soviet-bloc and 7 non-Soviet-bloc.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research). Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Institute of Physics imeni P. N. Lebedev, Academy of Sciences USSR)

SUBMITTED: August 3, 1960

Card 3/3

KAZARNOVSKIY, M.V.; STEPANOV, A.V.

Theory of resonance scattering on atomic systems. Acta phys Hung 14 no.1:45-66 '62.

1. Fizicheskiy Institut im. P.N. Lebedeva AN SSSR, Moskva, SSSR. Predstavleno Albert Konya.

KAZARNOVSKIY, M.V.; STEPANOV, A.V.

"Observed" probabilities of elastic neutron scattering and the Mossbauer effect in degenerated systems, and some new possibilities for producing such systems. Zhur.eksp.i teor.fiz. 43 no.6: 2299-2301 D '62. (MIRA 16:1)

1. Fizicheskiy institut im[redacted]i Lebedeva AN SSSR.
(Neutrons--Scattering) (Mossbauer effect) (Quantum theory)

S/056/62/042/002/029/055
B108/B104

26.2242

AUTHORS: Kazarnovskiy, M. V., Stepanov, A. V.

TITLE: Theory of resonance scattering from atomic systems. I. General formulas

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 2, 1962, 489 - 498

TEXT: The authors derived general formulas for the probabilities of resonance and interference scattering. Under the assumption that an excitation (gamma absorption or neutron capture) does not affect the motion of the center of gravity of the scattering atoms, and that energy and width of the excited level are independent of atomic number and spin projection of the excited nuclei, the total probability of resonance scattering is

$$W(\mathbf{p}_i, \mathbf{p}_f) = 2\pi A \sum_{\nu} w_{\nu\nu}(\mathbf{p}_i, \mathbf{p}_f) + 2\pi B \sum_{\nu \neq \nu'} w_{\nu\nu'}(\mathbf{p}_i, \mathbf{p}_f),$$

$$w_{\nu\nu'}(\mathbf{p}_i, \mathbf{p}_f) = \sum_{m_i} \sum_{m_f} g_{m_i} \sum_{m_\lambda} \sum_{m'_\lambda} (E_i - E_0 - E_{m_\lambda} + \tfrac{1}{2} i\Gamma)^{-1} \times \quad (1)$$

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Theory of resonance scattering...

$$\times (E_i - E_0 - E_{m'_\lambda} - \tfrac{1}{2} i\Gamma)^{-1} \langle m_f | \exp(-i p_f R_\nu) | m_\lambda \rangle \langle m_\lambda | \exp(i p_i R_\nu) | m_i \rangle \times \times \langle m_f | \exp(-i p_f R_{\nu'}) | m'_\lambda \rangle^* \langle m'_\lambda | \exp(i p_i R_{\nu'}) | m_i \rangle^* \delta(E_i - E_f), \quad (2)$$

where $g_{m_i}$ is the probability that the scattering system initially was in the state $m_i$. Moreover,

$$w_{\nu\nu'}(p_i, p_f) = (2\pi)^{-1} \int_{-\infty}^{\infty} d\mu \int_0^{\infty} dt \int_0^{\infty} dt' Z_{\nu\nu'}(p_i, p_f, \mu, t, t') \times \times \exp\{i\mu(E_{p_f} - E_{p_i}) + it(E_{p_i} - E_0 + \tfrac{1}{2} i\Gamma) - it'(E_{p_i} - E_0 - \tfrac{1}{2} i\Gamma)\}, \quad (8)$$

with

$$Z_{\nu\nu'}(p_i, p_f, \mu, t, t') = (\mathrm{Sp}\, e^{-H/T})^{-1} \mathrm{Sp}\, [e^{-H/T} \hat{Z}_{\nu\nu'}]; \quad (10)$$

$$\hat{Z}_{\nu\nu'} = \exp\{-i p_i \hat{R}_{\nu'}(\mu + t - t')\} \exp\{i p_f \hat{R}_{\nu'}(\mu + t)\} \times \times \exp\{-i p_f \hat{R}_\nu(t)\} \exp\{i p_i \hat{R}_\nu(0)\}. \quad (11)$$

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B108/B104



The physical meaning of the correlation function $Z_{\nu\nu'}$ can be seen from

$$\Gamma_{\nu\nu'}(\mathbf{R}_1, \mathbf{R}_2, \mu, t, t') = (2\pi)^{-6}\int d\mathbf{p}_i d\mathbf{p}_j Z_{\nu\nu'}(\mathbf{p}_i, \mathbf{p}_j, \mu, t, t')\, e^{i\mathbf{R}_1\mathbf{p}_i - i\mathbf{R}_2\mathbf{p}_j}, \quad (12)$$

$$Z_{\nu\nu'}(\mathbf{p}_i, \mathbf{p}_j, \mu, t, t') = \int d\mathbf{R}_1 d\mathbf{R}_2 \Gamma_{\nu\nu'}(\mathbf{R}_1, \mathbf{R}_2, \mu, t, t')\, e^{i\mathbf{R}_2\mathbf{p}_j - i\mathbf{R}_1\mathbf{p}_i}, \quad (13)$$

which equations show that $\Gamma_{\nu\nu'}$ determines the spatial correlation of the $\nu$-th and the $\nu'$-th particle at four different instants of time. Interference of resonance and potential scattering can be taken into account by adding to the resonance scattering probability a term of the form

$$W_{int}(\mathbf{p}_i, \mathbf{p}_j) = 4\pi\, \mathrm{Re}\left\{A' \sum_{\nu} v_{\nu\nu}(\mathbf{p}_i, \mathbf{p}_j) + B' \sum_{\nu \neq \nu'} v_{\nu\nu'}(\mathbf{p}_i, \mathbf{p}_j)\right\}, \quad (23)$$

with

$$v_{\nu\nu'}(\mathbf{p}_i, \mathbf{p}_j) = -i(2\pi)^{-1} \int_{-\infty}^{\infty} d\mu \int_0^{\infty} dt Z_{\nu\nu'}(\mathbf{p}_i, \mathbf{p}_j, \mu, t, 0) \times$$
$$\times \exp\{i\mu(E_{p_i} - E_{p_j}) + it(E_{p_i} - E_0 + \tfrac{1}{2} i\Gamma)\}, \quad (24)$$

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Theory of resonance scattering... S/056/62/042/002/029/055
B108/B104

In a subsequent paper the results of this work are to be applied to some simple models of the motion of the scatterer atoms. Mention is made of A. Akhiyezer, I. Pomeranchuk (J. Phys. USSR, 11, 167, 1947), I. P. Dzyub, A. F. Lubchenko (FTT, 3, 2275, 1961; Izv. AN SSSR, seriya fiz., 25, 901, 1961). There are 22 references: 7 Soviet and 15 non-Soviet. The four most recent references to English-language publications read as follows: P. Schofield. Phys. Rev. Lett., 4, 239, 1960; K. S. Singwi, A. Sjölander. Phys. Rev., 120, 1093, 1960; G. Baym. Phys. Rev., 121, 741, 1961; M. V. Kazarnovskiy, A. V. Stepanov. Inelastic scattering of neutrons in solids and liquids, Intern. Atomic Energy Agency, Vienna, 1961, p. 87.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physics Institute imeni P. N. Lebedev of the Academy of Sciences USSR)

SUBMITTED: July 31, 1961

Card 4/4

S/2504/64/024/000/0212/0261

ACCESSION NR: AT4041827

AUTHOR: Stepanov, A. V.

TITLE: Some problems in the theory of thermal neutron interactions with matter.

SOURCE: AN SSSR. Fizicheskiy institut. Trudy*, v. 24, 1964. Issledovaniya po neytronnoy fizike (Research in neutron physics), 212-261

TOPIC TAGS: neutron, thermal neutron, neutron bombardment, neutron matter interaction, neutron distribution function, neutron transport process, atomic motion, chemical bond, phonon process, neutron scattering, neutron capture

ABSTRACT: Since the early days of neutron physics, two basic problems have become prominent: the investigation of the elementary interaction of neutrons with matter and the study of the transport processes of neutrons. A short discussion is presented on the processes involved in neutron scattering on atoms in crystalline solids and liquids including the temperature effect, phonon production, etc. The major part of this work, however, is concerned with the transport properties of neutrons. The following topics are investigated: a) the asymptotic behavior of the energy function and spatial-energy distribution of neutrons in a heavy crystalline moderator for neutrons with energy $E \gg k_B T$ and $E \gg \theta_B k$ (where $\theta$ is the Debye temperature); b) an analytical approach to

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the problem of neutron thermalization; and c) the resonance interaction of thermal neutrons with matter, which is related to the theory of thermalization, taking into account chemical bonds and the thermal motion of the absorbing atoms. The neutron distribution function in a moderator is obtained by solution of the integral differential equation with a kernel W(V, V') where W is the probability that neutrons with the velocity V will scatter in the velocity interval V', V' + dV'. The basic equation of neutron transport for the case of a heterogeneous moderator is derived as

$$-\mathbf{v}\nabla N(\mathbf{r},\mathbf{v}) - N(\mathbf{r},\mathbf{v})\left[\frac{1}{T(v)} + \int W(\mathbf{v},\mathbf{v}')\,d\mathbf{v}'\right] + \int N(\mathbf{r},\mathbf{v}')\,W(\mathbf{v}',\mathbf{v})\,d\mathbf{v}' + q(\mathbf{r},\mathbf{v}) = 0. \qquad (1)$$

$$\frac{v^2}{3}\nabla\left\{\left[\frac{1}{T(v)} + \int_0^\infty \omega(v,v')\,dv'\right]^{-1}\nabla N_0(\mathbf{r},v)\right\} - N_0(\mathbf{r},v)\frac{1}{T(v)} + \int_0^\infty N_0(\mathbf{r},v')\,\omega(v',v)\,dv' - N_0(\mathbf{r},v)\int_0^\infty \omega(v,v')\,dv' + Q(\mathbf{r},v) = 0, \qquad (2)$$

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The spatial energy distribution function for a moderator of a heavy monoatomic gas is given by

$$\frac{1}{3}\nabla(\lambda_s \nabla N(\mathbf{r}, x)) + \frac{2}{\mu\lambda_s}\left[x\frac{\partial^2 N(\mathbf{r}, x)}{\partial x^2} + x\frac{\partial N(\mathbf{r}, x)}{\partial x} + N(\mathbf{r}, x)\right] + \frac{Q(\mathbf{r}, \sqrt{x})}{\sqrt{x}} = 0. \quad (3)$$

and it is shown that it can be reduced to the age equation by Laplace transformation. It is also shown that this function can be obtained in the form of a collection of neutron groups. If a moderator is a homogeneous, spatially finite body, the distribution function is given by

$$N(\mathbf{r}, x) = \mu\lambda_s \sum_l Z_l(\mathbf{r}) Z_l(\mathbf{r}_0) \frac{\Gamma(\beta B_l)}{x_0^{\beta B_l}} xe^{-x}\Phi(\beta B_l, 2, x), \quad (4)$$

For monoenergetic neutrons in an infinite moderator, the function is given by

$$N(\mathbf{r}, x) = \frac{6}{\lambda_s}\frac{xe^{-x}}{4\pi r}\sum_{n=0}^{\infty}\frac{L_n^{(1)}(x) L_n^{(1)}(x_0)}{n!(n+1)!!}\exp\left(-\sqrt{\frac{6n}{\mu\lambda_s^2}}r\right). \quad (5)$$

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and for a moderator consisting of two adjacent homogeneous plates, by

$$N(z, x) = 6xe^{-x}\sum_{n=0}^{\infty}\frac{L_n^{(1)}(x)\,L_n^{(1)}(x_0)}{n!\,(n+1)!\,\sqrt{n}}\left[\frac{\lambda_{s1}}{\varkappa_1}\operatorname{cth}\frac{\sqrt{n}}{\varkappa_1}a+\frac{\lambda_{s2}}{\varkappa_2}\operatorname{cth}\frac{\sqrt{n}}{\varkappa_2}b\right]^{-1}\frac{\operatorname{sh}\left[\frac{\sqrt{n}}{\varkappa_1}(a-z)\right]}{\operatorname{sh}\frac{\sqrt{n}}{\varkappa_1}a}, \qquad (6)$$

$$N(z, x) = 6xe^{-x}\sum_{n=0}^{\infty}\frac{L_n^{(1)}(x_0)\,L_n^{(1)}(x)}{n!\,(n+1)!\,\sqrt{n}}\frac{\operatorname{sh}\frac{\sqrt{n}}{\varkappa_2}(b+z)}{\operatorname{sh}\frac{\sqrt{n}}{\varkappa_2}b}\cdot\left[\frac{\lambda_{s1}}{\varkappa_1}\operatorname{cth}\frac{\sqrt{n}}{\varkappa_1}a+\frac{\lambda_{s2}}{\varkappa_2}\operatorname{cth}\frac{\sqrt{n}}{\varkappa_2}b\right]^{-1}. \qquad (7)$$

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$$\cdot\left\{\operatorname{ch}\frac{\sqrt{n}}{\varkappa_1}z+\frac{\lambda_{s2}\varkappa_1}{\lambda_{s1}\varkappa_2}\operatorname{cth}\frac{\sqrt{n}}{\varkappa_2}b\cdot\operatorname{sh}\frac{\sqrt{n}}{\varkappa_2}z-\right.$$

$$\left.-\frac{\varkappa_1}{\lambda_{s1}}\left[\frac{\lambda_{s1}}{\varkappa_1}\operatorname{cth}\frac{\sqrt{n}}{\varkappa_2}a+\frac{\lambda_{s2}}{\varkappa_2}\operatorname{cth}\frac{\sqrt{n}}{\varkappa_2}b\right]\operatorname{sh}\frac{\sqrt{n}}{\varkappa_1}(z-z_0)\frac{\operatorname{sh}\frac{\sqrt{n}}{\varkappa_1}a}{\operatorname{sh}\frac{\sqrt{n}}{\varkappa_1}(a-z_0)}\right\}, \tag{8}$$

$$N(z,x)=6xe^{-x}\sum_{n=0}^{\infty}\frac{L_n^{(1)}(x_0)L_n^{(1)}(x)}{n!(n+1)!\sqrt{n}}\left[\frac{\lambda_{s1}}{\varkappa_1}\operatorname{cth}\frac{\sqrt{n}}{\varkappa_1}a+\frac{\lambda_{s2}}{\varkappa_2}\operatorname{cth}\frac{\sqrt{n}}{\varkappa_2}b\right]^{-1}\cdot$$

$$\cdot\left\{\operatorname{ch}\frac{\sqrt{n}}{\varkappa_1}z+\frac{\lambda_{s2}\varkappa_1}{\lambda_{s1}\varkappa_2}\operatorname{cth}\frac{\sqrt{n}}{\varkappa_2}b\operatorname{sh}\frac{\sqrt{n}}{\varkappa_1}z\right\}\frac{\operatorname{sh}\frac{\sqrt{n}}{\varkappa_1}(a-z_0)}{\operatorname{sh}\frac{\sqrt{n}}{\varkappa_1}a}, \tag{9}$$

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ACCESSION NR: AT4041827

For a heavy crystalline moderator and small values of V-V', the distribution function is given by

$$\frac{v^2}{3}\nabla\left\{\left[\frac{1}{T_s}+\int_0^\infty \omega(v,v')\,dv'\right]^{-1}\nabla N_0(r,v)\right\}-\frac{N_0(r,v)}{T(v)}+$$
$$+N_0(r,v)\,I_0(v)+\frac{v}{1!}\frac{\partial N_0(r,v)}{\partial v}I_1(v)+\frac{v^2}{2!}\frac{\partial^2 N_0(r,v)}{\partial v^2}I_2(v)+$$
$$+\frac{v^3}{3!}\frac{\partial^3 N_0(r,v)}{\partial v^3}I_3(v)+\cdots+Q(r,v)=0, \quad (10)$$

for $V \ll V_0$ it is given by

$$N_0(v)=\frac{\mu\lambda_s}{v^2}e^{-A/v}\left[1+\frac{2\tau}{v^2}+\frac{6\tau^2}{v^4}-\frac{5}{8}\frac{\overline{\Omega}^2}{v^4}-\right.$$
$$\left.-\frac{7}{6}\frac{\tau}{v^2}\frac{A}{v}+\frac{1}{8}\frac{\tau}{v^2}\frac{A^2}{v^2}\right], \quad (11)$$

and the estimate of the influence of the chemical bond and the thermal motion of the atom is based on

$$N_0(v)=\frac{\mu\lambda_s}{v^2}e^{-A/v}\left[1+\frac{2\tau}{v^2}+\frac{6\tau^2}{v^4}-\frac{5}{8}\frac{\overline{\Omega}^2}{v^4}-\right.$$
$$\left.-\frac{7}{6}\frac{\tau}{v^2}\frac{A}{v}+\frac{1}{8}\frac{\tau}{v^2}\frac{A^2}{v^2}\right], \quad (12)$$

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The thermalization and diffusion of neutrons is analyzed by the expansion of the distribution function in energy groups. The neutron balance relations are given by

$$\frac{1}{\sqrt{x}}\frac{\partial N(r,x,t)}{\partial t}+\frac{1}{3}\nabla\{\lambda\nabla N(r,x,t)\}-\frac{1}{\sqrt{x}T(x)}N(r,x,t)-$$
$$-N(r,x,t)\int_0^\infty g(x,x')\,dx'+\int_0^\infty N(r,x',t)g(x',x)\,dx'+P(r,x,t)=0. \quad (13)$$

$$\sum_{l=0}^{\infty}\left\{-\left(\frac{1}{\sqrt{x}}\right)_{lk}\frac{\partial n_l(r,t)}{\partial t}+\frac{1}{3}\nabla\{(\lambda)_{lk}\nabla n_l(r,t)\}-n_l(r,t)\cdot\left(\frac{1}{\sqrt{x}T(x)}\right)_{lk}-\right.$$
$$\left.-\gamma_{lk}n_l(r,t)\right\}+P_k(r,t)=0,\quad k=0,1,2\ldots \quad (14)$$

Derivation of the distribution function for the case of a pulsed neutron source in finite a neutron is based on

$$\sum_{l=0}^{\infty}\left\{-\left(\frac{1}{\sqrt{x}}\right)_{lk}\frac{\partial n_l(r,t)}{\partial t}+\frac{1}{3}\nabla\{(\lambda)_{lk}\nabla n_l(r,t)\}-n_l(r,t)\cdot\left(\frac{1}{\sqrt{x}T(x)}\right)_{lk}-\right.$$
$$\left.-\gamma_{lk}n_l(r,t)\right\}+P_k(r,t)=0,\quad k=0,1,2\ldots \quad (15)$$

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The spatial-energy distribution function in a heterogeneous moderating medium is given in the frame of the two-group approximation by

$$n_0^{I}(z) = \left(\frac{1}{k_1 - k_2}\right)^{I} \left\{k_1\left[e^{-\alpha_2 z}\left(C_2 + \frac{\varphi_2}{2\alpha_2^2}\right) - \frac{\varphi_2}{\alpha_2^2}\right] - k_2\left[e^{-\alpha_1 z}\left(C_1 + \frac{\varphi_1}{2\alpha_1^2}\right) - \frac{\varphi_1}{\alpha_1^2}\right]\right\}^{I},$$

$$n_1^{I}(z) = \left(\frac{1}{k_1 - k_2}\right)^{I} \left\{e^{-\alpha_1 z}\left(C_1 + \frac{\varphi_1}{2\alpha_1^2}\right) - e^{-\alpha_2 z}\left(C_2 + \frac{\varphi_2}{2\alpha_2^2}\right) - \frac{\varphi_1}{\alpha_1^2} - \frac{\varphi_2}{\alpha_2^2}\right\}^{I}, \quad z > a; \qquad (16)$$

$$n_0^{II}(z) = \left(\frac{1}{l_1 - l_2}\right)^{II} \left\{l_1\left[D_2 \operatorname{ch} \beta_2 z + \frac{\psi_2}{\beta_2^2}(\operatorname{ch} \beta_2 z - 1)\right] - l_2\left[D_1 \operatorname{ch} \beta_1 z + \frac{\psi_1}{\beta_1^2}(\operatorname{ch} \beta_1 z - 1)\right]\right\}^{II}, \qquad (17)$$

$$n_1^{II}(z) = \left(\frac{1}{l_1 - l_2}\right)^{II} \left\{D_1 \operatorname{ch} \beta_1 z + \frac{\psi_1}{\beta_1^2}(\operatorname{ch} \beta_1 z - 1) - D_2 \operatorname{ch} \beta_2 z - \frac{\psi_2}{\beta_2^2}(\operatorname{ch} \beta_2 z - 1)\right\}^{II}, \quad a > z > 0.$$

The influence of the dynamic properties of the atoms of the moderating medium on the therr alization of neutrons is also investigated by studying the relation between the parameters of thermalization and the correlation function in the moderating material.

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In the investigation of the resonance interaction of thermal neutrons and $\gamma$ quanta with matter, the probability of resonance absorption is derived and given by

$$W(E) = \frac{2}{\hbar\Gamma}|M_c|^2 \operatorname{Re}\int_0^\infty dt\, e^{\frac{it}{\hbar}(E_0 - E + i\Gamma/2)}\, e^{-\frac{k^2}{4}\Delta^2(t)}. \quad (18)$$

In the case of a liquid moderator this probability is given by

$$G_s(\mathbf{r}, t) = N^{-1}\left\langle \sum_{l=1}^{N} \int d\mathbf{r}'\,\delta(\mathbf{r} + \hat{\mathbf{R}}_l(0) - \mathbf{r}')\,\delta(\mathbf{r}' - \hat{\mathbf{R}}_l(t))\right\rangle \quad (19)$$

"The author is indebted to M.V. Kazarnovskiy for his constant interest, valuable comments and advice, to F. L. Shapiro for stimulating discussions and to Z. P. Mukhin for carrying out a significant proportion of the numerical calculations. Orig. art. has: 1 table, 4 figures and 121 numbered formulas.

ASSOCIATION: Fizicheskiy institut im. P.N. Lebedeva AN SSSR (Physics Institute, AN SSSR)

ACCESSION NR: AT4041827

SUBMITTED: 00

ENCL: 00

SUB CODE: NP

NO REF SOV: 013

OTHER: 042

Card 10/10

ACCESSION NR: AP4042382 S/0056/64/047/001/0139/0146

AUTHORS: Kazarnovskiy, M. V.; Stepanov, A. V.

TITLE: Elastic scattering of neutrons and the Mossbauer effect in systems with local degrees of freedom

SOURCE: Zh. eksper. i teor. fiz., v. 47, no. 1, 1964, 139-146

TOPIC TAGS: neutron scattering, energy level, Mossbauer effect, temperature dependence, correlation statistics, krypton

ABSTRACT: It is shown that additional valuable information on the energy levels corresponding to the local degrees of freedom, and particularly their lifetime, can be obtained from an analysis of elastic (more precisely, quasielastic) scattering of neutrons. The possibilities are discussed of investigating these lifetimes and the laws of motion relative to local degrees of freedom by quasielastic incoherent scattering of slow neutrons and also by the Mossbauer

ACCESSION NR: AP4042382

effect. It is shown, in particular, that under conditions of "poor resolution" the dependence of the probabilities for these effects on momentum transfer and on the temperature of the medium differs essentially from that of a system without local state. It is demonstrated that the cross section for quasielastic scattering of neutrons should depend significantly on whether local degrees of freedom are or are not present. The magnitude of the effect, as expressed by the ratio of the correlation functions, amounts to 0.2 as determined by neutron scattering and 0.5 as determined by the Mossbauer effect. It is pointed out that at large momenta, the probability may even increase with temperature. This effect may explain the peculiar temperature dependence of the Mossbauer effect on krypton embedded in organic compounds (Hazoni et al., Physics Letters, 2, 337, 1962). The practical difficulties of observing the peculiarities in the temperature behavior of the correlation function when local degrees of freedom are present are discussed. "The authors are deeply grateful to F. L. Shapiro for continued interest

ACCESSION NR: AP4042382

and to M. A. Krivoglaz and A. A. Maradudin for helpful discussions." Orig. art. has: 3 figures and 18 formulas.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physics Institute, Academy of Sciences, SSSR)

SUBMITTED: 30Oct63 ENCL: 00

SUB CODE: NP NR REF SOV: 003 OTHER: 004

S/0056/64/047/002/0543/0557

ACCESSION NR: AP4043629

AUTHORS: Kazarnovskiy, M. V.; Stepanov, A. V.

TITLE: The time correlation function method and its application to the theory of Mossbauer line shift and deformation

SOURCE: Zh. eksper. i teor. fiz., v. 47, no. 2, 1964, 543-557

TOPIC TAGS: Mossbauer effect, excited state, correlation technique, radiation effect theory, time correlation, line shift

ABSTRACT: The interaction between radiations of arbitrary type (particles, quanta) with complex systems (molecules, liquids) is analyzed in order to ascertain what information concerning the structure and dynamics of the complex system can be obtained from an analysis of the data obtained by sounding the system with radiation and, conversely, what characteristic of the complex system must be known in order to predict the results of such an action. Starting

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ACCESSION NR: AP4043629

with the van Hove expression for the differential scattering cross section

$$\frac{\partial^2\sigma}{\partial E\partial\Omega} \backsim \int_{-\infty}^{\infty} \exp\left(-\frac{i}{\hbar} t\Delta E\right) K(t)\, dt,$$

where K(t) is the statistical and quantum mechanical mean of an operator $T^+(t)T(0)$ and $\Delta E$ -- energy transfer, it is shown here that (1.1) is a general formula and different types of sounding particles and their interaction with the system differ only in the concrete form of the operator T(t). Each such operator is regarded as a dynamic variable characterizing the investigated system. The corresponding function K(t) is the time correlation function of this dynamic variable. The types of the operator T(t) for different particular cases are considered. By way of an example, the shift and deformation of a Mossbauer line due to the difference in the Hamiltonians of the atomic motion, when the Mossbauer nucleus is in the ground state and in the excited state. Integral relations connecting the

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ACCESSION NR: AP4043629

Mossbauer probability (as a function of the temperature) with the shape of the Mossbauer line are obtained. It is shown that when there are discrete degrees of freedom, the Mossbauer line will not only shift but will also be greatly distorted. Some possible applications of the time correlation function technique are discussed. Orig. art. has: 49 formulas.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physics Institute, Academy of Sciences SSSR)

SUBMITTED: 10Jan64 ENCL: 00

SUB CODE: NP NR REF SOV: 006 OTHER: 011

Card 3/3

L 27510-66 EWT(1)/EWT(m)/FCC/EWA(h) GS/GW

ACC NR: AT5023950 UR/0000/65/000/000/0357/0360

33
B+1

AUTHOR: Gedeonov, L.I.; Zhilkina, M.I.; Il'inskaya, T.A.; Stepanov, A.V.

ORG: None

19

TITLE: Chemical composition of atmospheric precipitation and fallouts in the vicinity of Leningrad

SOURCE: Nauchnaya konferentsiya po yadernoy meteorologii. Obninsk, 1964. Radioaktivnyye izotopy v atmosfere i ikh ispol'zovaniye v meteorologii (Radioactive isotopes in the atmosphere and their use in meteorology); doklady konferentsii. Moscow, Atomizdat, 1965, 357-360

TOPIC TAGS: ~~fallout chemical composition, Leningrad vicinity fallout, fallout determination methods~~ radioactive fallout, atmospheric precipitation, radioactive fallout, atmospheric precipitation

ABSTRACT: The aim of this study was the determination of radioactive fallout composition with higher than usual precision and range. Samples were analysed to determine two groups of data: a) radioactive fission products content, b) content of macroadmixtures. Radioactive fission products were caught into aluminum containers with 1 squ. meter area, 10 cm. deep, provided with a layer of oiled filter paper on the bottom, and into porcelain tanks filled with a weak solution of nitric acid in water. After a monthly exposure on an open platform, the accumulated material was evaporated, burned, fired and weighed. After a measurement of total beta activity and the spectrum of

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Card 1/3 UDC: None

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ACC NR: AT5023950

D

TABLE 1

Composition of fallout by individual elements, in the viscinity of Leningrad. Period of collection: 1960-1963.

| Element: | Concentration, % : |
|---|---|
| As, Bi, Cd, Ge, Hg, In, Nb, Sb, Ta, Tl, W, Th, Sc, U | Not detected by the spectral analysis method |
| Ag, Be, Mo, Co, Ga, Cs | ≤0,001 |
| Sn, Y | 0,001—0,01 |
| Cu, Cr, Mn, Ni, Pb, Sr, Zn, Zr, La, Ce, V | 0,01—0,1 |
| Ti, Ba | 0,1—1,0 |
| Ca, Si, Fe, Al, Mg, P, Na, K | 1,0—10 and over. |

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ACC NR: AT5023950

0

gamma radiation, the samples were subjected to radiochemical analysis for the determination of the fission products $Sr^{89-90}$, $Ce^{141-144}$, $Cs^{137}$, and $Y^{91}$. In some samples, the content of $Ba^{140}$, $Ag^{111}$, $Mo^{99}$, $Zn^{95}$, $Sb^{125}$, $Be^{7}$, and other isotopes was also determined. Macroadmixtures were determined by using spectral analysis and analytical methods for Ca, Fe, Si, Ba and Al. Flame photometry was utilized for K and Cs content determinations. Table 1 shows the results of analysis of 50 samples gathered during the 1960-1963 period in the viscinity of Leningrad. Orig. art. has: 2 tables.

SUB CODE: 18, ~~07~~ SUBM DATE: 28Apr65 ORIG REF: 014 OTH REF: 001

(18)

Card 3/3 BLG

L 07061-67 EWT(m)
ACC NR: AP6021629 SOURCE CODE: UR/0089/66/020/003/0265/0266

33
B

AUTHOR: Stepanov, A. V.

ORG: none

19

TITLE: Contribution to the theory of neutron transport in media with random inhomogeneities

SOURCE: Atomnaya energiya, v. 20, no. 3, 1966, 265-266

TOPIC TAGS: reactor neutron flux, transport phenomenon, kinetic equation, reactor moderator, thermal neutron

ABSTRACT: This is an abstract of paper no. 60/3372 submitted to the editor and filed, but not published in full. The kinetic equation is written out for the neutron density in an inhomogeneous moderator whose scattering properties are random functions of x (x is the total aggregate of independent variables of the problem). The authors determine the average neutron density, for which they derived an approximate equation by quantum theory. This equation is solved for stationary diffusion of thermal neutrons from a flat source placed in an infinite moderator with random but weak absorption. The solution displays the transient and the asymptotic terms and an expression for the relaxation length of the asymptotic solution is given. The expressions are valid for both strong and small-scale fluctuations. If the thermal neutrons diffuse from a non-stationary flat source placed in an inhomogeneous layer of the moderating substance, the main spatial harmonic of the neutron flux decreases with time in a non-exponential fashion. Orig. art. has: 3 formulas.

SUB CODE: 18/ SUBM DATE: 19Jul65

Card 1/1 [illegible] UDC: 621.039.51.12

PROCESSES AND PROPERTIES INDEX

**The relation between the energy of deformation and the heat of fusion.** A. V. Stepanov. *Physik. Z. Sowjetunion* **2**, 537-40(1932).—The mech. properties of crystals are discussed on the basis of an empirically found proportionality between the energy of deformation and the heat of fusion.

Morris Muskat

METALLURGICAL LITERATURE CLASSIFICATION

1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

2

**Mechanism of plastic deformation. II. Effect on the phase changes.** A. V. Stepanov. *Physik. Z. Sowjetunion* 5, 70[illegible]-13(1934); cf. *C. A.* **27**, 3372.—In plastic deformation the lattice dissocn. takes place at the gliding planes. The various factors affecting permanent changes in properties are considered. Greer M. Evans

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

PROCESSES AND PROPERTIES INDEX

**Plastic properties of single crystals of silver and thallium halides.** A. V. Stepanov. *Physik. Z. Sowjetunion* 6, 312-15(1934).—AgBr, TlCl and TlBr are plastic, like AgCl. The plastic properties are detd. not by intermolecular forces but by polarization properties of the particles in the lattice. A detailed picture of the deformation process is given. A. B. F. Duncan

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

3RD AND 4TH ORDERS

*Practical Strength. A. V. Stepanov (*Zhurnal Tekhnicheskoy Fiziki* (*J. Tech. Physics*), 1935, 5, (2), 340–361).—[In Russian.] The strength of crystals and the factors governing rupture depend mainly on changes brought about in the crystal by plastic deformation.—N. A.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

BC

PROCESSES AND PROPERTIES INDEX

a-1

**Plastic properties of silver chloride and sodium chloride single crystals.** A. V. Stepanov (Physikal. Z. Sowjetunion, 1936, 9, 35—40).—The plastic properties of single crystals of AgCl and NaCl are compared to show that they are connected with the polarisation effect of the lattice. Single crystals of AgCl show a high degree of plasticity and metallic properties in general. AgCl which has been exposed to light is not so plastic. The elastic limit along the cubic axis of a crystal tempered at 350° was 70 g. per sq. mm. Deformation on extension is similar to that of a metal belonging to the cubic system. The elastic limits for crystals of AgCl and NaCl are similar. The deformation work for NaCl is > for AgCl. At room temp. AgCl is more plastic than NaCl.

A. J. M.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

PROCESSES AND PROPERTIES INDEX

BC

A-1

Cause of premature rupture of crystals. A. V. STEPANOV (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 797—813; cf. A., 1937, I, 504; 1936, I, 182, 183).—Further experiments on rock-salt, including the effect of grooves, and examination with polarised light of crystals stretched along [110] and [111] directions, confirm the primary cause as plastic deformation. The interaction of slip and local distortion is discussed. A range of tensile strengths 80—2000 g. per sq. mm. (normal val. ~600) is attainable under varied conditions. I. McA.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

**The effect of grooving on the strength of rock salt. II.** A. V. Stepanov. *J. Exptl. Theoret. Phys.* (U. S. S. R.) 7, 1168-70(1937). The effects of various types of grooves were studied. When the grooves are in the direction of the slip planes, the strength of the crystals is greatly reduced. Fracture occurs not in the grooves, but along the slip planes.

F. H. Rathmann

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

PROCESSES AND PROPERTIES INDEX

A-1

Two experiments on strength (of crystals). A. V. STEPANOV (Physikal. Z. Sovietunion, 1937, 12, 182—190).—Two experiments are described which show that the low val. of the practical strength of rock-salt crystals is due to plastic deformation. For crystals which, under ordinary conditions, have a rupturing strength of 800 g. per sq. mm., the strength could be increased to 2000 g. per sq. mm. when plastic deformation was eliminated, and decreased to 80 g. per sq. mm. when such deformation was favoured.

A. J. M.

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PROCESSES AND PROPERTIES INDEX

A-1

**Effect of a groove on the strength of single crystals of rock-salt. I. Effect of a rectangular groove.** A. V. Stepanov (Physikal. Z. Sowjetunion, 1937, 12, 101—[illegible]).—Plastic deformation of rock-salt crystals on applying tensile can be hindered by cutting a deep groove (for which height (h)/diameter (d) $<1$) in the crystal. The strength of the crystal can thus be considerably increased (e.g. four-fold); this increase is not due alone to the decrease in the plastic deformation. For a given d the strength is the higher the smaller is h, and for a given h, the strength first increases with decreasing d, and then decreases. Annealing the crystal and smoothing its surface did not alter the effect of grooving. The effect of temp. and erosion of the crystal by dissolution on the strength of the grooved crystals was determined.

A. J. M.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

BC

A-1

Influence of a groove on the strength of rock-salt. II. [illegible] A. V. Stepanov (Fizich. Z. [illegible], 1937, 11, [illegible]).—[illegible] grooves are given lateral cuts of varying type, depth, and inclination (α) to the prism axis [100], along which tension is applied. Smooth fracture usually occurs in the full cross-section in a cube plane. The dependence of limiting strength on temp., "neck" cross-section, α, and surface erosion is determined. Results are interpreted through plastic deformation. I. McA.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

A-1

**Influence of surface state on the plasticity of crystals.** A. V. [illegible] (Compt. rend. Acad. Sci. U.R.S.S., [illegible], 15, 547—[illegible]).—Examination in polarised light of the results of a surface scratch on a crystal of rock-salt showed that this, together with the vol. change produced by it, is a source of slip, which, by causing further slips, may lead to rupture of the whole crystal. R. C. M.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

considered an "artificial" shear or slip, the latter as natural shear. Expts. made to det. the cause of artificial shear formation showed that the chief factors are not the macrodefects of the surface but rather the microdefects and the plastic rotation deformations of the lattice. Even at temps. as high as 280°, where the material of the crystal is plastic and may be rotated as much as 20°, the scratch exerts its effect and forms the origin of the slip shear planes. For the rupture process itself the slip surface defect first produces the slip shear plane which then acts to develop further the surface defect, etc., leading eventually to rupture which takes place with a finite velocity. The formation of a small merely local cleavage fissure does not necessarily lead to its growth and the rupture of the crystal. If the load is removed from the crystal and a new load then applied the shear fissure grows only if the new load is greater than the old load. Fissures are usually initiated in the corners. By observations made on the fissure zone in polarized light it was found that the velocity of shear is smaller than the velocity of growth of the cleavage fissures.

F. H. Rathmann

ASM-SLA METALLURGICAL L

**The phenomenon of artificial secondary twin gliding. I.** A. V. Stepanov. *J. Exptl. Theoret. Phys.* (U.S.S.R.) 17, 602-10(1947)(in Russian); cf. *C.A.* 42, 5295i. The action of primary defects in a crystal was studied. A primary defect is requisite for a plastic deformation effect. The defect can develop only if it is stimulated by such a deformation. The following assumptions on the mechanism of this process are discussed: (1) The gliding can go through the crystal to the surface defect and thus enhance its development. (2) The primary defect can enhance the development of the gliding process and thus make the primary defect grow. Expts. performed with rock-salt crystals examd. in their gliding phenomena in polarized light showed convincingly that any superficial scratch may be the starting point for gliding systems. The primary scratches were oriented in the direction (100), perpendicular to the plane of the photographic plate on which the phenomenon was documented. The scratches were produced on the Martens sclerometer under a load of only 0.5-1.0 g., the width of the grooves was 5-7 microns, and even much finer invisible scratches may act in the same manner as starting points for gliding lamellas. From all the expts. it is concluded that not macroscopic defects of the crystal surface but microscopic scratches and lattice defects of a plastic-deformation character are decisive for producing an artificial gliding. Natural and annealed crystals were examd., the latter being cured for 6 hrs. at 600°. It is remarkable that for annealed rock salt crystals the load for the production of artificial gliding is only about 110 g. per sq. mm., whereas natural crystals glide only under a considerably higher load, namely of about 150 g./sq. mm. But in both cases the mechanism is the same, since scratches must act as primary defects from which the gliding planes must start. Also at elevated temps. the effect of scratches is the same, e.g. at 250°. There is, however, a difference in the rupture character: although at room temp. under a load of 200 g./sq. mm., rupturing takes place, a tension of 425 g./sq. mm. is insufficient at 250° for rupture, but rather the crystal is quietly stretched. The possibility of the localization of gliding by scratches was also examd. for multiple systems of such deliberately applied defects on the crystal surface, e.g. by the study of effects of 5 or 10 scratches near one another. The mutual connection of plastic deformation inducing superficial defects and of cracks penetrating into and through the crystal is characterized by a definite difference of the speed of their formation: although scratches and similar defects grow slowly, cracks have a much higher speed of transmission. For the theory of crystal fracturing this phenomenon is important. W. E.

1ST AND 2ND ORDERS — 3RD AND 4TH ORDERS

PROCESSES AND PROPERTIES INDEX

S 19

THE PHENOMENON OF MECHANICAL TWINNING. AV Stepanov. Journal of experimental and Theoretical Physics USSR, 1947, vol. 17, Aug., pp. 713-723. This is a theoretical discussion with only brief reference to experimental data previously available regarding the pehonomenon of twinning in zinc, alpha iron, bismuth, antimony cadmium, magnesium , and calcite. The author puts forward the hypothesis that withitwinning is a mechanical orientation effect connected with the anisotroppic modulus of elasticity of the crystal. A force applied to the crystal gives rise to an asymmetric distribution of the shearing stress and this, when the elastic energy approaches the value of the energy of activation involved, results in a mchanical reorientation twinning in the volume of the crystal orientated with the lowest value of the modulus of elasticity relative to the plant containing the applied force. Two distinct stages of the twinning process areldistinguished. The first, just referred to, is an elastic, reversible mechanical orientation proces es, which results in the formaton of a twinned nacleus. The second stage is the growth of this neculeus into a visible twin. This growth contratry to the format on of the nucleus a purely drystal lattice phenomenon occurs as a result of boundry displacement and requires much lower values of the mean stress.

CA

**Artificial crystal gliding. II. Nuclei of artificial gliding.** A. V. Stepanov (Leningrad Phys.-Tech. Inst.). *Zhur. Eksptl. Teoret. Fiz.* 18, 741-9(1948); cf. *C.A.* 42, 6000f.— Strains applied on NaCl crystals in the direction [100], and perpendicular to the cleavage plane, bring about nuclei of gliding in the system (110)-[110] by local material displacement. These glidings are observed in polarized light on suitably oriented prisms by their anomalous opticoelastic birefringence. From the theory of elastic def - mation of isotropic and anisotropic (cryst.) media, the fundamentally distinguishing characteristics of mech. deformation of a solid plate are deduced. For isotropic media, systems of circular isochromatic curves appear, while in NaCl, KCl, etc., the max. strains are observed along isochromatic curves of the fourth order, and the angle included between the direction of the applied force with the axes of anisotropy is an essential factor for the resulting optico-elastic phenomena. Since for KCl the ratio of Young's modulus in [100] to that in [111] is 3.2, for NaCl only 1.34, the elastic deformations are more easily verified in KCl. Gliding directions are characterized by a "concentration" of the deformations and indicated in the shape of the max. strain curves. The gliding mechanism itself is detd. by the local conditions of min. free energy which bring about the observed nucleation of the displacements. The fact that surprisingly low forces (e.g., 1 g. load on a diamond pointer of a Martens hardness tester) are sufficient for inducing the nucleation cannot yet be entirely explained from inner-crystal dynamics; the theory of the Hertz-Auerbach abs. hardness indicates, however, the order of magnitude of the applied forces for a given Young's modulus, and Poisson const. of the cryst. material in question. **III.** A. V. Stepanov and E. A. Mil'kamanovich. *Ibid.* 773-5.—On the (110) face of rock-salt prisms, as described in the preceding part, under a load of 50 g. a scratch is produced by the diamond pointer of a Martens hardness tester, oriented parallel [100] and perpendicular to the [110] elongation. After annealing the crystal for 10 hrs. at 650°, the extension in the [110] direction and the spontaneous gliding is observed at 200° between crossed nicols. The mechanism is that of (100)-[110] gliding, and the optical elastic limits are measured. With wetted (110) faces (cf. Ioffe, *et al.*, *C.A.* 18, 2447), the elastic limit is measured at room temp. to be 800 g./sq. mm. Particularly characteristic are the changes in the appearance of the gliding lamellae at different temps., starting from the scratch in side-view. At high temps. the "arrows" are sharp-outlined, indistinct at lower temps. The gliding mechanism is taking place in 2 distinct steps: (1) an activation and nucleation, (2) the growth of activation centers. Those centers which are formed at room temp. are unable to grow; they can, however, be developed and observed by temp. increase, and the interval of 20 to 30° is particularly efficient. The gliding lamellae appear pair-wise oriented on both sides of the scratch; the crystallographic meaning of the fields of max. tension in the neighborhood of the scratch is not sym., since the plane going through the scratch, and perpendicular to the crystal surface, is not a plane of symmetry of

MW

FA 9/49T97

STEPANOV, A.V.

USSR/Physics — Sep 48
Crystallography
Crystals - Elastic Properties

"Optical Limits of the Elasticity of Rock Salt Crystals for Slip Along the Plane of a Cube," A. V. Stepanov, Ye. A. Mil'kamanovich, Leningrad Phys-Tech Inst, Acad Sci USSR, 4 pp

"Zhur Eksper i Teoret Fiz" Vol XVIII, No 9
p. 769-72

Shows results of determination, by optical method, of elastic limit of rock salt crystals for case of slip along plane of a cube (100), and in the direction [111]. Establishes relationship of elastic limit to temperature.

[redacted] 9/49T97

PROCESSES AND PROPERTIES INDEX

SA

A54T

548.0 : 539.373

1227. The phenomenon of artificial displacement. III. STEPANOV, A. V. AND MILKAMANOVICH, E. A. *J. Exp. Theor. Phys., USSR*, 18, 773-5 (*Sept.*, 1948) *In Russian*.—[See Abstr. 4017 (1948)]. The phenomenon is described for NaCl crystals along the cubic face (100) and in the direction [110]. IV. [*Ibid.*, 776-9]. Some more details of the structure of the deformed crystal obtained in investigations by optical methods are given. A.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

STEPANOV, A. V.

35820. Svoystva prochnosti polimerov v oriyentirovannom sostoyanii. Zhurnal eksperim. i teoret. fiziki, 1949, vyp. 11, s. 973-88.-Bibliogr: 16 nazv.

SO: Letopis' Zhurnal'nykh Statey, Vol. 39, Moskva, 1949

STEPANOV, A. V.

PA 40/49T51

USSR/Engineering — Feb 49
Stress Analysis
Optics

"New Optical Method of Studying Stresses in Polarized Light," A. V. Stepanov, Leningrad Physicotech Inst, Acad Sci USSR, 12¼ pp

"Zhur Tekh Fiz" Vol XIX, No 2 · p 205-17

Proposes new optical method to study stresses in polarized light. Material used for model is crystalline and behaves similarly to metals. Presents preliminary data on suitable material,

[redacted] 40/49T51

USSR/Engineering (Contd) — Feb 49

and results of experiments showing possibilities of method. Includes 21 diagrams. Some show stress lines in color. Submitted 14 Sep 46.

[redacted] 40/49T51

STEPANOV. A. V. PA 48/49T95

USSR/Physics Apr 49
Cleavage

"Cleavage Phenomena," A. V. Stepanov, Leningrad Physicotech Inst, Acad Sci USSR, $14\frac{1}{4}$ pp

"Zhur Tekh Fiz" Vol XIX, No 4 p.492-506

Draws attention to the fact that prerequisites for the presence of the cleavage phenomenon in crystals are to be found in the anisotropy of their elastic properties. Submitted 25 Dec 48.

[redacted] 48/49T95

C. A. 31

**The strength of polymers in the oriented state.** A. V. Stepanov (Phys. Tech. Inst., Leningrad). *Zhur. Eksptl. Teoret. Fiz.* 19, 973-88(1949).—The mechanism of the development of regions of local fracture in stressed bodies is examd. for elastically isotropic and anisotropic materials. Such local regions consist of micro-fissures and micro-hollows. In some solids (examples: NaCl, Zn, quartz) these grow readily, in which case the observed tensile strength is 1-0.1% of the theoretical value calcd. from the formula: (tensile strength) = 0.1 (Young's modulus). Where the micro-fracture points cannot develop, macro-fracture must result from simultaneous development of many micro-fracture points. In this case, the observed tensile strength is 5-30% of the theoretical. Examples of the latter case are flax, asbestos, mica, and polymers in the oriented state such as natural silk, stretched rubber, shrunken collagen, or stretched gelatin. H. K Livingston

PROCESSES AND PROPERTIES INDEX

SA

A 53
FF

539.375 : 548.0

2101. Reasons for the characteristics of breakdown of elasto-anisotropic bodies. A. V. Stepanov. Izv. Akad. Nauk, SSSR, Ser. Fiz., 14 (No. 1) 122-41 (1950) In Russian.

Theoretical. Methods of representing the elastic properties of elasto-anisotropic bodies and evaluating the acting stresses in anisotropic bodies are discussed. In comparing elasto-anisotropic and elasto-isotropic bodies the following points are considered: the state of stress depends on the angle between the directions of the acting force and the axes of anisotropy of the sample; the direction of max. stress does not coincide with the direction of max. deformation; the direction of max. stress does not coincide with the direction of the acting force; the state of stress depends on the period of the acting force (e.g. the difference between figures of pressure and strike for crystals), in anisotropic laminae the effect of the concn. of stress along the direction of the highest value for Young's modulus, and deconcentration for the direction with the least value for Young's modulus is manifest; there exist characteristic forms of stress inherent in all anisotropic media, and consequently analogous forms of breakdown; the results of interaction of an external force depend on its sign.

W. HUGHES

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

STEPANOV, A. V.

PA 160T104

USSR/Physics - Quartz
Crystals, Twinning

May 50

"Mechanical Twinning of Quartz," A. V. Stepanov, Leningrad Physicotech Inst, Acad Sci USSR, 4 pp

"Zhur Eksper i Teoret Fiz" Vol XX, No 5 p.438-41

Considers possible existence of relation between phenomena of mechanical twinning and elastic properties of quartz crystals. Submitted 4 Nov 49.

[redacted]

160T104

STEPANOV, A. V.

Stepanov, A. V. The mechanism of destruction of elastic-anisotropic bodies.

The Leningrad Physico-Technical
Inst. of Acad. of Sci. USSR
Aug. 10, 1949.

SO: Journal of Technical Physics, Vol. 20, No. 10. October 1950.

S.A.

Sect. A

Crystallography

548.0 : 539.373

1304. **The phenomenon of artificial displacement. IV. The growth of centres of slip.** A. V. STEPANOV AND E. A. MILKAMANOVICH. *Zh. Eksper. Teor. Fiz.*, 21, 401–8 (*No.* 3, 1951) *In Russian.*

For Pt III, see Abstr. 1227 (1949). Descriptive. Slip in the direction [110] of the planes (110) was produced in crystals of rock salt by the application of a mechanical tension. The process was filmed and about 40 frames are reproduced to illustrate the phenomenon. The temperature was varied and the stress necessary to cause slip followed the change of elastic limit with temperature.    A. L. MACKAY

S.A.
Sect. A

Crystallography

548.0 : 539.373

1305. **The phenomenon of artificial displacement. V. The influence of solution on artificial slip formation.** ~~[illegible]~~ E. A. Milkamanovich. *Zh. Eksper. Teor. Fiz.*, 21, 409-12 (No. 3, 1951) *In Russian.*

Numerous experiments are described with photographs showing that the action of a solvent on the surface of a crystal of rock salt affects the spreading of faults into the volume of the crystal. The experiments continue the study described by A. V. Stepanov [*Zh. Eksper. Teor. Fiz.*, 17, 601 (1947)]. A scratch was made on the wet surface of the crystal with a diamond and tension was applied until slipping began. Layers of various thickness were dissolved off the crystal which was examined in polarised light.

A. L. MACKAY

STEPANOV, A. V.; KRASNOV, V. M.

Crystallography.

Optical methods of investigating centers of disintegration. I. Zhur. eksp. i teor. fiz 23, No. 2, 1952.

Monthly List of Russian Accessions, Library of Congress, December 1952. Unclassified.

STEPANOV, A.V.

Chemical Abst.
Vol. 48 No. 4
Feb. 25, 1954
General and Physical Chemistry

The basis of the [illegible] and plasticity of crystals. A. V. Stepanov (Leningrad Phys.-Tech. Inst., Acad. Sci. U.S.S.R.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* 17, 271-[illegible](1953); cf. *C.A.* 42, 6890f; 45, 9975a-g, 9976c; 46, 4000g.—Previous papers about phenomena that appear on destruction of a crystal are summarized. The nature of elastic anisotropy and the elastic theory of periodic media are examd. The elastic properties of an anisotropic medium can be represented by periodic arrays of isotropic elements with different elastic characteristics; thus the theory can be expressed by finite difference equations and not by differential equations. In another approach the equations of the classical elasticity theory will lose their validity only for certain planes and directions of the anisotropic medium, such as planes and directions of equal deformation or of equal stress; or planes and directions along the same structural elements or perpendicular to different types of elements. Destruction is obtained when the elastic limit is exceeded. In crystals stresses exceeding the elastic limit can lead to a change in at. structure; some results of destruction can heal by themselves if adsorption is not present; the problem of destruction must be handled by the theory of nonisotropic periodic media. Since the free energy depends on the direction of the crystal faces, new forms of equilibria can appear in crystals under the action of outside stresses (mech. orientation phenomena). The stresses first produce nuclei of destruction which lead to gliding, twinning, and splits. The conditions of formation of such nuclei are discussed, especially their dependence on temp. The formation of nuclei of twinning is described and conditions for twinning are calcd. for Zn, α-Fe, Bi, Sb, Cd, Mg, calcite, and quartz. Although crystal structures are widely different, similar conditions exist for the formation of nuclei of twinning.

Serge Palomar

STEPANOV, A. V.

Chemical Abst.
Vol. 48 No. 4
Feb. 25, 1954
General and Physical Chemistry

Goals of structural analysis of a deformed crystal in connection with new data concerning the mechanism of slip formation. A. V. Stepanov (Leningrad Phys.-Tech. Inst., Acad. Sci. U.S.S.R.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* 17, 342–51(1953).—Before subjection to plastic deformation crystals of NaCl and AgCl were scratched in a Martens app. along (100). This scratch is a source of "artificial" slips. Photographs in polarized light show how the nucleus of slip was transformed by elongation into a slip pattern. The scratch creates surface and vol. changes that are a function of the extension and depth of the scratch; the resulting slip conserves the optical properties of the nucleus; slips can be mirror-like-"pos." and "neg." If several slip nuclei are created in close proximity to one another they give an interference pattern which can also be observed in natural crystals. Other cases such as the transformation of a reversible slip into an irreversible, the crossing of a first series of slips by a 2nd series are discussed and it is shown that in a deformed crystal there are 7 different regions, each with different properties relative to recrystn., etc. Slip growth was studied by taking motion pictures at a speed of 2 frames per sec. The growth of nuclei is a different process than their formation and the elastic limit corresponds to the load at which slip nuclei start to grow and become visible slips. Artificial slips were observed on NaCl in the temp. interval −195° to 300°. However, the growth of slips in the system (100) (110) is temp.-dependent. Tests to remove the scratch by $H_2O$ showed that the scratch grew in length and in width, i.e. the remanent tensions penetrated deeper. From these tests it is concluded that the region of artificial slips is at a depth of 0.02–0.1 mm. from the surface of the crystal. Surface action has a considerable effect on slips in the vol. of the crystal. In conclusion 11 problems of the structural analysis of crystals are enumerated, to be solved by x-ray analysis. S. Pakswer

4

USSR

Dislocation theories of stability and plasticity of solids. A. V. Stepanov. *Zhur. Tekh. Fiz.* 23, 1212-16(1953); cf. C.A. 48, 1759f.—A review of 15 yrs. work on the dislocation theory. Issue is taken with the theories and their application.

J. Rovtar Leach

STEPANOV, A.V

USSR

233. **An optical investigation of the stress condition of an anisotropic plate subjected to a concentrated force.** V. M. KRASNOV AND A. V. STEPANOV. *Zh. éksper. teor. Fiz.*, **25**, *No.* 1(7) 98–106 (1953) In Russian.

See also Abstr. 5739 (1953). Photoelastic methods were used to determine the stressed state in an anisotropic plate cut out from a single crystal of the 60 mol-% TlBr/40 mol-% TlI alloy, so that the plane of the plate coincided with the cube face, a concentrated force being applied along the cube axis. The apparatus used is described in some detail. A fair agreement was found to exist between experimental results and values calculated from the moduli of elasticity.

F. LACHMAN

FD-589

USSR/Physics - Crystallography

Card 1/1 : Pub 153-1/22

Author : Stepanov, A. V. and Donskoy, A. V.

Title : New Mechanism of plastic deformation of crystals. I. Study of laminating process by an optic method. II. Determination of crystallographic characteristics of the laminating process.

Periodical : Zhur. tekh. fiz., 24, 161-183, Feb 1954

Abstract : Describe new mechanism governing the plastic deformation of crystals called lamination, first discovered by A. V. Stepanov (Izv. ak. nauk SSSR, fiz. 797 (1937)). Consider this phenomenon, together with sliding and twinning, a common property of all crystals, including metals and alloys. Give detailed method of investigation, tables, graphs and pictures. Indebted to A. L. Shakh-Budagov and V. A. Moskiyevskiy of Leningrad Mining Institute. 27 references, including 7 foreign. Reported in the Leningrad Politechnic Institute im M. I. Kalinin in May 1949 and at a meeting of the Commission on Stability, Acad Sci USSR, in May 1952.

Submitted : August 15, 1952

STEPANOV, A.V.

Phase transitions in austenitic steels under the action of stresses. Met. i obr.met. no.5: 42-52 N '55. (MIRA 9:3)

(Steel alloys--Metallography)

STEPANOV, A.V.

Category : USSR/Solid State Physics -- Phase Transformation in Solid Bodies E-5

Abs Jour : Ref Zhur -- Fizika, No 3, 1957, No 6632

Author : Stepanov, A.V.

Title : Investigation of the Segregation of Phosphorus in Steel by the Autoradiography Method.

Orig Pub : Metallovedeniye i obrabotka metallov, 1955, No 7, 55-60

Abstract : No abstract

Card : 1/1

Card 1/1 Pub. 146-15/2

Author : Stepanov A. V. and Eydus I. M.

Title : Relation of Elasticity constants of single crystals of sodium chloride and silver chloride to temperature

Periodical : Zhur. Eksp. i Teor. Fiz., 29, No 5, 669-675, 1955

Abstract : Research, started in previous works by A. V. Stepanov (Sow. Phys. 6, 312, 1934; ibid. 8, 25, 1935; Zhur. Tekh. Fiz., 19, 205, 1949; ZhETF 25, 98, 1953) is continued. Results of determinations of elasticity constants of single crystals of sodium chloride and of silver chloride are tabulated in a temperature range from room temperature to the melting point. Indebted to Ye. M. Yevstaf'yev, and A. L. Shakh-Budagov for discussions. Thirteen references, including five foreign.

Institution : Leningrad Physico-Technical Institute, Acad. Sci. USSR

Submitted : March 26, 1953

STEPANOV, A.V.

Category : USSR/Solid State Physics - Mechanical Properties of Crystals and Polycrystalline Compounds E-9

Abs Jour : Ref Zhur - Fizika, No 3, 1957, No 6777

Author : Zhitnikov, R.A., Stepanov, A.V.

Inst : Leningrad Pedagogical Institute, USSR

Title : Optical Method of Investigation of Averaged Stressed States in Fine Grain Polycrystals. I. Preparation of Fine-Grain Silver-Chloride Polycrystal Specimens.

Orig Pub : Zh. tekhn. fiziki, 1956, 26, No 4, 772-778



Abstract : It is proposed that silver chloride be used as a material suitable for the solution of various problems in elasticity and plasticity of polycrystals by optical methods, for it has a considerable piezo-optical activity and its structure is similar to that of metals. Fine-grain specimens, necessary for the study of macroscopically averaged stressed states in polycrystalline media, were prepared by annealing for 1 -- 5 hours at 150°, bars (or rods), pressed with various degrees of deformation from high grade AgCl ingot. The recrystallized bars with grain dimensions 0.1 -- 0.3 mm were

Card : 1/2

Category : USSR/Solid State Physics - Mechanical Properties of Crystals and Polycrystalline Compounds E-9

Abs Jour : Ref Zhur - Fizika, No 3, 1957, No 6777

rolled into ribbons approximately 24 mm wide and approximately w mm thick, while the rods (with grain dimensions 0.05 -- 0 1 mm) were pressed into strips with transverse sections 10 x 2 mm. Both types of strips have a similar structure and consist of grains that have a ribbon-like form and are stretched in the rolling direction or in the pressing direction. To obtain fine grain specimens without a recrystallization texture, the rods were upset between steel plates into plane-parallel laminae approximately 2 mm thick, which acquired after 12 hours' annealing at 100° a fine, very uniform equilibrium grain measuring 0.05 -- 0.07 mm.

Card : 2/2

STEPANOV, A.V.

Category : USSR/Solid State Physics - Mechanical Properties of Crystals and Polycrystalline Compounds E-9

Abs Jour : Ref Zhur - Fizika, No 3, 1957, No 6778

Author : Zhitnikov, R.A., Stepanov, A.V.
Inst : Leningrad Pedagogical Institute, USSR
Title : Optical Method of Investigation of Averaged Stressed States in Fine Grain Polycrystals. II. Photoelastic Effects in Crystals of the Cubic System in the Case of Plane Loading.

Orig Pub : Zh. tekhn. fiziki, 1956, 26, No 4, 779-785

Abstract : On the basis of the Pockels theory and Krasnov's work on piezo-optical phenomena in crystals, the authors examine the photoelastic behavior of a plane-parallel plate, cut in an arbitrary direction from a crystal of the cubic system and placed in a plane loaded state. The resultant relationship between the optical path differences of two plane-polarized beams and the principal stresses makes it possible in many particular cases to obtain purely-optical solutions to the problem of the plane-loaded state; namely: to find the

Card : 1/2

ZHITNIKOV, R.A.; STEPANOV, A.V.

Optical method for investigating neutralized stress states in fine-grained polycrystals. Part 3. Photoelastic (piezooptical) properties of polycrystalline silver chloride. Zhur.tekh.fiz. 26 no.4:786-794 Ap '56. (MLRA 9:8)

1. Gosudarstvennyy pedagogicheskiy institut, Leningrad.
(Silver chloride--Optical properties)
(Photoelasticity)

APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001653130005-7"

STEPANOV, A.V.; BOBRIKOV, V.P.

Temperature dependence of the photoelasticity limit in the system (111); [011] for table salt crystals. Zhur.tekh.fiz. 26 no.4: 795-799 Ap '56. (MLRA 9:8)

1. Leningradskiy gosudarstvennyy pedagogicheskiy institut.
(Sodium chloride--Optical properties)

STEPANOV, A. V.

"On the Study of the Physicomechanical Properties of Heterogeneous and Anisotropic Media," paper presented at the First All-Union Conference on Tectonophysics, Moscow, 29 January through 5 February 1957.

Physicotechnical Institute, Academy of Sciences USSR

Sum 1563

STEPANOV, A. V.

"On the Problems of modeling Tectonic Phenomena," physicists L. M. Kachanov, Ye. I. Edel'shteyn, G. V. Vinogradov, G. N. Kuznetsov, M. P. Volarovich, and A. V. Stepanov and Geologists F. I. Vol'fson, V. A. Aprodov, N. I. Borodayevskiy, and Yu. S. Shikhin

paper presented at the first All-Union Conference on Tectonophysics, Moscow, 29 Jan - 5 Feb 1957.

Sum 1563

GOL'DFARB, V. M. and STEPANOV, A. V.

"Elastic Constants and Strained Condition of Laminated Nonhomogeneous Media." Voprosy dinamiki i prochnosti (Problems of Dynamics and Strength), Riga, Izd-vo AN Latviyskoy SSR, 1958, 178 pp. (Sbornik Statey, Inst. mashinovedeniya, AN Lat SSR, vyp. 5)

The book is a collection of ten research papers, prepared by members of Acad. Sci. Lat SSR, Latvian State University and the Riga Red Banner Higher Military School for Aeronautical Engineering im. K. E. Voroshilov.

STEPANOV, A. V.

"The Slipformation Process in Crystals of Sodium Chloride and Silver Chloride,"

paper presented at the Confe.on Mechanical Properties of Non-Metallic solids, (IUPAP) Leningrad, USSR, 19-26 May 58.

Physical-Technical Institute of the Acad. Sci., USSR, Leningrad.

S/124/61/000/012/033/038
D237/D304

AUTHORS: Gol'dfarb, V. M., and Stepanov, A. V.

TITLE: Elastic constants and stress condition of stratiform heterogenous media

PERIODICAL: Referativnyy zhurnal, Mekhanika, no. 12, 1961, 6, abstract 12V33 (V sb. Vopr. dinamiki i prochnosti, no. 5, Riga, AN LatvSSR, 1958, 127-158)

TEXT: A stratiform medium is considered, where each layer consists of a different material. The medium is put under stress in such a manner that mean stresses in each layer are constant. It was shown that the given medium can be considered anisotropic, and the method for determining elastic constants in an anisotropic medium with elastic constants of each layer known was given. As an example, stretching of a stratiform model was considered. Each layer, in this case, is shown to be under a

Card 1/2

129-58-7-15/17

AUTHOR: Stepanov, A. V.

TITLE: Precipitation of Carbides During Tempering of Alloy Steels (Vydeleniye karbidov pri otpuske legirovannykh staley)

PERIODICAL: Metallovedeniye i Obrabotka Metallov, 1958, Nr 7, pp 59-61 (USSR)

ABSTRACT: A review of Western practice based on information published in British and American literature. There are 4 references, all of which are English.

Card 1/1

70-3-3-35/36

AUTHOR: Stepanov, A.V.

TITLE: The Theory of Crystals of the Rare Gases (K teorii kristallov blagorodnykh gazov)

PERIODICAL: Kristallografiya, 1958, Vol 3, Nr 3, pp 392 - 394 (USSR).

ABSTRACT: Various properties of the rare gases can be estimated from the gas kinetic relations and from the rule of Leonard-Jones; U is the lattice energy equal to λ the heat of sublimation, M is the modulus of compressibility and the characteristic temperature. Using well-known formula:

$v_U = p.D = 8.42$ D Kcal/mol; $v_M = 1.34\ k/k_r$ dynes/cm$^2$ ;

$v_C = m\ \overline{p/2}$ . The formulae were made appropriate to diatomic molecules so that the constants of the crystal could be related to the constants of the molecule and the influence of the condensation of the atoms on their interactions estimated. For the calculation it was assumed that the smallest distance between atoms ($k_r$) was equal to the equivalent distance ($m_r$) between atoms in a diatomic molecule and that the crystal was face-centred with co-ordination number 12. A table of the

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properties of the molecules and crystals is given for He, Ne, A, Kr and Xe where the following data are given: Experimental data for a diatomic molecule, constants in Leonard-Jones' expression, D in kilocals./mol, $m_r$ and K ; experimental data for real crystals, $k_r$ , λ , M and ρ; properties of the crystals as calculated, U, $^{v}M$ , and $^{v}$ρ ; comparison of theoretical and experimental data for crystals, $^{v}\lambda/U$ , $^{v}M/M$ , $^{v}\rho/\rho$ and $RT_n$ . R is the gas constant, k is Boltzmann's constant, D is the energy of dissociation and K is the force constant - the superscript v presumably indicates calculated values. The agreement is about 20% in most cases. The following approximate relationships between the crystal constants are found, some being previously known $k_r = m_r$ ;

$\lambda = U = 1/2\ D$ ; $T_{m.p.} = T\ b.p.$ ; $T_{b.p.} = 0.56\ T_{crit.}$ ;

$T_{m.p.} = 3.58 \times 10^2\ D = 6.10\ 1/2\ D$ ; $T_{b.p.} = 3.60 \times 10^2\ D = 6.10\ 1/2\ D$ ; $T_{crit.} = 6.5 \times 10^2\ D = 1.08 \times 10^2\ 1/2\ D$.

Card2/3 The above relationships should be applicable also to other