SOV/143-59-6-7/21

The Development of the Studies of Interaction Between Ionic Crystals in the Works of the Tomsk Scientists

Fifties, such work was also started at TPI. Some crystal properties (heat capacity, modulus of deformation and others) do not only determine the lattice energy, but also its derivatives in various parameters. Studying the properties of ionic crystals of haloid compounds of metals of the first and second group of D.I. Mendeleyev's system and metal oxides of the second group resulted in some data which are presented by the author in the form of a comparison of the properties of ionic crystals and the energy of the crystal lattice. The author does not present any names of personnel involved in the research in Tomsk. There are 10 graphs.

ASSOCIATION: Tomskiy ordena Trudovogo Krasnogo Znameni politekhnicheskiy institut imeni S.N. Kirova (Tomsk-Red Labor Banner Order- Polytechnic Institute imeni S.N. Kirov)

PRESENTED: Kafedra tekhniki vysokikh napryazheniy (Chair of High Voltage Engineering)

SUBMITTED: December 22, 1958

Card 2/2

VOROB'YEV, A.A.; ZAVADOVSKAYA, Ye.K.; IVANKINA, M.S.; SAVINTSEV, P.A.

Physical properties of solid solutions of alkali halide compounds, and the molecular concentration. Izv.vys.ucheb.zav.; fiz. no.6:162-165 '59. (MIRA 13:6)

1. Tomskiy politekhnicheskiy institut imeni S.M.Kirova.
(Alkali metal halides) (Solutions, Solid)

VOROB'YEV, A.A.

2.5 Mev microtron of the Institute of Physics of Naples University. (MIRA 12:4)
Izv.vys.ucheb.zav.; fiz. no.6:167-170 '59.

1. Tomskiy politekhnicheskiy institut im. S.M. Kirova.
(Particle accelerators)

SOV/144-59-7-1/17

AUTHORS: Vorob'yev, A.A., Doctor of Physico-Mathematical Sciences, Professor, Director; and Mogilevskaya, T.Yu., Senior Lecturer

TITLE: The Motion of a Single Unipolar Voltage Pulse Along a Coaxial Cable with a Ferromagnetic Sheath and the Transfer of the Pulse into a Semiconducting Medium

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Elektromekhanika, 1959, Nr 7, pp 3-9 (USSR)

ABSTRACT: The physical arrangement of the cable is shown in Fig 1. It is assumed in the analysis that: no surface effects exist; the medium at the output of the system is uniform, isotropic and semiconducting; the parameters of the "lead and tube" which form the coaxial line are chosen to give distortionless transmission. Fig 2 is an equivalent circuit where ℓ_1 is the exciting line connected to the generator, ℓ_2 is the coaxial line and Z_p is the termination representing the impedance of the medium. The effect of ℓ_1 is neglected since it is much shorter than a wave length and its longitudinal and transverse electrical elements are insignificant compared with those of the pulse source. The condition for distortionless transmission is Heavisides Eq (1). The inductance is

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SOV/144-59-7-1/17

The Motion of a Single Unipolar Voltage Pulse Along a Coaxial Cable with a Ferromagnetic Sheath and the Transfer of the Pulse into a Semiconducting Medium

found from the mean value of tube permeability; the capacitance and conductance of the space between the lead and the tube are found from the nomogram for a mixture of dielectrics given in Refs 3 and 4. The impedance of the medium at the end of the line is calculated as an "end-effect" due to the fringeing of the field into the medium. The end-capacitance is calculated from Eq (2) found in Ref 5 and plotted in Fig 3. The end-conductance is similarly found as Eq (3). Since the transmission time for the pulse is much longer than the pulse duration the equivalent circuit for transient conditions, Fig 4, may be used. The shape of the generated pulse is Eq (4). The voltage and power at the end of the coaxial section are respectively Eqs (8) and (9). In the majority of cases where the line length is a few kilometres and the dielectric is crushed rock the attenuation is small. Also the terminating impedance is high and the output voltage is practically doubled. This increase in pulse voltage favours the creation of a spark discharge. The penetration of the voltage wave into the medium is calculated using the

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The Motion of a Single Unipolar Voltage Pulse Along a Coaxial Cable with a Ferromagnetic Sheath and the Transfer of the Pulse into a Semiconducting Medium

"refractive indices" of power and energy defined in Eqs (10) and (11). Fig 5 shows how these indices vary with the pulse shape as controlled by p_1 and p_2 in Eq (4). The specific conductance of the terminating medium is assumed to be 10^{-6} MKS units. Fig 6 shows the dependence of the refractive indices on the wave-resistance of the coaxial line. The optimum value of the latter is 283 ohms. For this value, Fig 7 shows that the practically 100% absorption of energy into the medium is about 10^{-2} MKS units. when the specific conductance is about 10^{-2} MKS units.

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SOV/144-59-7-1/17

The Motion of a Single Unipolar Voltage Pulse Along a Coaxial Cable with a Ferromagnetic Sheath and the Transfer of the Pulse into a Semiconducting Medium

There are 7 figures and 5 references, 4 of which are Soviet and 1 English.

ASSOCIATION: Tomskiy politekhnicheskiy institut (Tomsk Polytechnical Institute) and Kafedra teoreticheskikh osnov elektrotekhniki, Tomskiy politekhnicheskiy institut (Chair of Theoretical Fundamentals of Electro-Technology, Tomsk Polytechnical Institute)

Card 4/4

SUBMITTED: March 22, 1959

66196

SOV/143-59-7-6/20

24(3) 24.7500

AUTHORS: Vorob'yev, A.A., Doctor of Physical and Mathematical Sciences, Professor, and Kislina, A.N., Candidate of Technical Sciences

TITLE: The Electric Strength and Microhardness of Solid Solution Crystals of Systems KJ-KCl and KCl-NaCl, Disintegrating During the Growing Process from the Melt

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Energetika, 1959, Nr 7, pp 41-42 (USSR)

ABSTRACT: Studying the properties of ionic solid solutions and obtaining stable systems is of great importance for the theory and practical application of dielectrics. Academician N.S. Kurnakov showed that ionic solid solutions are not stable and disintegrate after some time. For checking the influence of the disintegration of solid solutions on their physical and chemical properties, systems KJ-KCl and KCl-NaCl were investigated. Measurements of the electric strength, the microhardness and structural X-ray analyses were performed. Solid solutions of systems KJ-KCl and KCl-NaCl are characterized by a low thermodynamic stability. The

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SOV/143-59-7-6/20

The Electric Strength and Microhardness of Solid Solution Crystals of Systems KJ-KCl and KCl-NaCl, Disintegrating During the Growing Process from the Melt

microhardness was measured by a PMT-3 device. The dependence of the microhardness of KJ-KCl and KCl-NaCl crystals is of a complicated nature, as shown in fig.2. The dependence of the electric strength of KJ-KCl crystals on their chemical composition is shown in fig.3. The authors established that the disintegration of solid solutions leads to changes of the electric strength, the microhardness, the loss angle tgδ, and their properties approach those of mechanical mixtures, as indicated by Academician N.S. Kurnakov for some other properties. This paper was presented at the Kafedra tekhniki vysokikh napryazheniy (Department of High Voltage Engineering). There are 3 graphs and 3 Soviet references.

Card 2/2

ASSOCIATION: Tomskiy ordena Trudovogo Krasnogo Znameni politekhnicheskiy institut imeni S.M. Kirova (Tomsk - Order of the Red Labor Banner - Polytechnic Institute imeni S.M. Kirov)

IX

SUBMITTED: January 20, 1959

VOROB'YEV, A.A.

History of the development of electron accelerators. Vop. ist.est.i tekh. no.8:33-47 '59. (MIRA 13:5)
(Particle accelerators)

66170
SOV/143-59-9-7/22

~~5(0), 24(3)~~ 24.7500

AUTHORS: Vorob'yev, A.A., Doctor of Physical and Mathematical Sciences, Professor, ~~Ivankina, M.S.,~~ Kislina, A.N., Candidate of Technical Sciences, and Savintsev, P.A., Candidate of Physical and Mathematical Sciences, Docent

TITLE: The Physical and Chemical Properties of Insulating Crystals

PERIODICAL: Izvestiya vysshikh ucebnykh zavedeniy, Energetika, 1959, Nr 9, pp 43-47 (USSR)

ABSTRACT: During the years of Soviet rule, the scientists of Tomsk performed considerable research in studying the structures mechanical, thermal and electrical properties of ion crystals and alloys. The energy of the crystal lattice was selected as the magnitude which determines the structure and the interaction of particles in a crystal lattice, A.A. Vorob'yev (Ref.1). The values of the crystal lattice energy are unknown for crystals with admixtures. P.A. Savintsev (Ref.2) showed that the comparison of properties of crystals and alloys with identical type of the crystal lattice and identical chemical bonds between the particles may be performed

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SOV/143-59-9-7/22

The Physical and Chemical Properties of Insulating Crystals

by the molecular concentration α: $\alpha = \frac{D}{M} \cdot 10^3$ where D = crystal density; M = molecular weight. According to the Born formula, α is connected with the crystal lattice energy $U = C\sqrt{\frac{D}{M}}$ where C is a constant. According to Born's formula, the energy of alkali halides is proportional to the ratio D:M. The authors compare the properties of crystals and alloys with the lattice energy and the molecule concentration. The Tomsk scientists devoted great attention to studies of the mechanical properties of ion crystals. V.D. Kuznetsov (Ref.3) analyzed methods of determining the hardness of brittle bodies and developed a number of new methods: drilling, damped oscillations, mutual grinding. V.N. Kashcheyev (Ref.4) and L.A. Kudryavtseva (Refs.5,6) showed that the hardness in the method of mutual grinding does not depend on the type of the abrasive powder used for grinding, only when the mechanical strength of the powder is several times greater than the strength of crystals to be ground. In this case the hardness ratio coincides with the ratios of surface energies calculated by Born and Shtern.

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The Physical and Chemical Properties of Insulating Crystals

P.A. Savintsev, V.Ya. Zlenko and A.P. Naumov (Ref.7) determined the hardness in drilling of alkali halide monocrystals with admixtures. They found that admixtures of alkali halide salts reduce the hardness of crystals. P.A. Savintsev and V.V. Kutsepalenko (Refs.8,10) stated that the greatest hardness value is found in the area of equal component concentrations, which corresponds to the smallest value of α. M.S. Ivankina (Refs.12,13,14) investigated the structure of the crystal lattice of solid solutions of alkali halide salts and a number of their thermal properties depending upon the composition in connection with the energy of interaction of components. A.A. Vorob'yev, Ye.K. Zavadovskaya and A.M. Trubitsin (Ref.16) and K.A. Vodop'yanov and G.I. Galibina (Ref.23) determined the electrical properties of ion alloys of different stability degrees at room temperature. A.N. Kislina (Refs.19,20,21) investigated the electric strenght of KJ-KBr, KJ-NaJ and other properties of alkali halides. The authors present the following conclusions: The physical and chemical properties of ion crystals and their solid solutions are determined by the crys-

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SOV/143-59-9-7/22

The Physical and Chemical Properties of Insulating Cyrstals

tal lattice energies. The formation of alkali halide solid solutions KCl-NaCl, NaCl-NaBr, NaCl-NaJ, are accompanied by a destruction of the crystal lattice, absorption of heat, increased linear expansion coefficient, increased electric conductivity, a reduction of the density and molecule concentration, and a hardness reduction in mutual grinding and drilling. The aging of solid solutions will result. There are 2 sets of graphs and 24 Soviet references.

ASSOCIATION: Tomskiy ordena Trudovogo Krasnogo Znameni politekhnicheskiy institut imeni S.M. Kirova (Tomsk - Order of the Red Labor Banner - Polytechnic Institute imeni S.M. Kirov)

SUBMITTED: April 21, 1959

Card 4/4

VOROB'YEV, Aleksandr Akimovich; NAUMOVA, A.S., red.; MORDOVINA, L.G., tekhn. red.

[Physical properties of ionic crystalline dielectrics]
Fizicheskie svoistva ionnykh kristallicheskikh dielek-
trikov. Tomsk, Izd-vo Tomskogo univ. Book 1. 1960.
230 p. (MIRA 16:8)

(Ionic crystals)

BENING, P. [Boning, Paul]; MEL'NIKOV, M.A. [translator]; VOROB'YEV, A.A., prof., doktor fiziko-matem. nauk, red.; LARIONOV, V.P., red.; PINTAL', Yu.S., red.; BORUNOV, N.I., tekhn. red.

[Design and electrical strength of electric insulating materials] Elektricheskaia prochnost' izoliatsionnykh materialov i konstruktsii. Pod obshchei red. A.A.Vorob'eva. Moskva, Gos. energ. izd-vo, 1960. 215 p. Translated from theGerman. (MIRA 14:11)
(Electric insulators and insulation)

PHASE I BOOK EXPLOITATION SOV/4809

Vorob'yev, A.A., G.A. Vorob'yev, N.I. Vorob'yev, A.F. Kalganov, I.I. Kalyatskiy, V.D. Kuchin, G.A. Mesyats, S.F. Pokrovskiy, K.K. Sonchik, and A.T. Chepikov

Vysokovol'tnoye ispytatel'noye oborudovaniye i izmereniya (High-Voltage Testing Equipment and Measurements) Moscow, Gosenergoizdat, 1960. 583 p. Errata slip inserted. 10,500 copies printed.

Ed. (Title page): A.A. Vorob'yev, Professor; Ed. (Inside book): A.I. Dolginov; Tech. Ed.: K.P. Voronin

PURPOSE: This book is intended as a textbook for students taking courses dealing with high-voltage technique and high-voltage testing equipment. It may also be of use to the personnel in high-voltage laboratories and scientific institutions. New data contained in the book may be of interest to electricians.

COVERAGE: The book describes methods and installations used for generating and measuring high and superhigh constant, alternating, and pulse voltages used in laboratory work and in charged-particle acceleration processes. Some data contained in the book could be used in designing and computing high-voltage installations. The book was written by the staff members of the Department of High-Voltage Technique of the Tomsk Polytechnic Institute. Chapters I and II were written by A.A. Vorob'yev, with paragraphs I-1 and I-2 written jointly with

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I.I. Kalyatskiy, paragraph I-6 with N.I. Vorob'yev, paragraphs II-1 to II-6 and II-10 to II-13 with A.F. Kalganov, and paragraphs II-7 to II-9 with V.D. Kuchin. Ch. III was written by A.A. Vorob'yev, with the exception of paragraph III-4, written by S.F. Pokrovskiy, and paragraph III-6, written jointly by A.A. Vorob'yev and the latter. Ch. IV: paragraphs IV-1 to IV-3 were written by I.I. Kalyatskiy; paragraphs IV-5 and IV-6 by A.A. Vorob'yev; paragraph. IV-4 by A.A. Vorob'yev and I.I. Kalyatskiy jointly; paragraph. IV-7 by K.K. Sonchik; paragraph IV-8 by G.A. Mesyats; and paragraphs IV-9 and IV-10 by N.I. Vorob'yev. Ch. V: paragraphs V-1, V-2 and V-12 were written by A.A. Vorob'yev; paragraphs V-3, V-4 and V-8 by A.A. Vorob'yev and G.A. Vorob'yev jointly; paragraphs V-5 to V-7 by A.A. Vorob'yev and A.T. Chepikov jointly; paragraphs V-9 to V-11 by A.A. Vorob'yev; and paragraph. V-13 by K.K. Sonchik. The authors thank Engineer L.T. Murashko for his assistance. References accompany each chapter.

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High-Voltage Testing (Cont.)

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High-Voltage Testing (Cont.)

AVAILABLE: Library of Congress

JP/rsm/sfm
2-17-61

Card 6/6

VOROB'YEV, A.A.

PHASE I BOOK EXPLOITATION SOV/4379

Vsesoyuznaya konferentsiya po fizike dielektrikov. 2d, 1958

Fizika dielektrikov; trudy vtoroy vsesoyuznoy konferentsii (Physics of Dielectrics; Transactions of the 2d All-Union Conference on the Physics of Dielectrics) Moscow, Izd-vo AN SSSR, 1960. 532 p. Errata slip inserted. 5,000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Fizicheskiy institut imeni P.N. Lebedeva.

Ed. of Publishing House: Ye.L. Starokadomskaya; Tech. Ed.: I.N. Dorokhina; Editorial Board: (Resp. Ed.) G.I. Skanavi, Doctor of Physics and Mathematics (Deceased), and K.V. Filippova, Candidate of Physics and Mathematics.

PURPOSE: This collection of reports is intended for scientists investigating the physics of dielectrics.

COVERAGE: The Second All-Union Conference on the Physics of Dielectrics held in Moscow at the Fizicheskiy institut imeni P.N. Lebedeva (Physics Institute imeni P.N. Lebedev) in November 1958 was attended by representatives of the principal scientific centers of the USSR and of several other countries. This collection contains most of the reports presented at the conference and summaries of the discussions which followed. The reports in this collection deal with dielectric properties, losses, and polarization, and with specific inductive capacitance of various crystals, chemical compounds, and ceramics. Photoelectrets, ferroelectric crystals, and various radiation and irradiation effects on dielectrics are investigated. The volume contains a list of other papers presented at the conference dealing with polarization, losses, and breakdowns of dielectrics, which were published in the journal Izvestiya AN SSSR, seriya fizicheskaya, Nos. 1 and 2, 1960. No personalities are mentioned. References accompany each report.

69439

S/139/60/000/01/013/041
E201/E491

24.7700

AUTHOR: Vorob'yev, A.A.

TITLE: On the Problem of the Relationship of Dielectric Losses of Crystals with the Energy and the Degree of Perfection of the Lattice

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, Nr 1, pp 73-76 (USSR)

ABSTRACT: This communication discusses an earlier paper by Bogoroditskiy, Kulik and Fridberg (Ref 1). Bogoroditskiy et al state on p 2166 that "it seems more correct to relate electrical losses directly with crystallochemical properties of the lattice, especially as these properties govern the lattice energy". The present author points out that the lattice energy is itself a fundamental crystallochemical property and is not governed by other such properties. Vorob'yev uses Fig 3 of Ref 1 to show that there is a definite relationship (denied by Bogoroditskiy et al) between the lattice energy and the dielectric losses of alkali halides: the losses decrease with increasing lattice energy

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69439

S/139/60/000/01/013/041
E201/E491

On the Problem of the Relationship of Dielectric Losses of Crystals with the Energy and the Degree of Perfection of the Lattice

(cf Fig 1 in the present communication). Bogoroditskiy et al suggest that losses in ion-relaxation polarization are governed by the lattice defects. Vorob'yev supplements this suggestion by pointing out that the number of lattice defects decreases with increase of the lattice energy. Vorob'yev ends his communication with criticism of Bogoroditskiy et al's interpretation of the dielectric losses of solid solutions (especially the concentration dependence of the losses). Vorob'yev advises careful analysis of composition of mixed crystals and measurement of at least two properties in studies of decomposition of solid solutions. There are 1 figure and 6 Soviet references.

ASSOCIATION: Tomskiy politekhnicheskiy institut imeni S.M.Kirova (Tomsk Polytechnical Institute imeni S.M.Kirov)

SUBMITTED: April 9, 1959

Card 2/2

S/139/60/000/01/040/041
E201/E391

AUTHORS: Vorob'yev, A.A. and Ternov, I.M.

TITLE: International Conference on High-energy Particle Accelerators and on Nuclear-physics Instrumentation 14

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, Nr 1, pp 236 - 241 (USSR)

ABSTRACT: The conference was opened by the Chairman of CERN, Dr. Baker.
At the first session four papers were read on the necessity of building new high-energy accelerators. One of these papers was read by Professor Panovskiy, who argued that large accelerators give no information which could not be obtained from cosmic rays. The evening session on September 14 and two sessions on September 15 were occupied by twenty-one papers on extension of the accelerator energies towards higher values. During these sessions papers were presented by Koiomenskiy, V.P. Dmitriyevskiy (description of a 12 MeV cyclotron in Dubno, which uses spatial variation of the magnetic field) and

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S/139/60/000/01/040/041
E201/E391

International Conference on High-energy Particle Accelerators and on Nuclear-physics Instrumentation

V.I. Zamolodchikov (description of a 1.5 m cyclotron with azimuthal variation of the magnetic field). The morning session on September 15 included 7 papers on acceleration of charges in plasmas: 21 among these were papers by Rodionov, Academician I.F. Kvartskhava (experimental investigations of production and acceleration of plasmas), Academician V.I.Veksler (coherent shock acceleration of ring plasmas), A.N. Lebedev and A.A. Kolomenskiy (theory of stochastic acceleration and accumulation); A.A. Vorob'yev drew the attention of the conference to the absence of papers on injection.

The morning session on September 16 was devoted to fundamental limitations of accelerators. 19 Among the papers presented at this session there were communications from D.G. Koshkarev (theory of non-linear problems of betatron oscillations and particles losses in resonances); V.V. Vladimirskiy (space-charge limitations), Lebedev, Finkel'shteyn and Veksler.

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S/139/60/000/01/040/041
E201/E391

International Conference on High-energy Particle Accelerators and on Nuclear-physics Instrumentation

Another group of papers dealt with departure from cyclic acceleration of electrons due to radiation and quantum effects (A.N. Lebedev and D.G. Koshkarev participated in this group).
At the evening session on September 16, twelve papers were presented which described technical details of high-energy accelerators.
The 7 BeV proton synchrotron in Moscow and a planned 50 BeV synchrophasotron in Serpukhov were described by V.V. Vladimirskiy.
Engineer Zinov'yev described 30, 90 and 200 MeV linear electron accelerators, constructed at UFTI.
A.A. Vorob'yev read a paper on "The Theory of Cyclic Waveguide Electron Accelerators", based on his own work and that of A.N. Didenko, Ye.S. Kovalenko and B.N.Morozov.
At the morning session on September 17, devoted to

Card3/4

S/139/60/000/01/040/041
E201/E391

International Conference on High-energy Particle Accelerators and on Nuclear-physics Instrumentation

production, extraction and separation of particles in high-energy machines, papers were read by S.V. Chuvilo (formation of a meson beam of 7 BeV/c momentum in the Dubno synchrophasotron) and by Professor Panovskiy (microwave separation of particles).

ASSOCIATIONS: Moskovskiy gosuniversitet imeni M.V. Lomonosova (Moscow State University imeni M. V. Lomonosov) Tomskiy politekhnicheskiy institut imeni S.M. Kirova (Tomsk Polytechnical Institute imeni S.M. Kirov)

SUBMITTED: December 11, 1959

Card 4/4

S/139/60/000/03/042/045
E032/E314

AUTHORS: Vorob'yev, A.A., Savintsev, P.A. and Ulimtsev, B.F.

TITLE: The Ionisation Potentials of Atoms and the Mutual Solubility of Metals

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, No 3, pp 233 - 234 (USSR)

ABSTRACT: Depending on the type of interaction between the components, fused metals can form various types of alloys, e.g. eutectic mixtures, solid solutions or chemical compounds. It is well known that there is a definite periodicity in the ionisation potentials of elements, depending on their position in the periodic table. It is argued that intermetallic compounds are formed when the ionisation potentials of the two metals are considerably different. Conversely, in the case of eutectic alloys, the ionisation potentials of the components are roughly the same. Solid solutions are formed when the difference between the ionisation potentials of the components approach a certain average value. These ideas are illustrated in Table 1, in which eutectic alloys are shown on the left and solid solutions

VC

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The Ionisation Potentials of Atoms and the Mutual Solubility of Metals

on the right. φ_1 and φ_2 are the ionisation potentials and $\Delta\varphi$ is the difference between them.
There are 1 table and 2 Soviet references.

ASSOCIATION: Tomskiy politekhnicheskiy institut imeni S.M. Kirova (Tomsk Polytechnical Institute imeni S.M. Kirov)

SUBMITTED: October 26, 1959

Card 2/2

83366

24,7700
9,4300

S/139/60/000/004/033/033
E201/E591

AUTHORS: Vorob'yev, A.A. and Melik-Gaykazyan, I. Ya.

TITLE: Electron and Hole Centres in Ionic Crystals and the Lattice Energy

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, No.4, p.239

TEXT: Many physical and chemical properties of real ionic crystals are related to the lattice energy (Ref.1). The lattice energy characterizes an ideal crystal and its relationship with real crystals suggests that crystal imperfections may be governed by this energy (Ref.2). Among the defects related to the lattice energy are electron capture centres in alkali-halide crystals (Ref.3). It is also known that the energy quantum corresponding to an absorption band maximum rises with increase of the lattice energy in ionic crystals (Refs.4,5). Several electron and hole centres have their own absorption bands, each is characterized by a definite binding energy of the excess charge captured in the lattice. Figs. 1 and 2 compare the energy quanta corresponding to the maxima of electron and hole bands with the energy lattice of NaCl, KCl and KBr using Seitz's data (Refs. 6, 7). For all
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83366
S/139/60/000/004/033/033
E201/E591

Electron and Hole Centres in Ionic Crystals and the Lattice Energy

these electron and hole centres the electron or hole binding energy rises with increase of the lattice energy, showing a definite relationship between defects in an ionic lattice and its energy. There are 2 figures and 7 references: 5 Soviet and 2 English. LX

ASSOCIATION: Tomskiy politekhnicheskiy institut imeni S.M.Kirova (Tomsk Polytechnical Institute imeni S. M. Kirov)

SUBMITTED: September 21, 1959

Card 2/2

S/139/60/000/005/017/031
E032/E114

AUTHORS: Vorob'yev, A.A., and Ternov, I.M.

TITLE: Physical Problems in the Development of Cyclic Electron Accelerators 19

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, No. 5, pp 100-107

TEXT: The present paper is a summary of the Proceedings of the International Conference on High Energy Accelerators and Instruments which took place in Geneva in September 1959.

There are 7 figures and 3 Soviet references.

ASSOCIATION: Tomskiy politekhnicheskiy institut imeni S.M.Kirova, (Tomsk Polytechnical Institute imeni S.M. Kirov),

Moskovskiy gosuniversitet imeni M.V. Lomonosova (Moscow State University imeni M.V. Lomonosov)

SUBMITTED: December 22, 1959

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88059
S/139/60/000/006/028/032
E032/E414

9,2110 (1001, 1043, 1145)

AUTHORS: Vorob'yev, A.A., [redacted] Vorob'yev, G.A. and Kostrygin, V.A.

TITLE: Dependence on Thickness of the Breakdown Time of a Dielectric

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, No.6, pp.166-167

TEXT: Previous work on the electrical breakdown of solid dielectrics (Ref.1 to 4) showed that there exists an analogy between the behaviour of solid dielectrics and air. It was shown that the formation of discharge in NaCl and KCl crystals, having a thickness of a few tenths of a millimeter or more, is in fact a single cascade process. Fig.1 shows the dependence of the discharge delay time t_d as a function of the specimen thickness of NaCl, KCl and KBr crystals (t_d is in seconds, d is in cm). Fig.2 which was obtained experimentally by the present authors shows the discharge delay time t_d for an air gap as a function of the air gap length d (in mm). The results shown in Fig.2 were obtained with $p = 759$ mm Hg,

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S/139/60/000/006/028/032
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Dependence on Thickness of the Breakdown Time of a Dielectric

t = 20°C and the spherical electrodes irradiated with UV to avoid statistical effects. The analogy between the two figures is apparent. There are 2 figures and 8 references: 7 Soviet and 1 non-Soviet.

ASSOCIATION: Tomskiy politekhnicheskiy institut imeni S.M.Kirova (Tomsk Polytechnical Institute imeni S.M.Kirov)

SUBMITTED: October 6, 1960

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S/139/60/000/006/028/032
E032/E414

Dependence on Thickness of the Breakdown Time of a Dielectric

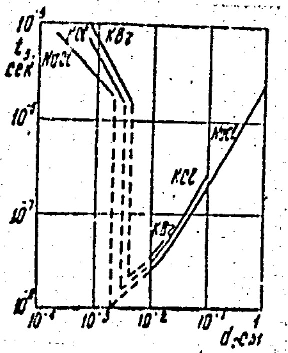

Рис. 1. Зависимость времени запаздывания разряда t_3 в кристаллах NaCl, KCl и KBr от толщины образца.

Fig.1.

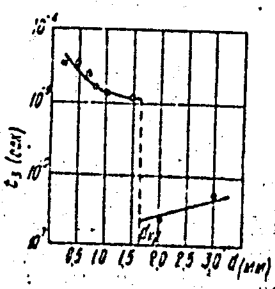

Рис. 2. Зависимость времени запаздывания разряда t_3 от длины воздушного промежутка d.

Fig.2.

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E073/E535

9,2400 (1001, 1150, 1331)

AUTHORS: Vorob'yev, A.A., Doctor of Physico-Mathematical Sciences,
Vorob'yev, G.A., Candidate of Technical Sciences,
Dmitrevskiy, V.S., Candidate of Technical Sciences and
Kalyatskiy, I.I., Candidate of Technical Sciences

TITLE: New High-Voltage Laboratory in Siberia.

PERIODICAL: Vestnik elektropromyshlennosti, 1960, No.7, pp.18-21

TEXT: In 1960 a comprehensive high-voltage laboratory was built at the Tomskiy politekhnicheskiy institut (Tomsk Polytechnical Institute). Breakdown phenomena of gaseous and liquid insulation, the breakdown and destruction of solid dielectrics and the insulation systems of high-voltage power equipment will be studied in this laboratory; it will also be available for experiments by students specializing in high-voltage engineering. The laboratory has a high-voltage hall of 460 m^2 floor space, an open testing area of 4000 m^2, and auxiliary buildings. The main equipment consists of a 5000 kV outdoor and a 3000 kV indoor surge generators and a series of test transformers rated at 50 c.p.s., 1000 kV and 1000 kVA. The space occupied by this equipment was the main

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New High-Voltage Laboratory in Siberia

factor determining the dimensions of the high-voltage laboratory. The high-voltage hall is 21 x 22 m with a height of 16 m. It has natural illumination from the southern and western sides, a ventilation system that ensures complete replacement of the air five times an hour, water-operated heating and electric lighting. For handling the equipment a 5 ton gantry crane with a span of 20 m is available. The 3000 kV surge generator is 9 m high with cross-section dimensions of 2.5 x 4 m. The step up-rectifier system for charging the surge generators is based on a doubling circuit with a maximum voltage of 300 kV and a power consumption of 20 kVA during maximal conditions. A photograph is included of the 3000 kV surge generator with a sphere-sphere gap. The total weight of the generator is about 12 tons. It has equipment for automatic striking of the first discharge gap, automatic grounding on disconnecting the generator, equipment for changing the polarity of the pulse and remote control of the movement of the rod with the intermediate discharge gaps and of the bottom, 1 mm dia., metering sphere. A 12-stage, 1200 kV surge generator is also erected in

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New High-Voltage Laboratory in Siberia

this hall and is built in six storeys, each containing condensers in metallic housings, 0.28 μF, 100 kV operating voltage; when using a surge capacitance of 23 000 pF, the energy reserve is 16.5 kW-secs. There is also a third surge generator, of 600 kV, made up of two stages and having an energy reserve of 17.3 kW-secs when the capacitance during the surge is 96 000 pF. The screening, which is described, proved sufficient during operation of the surge generator to exclude any electromagnetic influence on the metering and radio circuits in the halls neighbouring the high-voltage hall. Test transformers are used as the high-voltage a.c. source, and are installed in two zones of the high-voltage hall. For inter-phase tests, a 250 kV, 150 kVA transformer is used. Phase insulation is tested by means of a 200 kV, 35 kVA transformer. The transformers have a stepless voltage regulation and the necessary protective equipment. For measuring the high-voltage, 50 cm dia. sphere-sphere discharge gaps and 300 kV voltmeters are provided. Liquid insulation is tested in a tank of 3 m dia. and 16 m^3 volume which has a removeable lid and a bushing designed for 110 kV.

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Control of each of the high-voltage apparatus and the metering equipment is independent and is concentrated on a platform 3 m wide located at the third storey fitted with control panels for the 200 kV and 250 kV transformers and for the 600, 1200 and 3000 kV surge generators. The dimensions of the hall were governed by the size of the 3000 kV surge generator. The outdoor test space, 80 x 50 m, is provided for investigating insulation under the conditions of the Siberian climate. The high-voltage equipment of this test area consists of three 1000 kV, 1000 kVA transformers and a 5000 kV surge generator. The control of the high-voltage outdoor apparatus is from a single-storey building with a floor space of 170 m^2. A photograph is included of the outdoor test area which also shows a general view of the high-voltage laboratory building. The training and auxiliary buildings consist of a high-voltage laboratory with equipment for obtaining a.c., d.c. and surge voltages up to 300 kV, an over-voltage laboratory, an oscillographic laboratory and an insulation engineering laboratory, with an air-conditioned chamber in which any temperature between -70 and 100°C

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New High-Voltage Laboratory in Siberia

can be maintained while a high voltage of 30 kV is applied.
There are 4 figures.

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S/003/60/000/008/001/002
E073/E535

AUTHORS: Vorob'yev, A.A., Professor, Doctor of Physico-Mathematical Sciences and Andreyev, G. A., Candidate of Technical Sciences

TITLE: The Problem Laboratory Stimulates Major Creative Work

PERIODICAL: Vestnik vysshey shkoly, 1960, No.8, pp.48-51

TEXT: The problem laboratories which were created in 1957 are now fully in operation and have yielded the first results. The scientific activity of the Chairs has considerably expanded as a result of these laboratories, both as regards research on acute problems and the teaching activity of the Chairs. Positive results have been achieved by a number of Chairs of the Tomsk Polytechnical Institute imeni S. M. Kirov after establishing a problem laboratory on electronics, dielectrics and semiconductors. The laboratory, which was created in 1957 jointly by the Chairs of Physics, High-voltage Engineering, Electrical Insulation and Cable Engineering, has brought about full coordination of the activities of the 32 scientific workers of these Chairs. During the three years which have elapsed since the establishment of this laboratory, the

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The Problem Laboratory Stimulates Major Creative Work

personnel of these Chairs have prepared two doctor dissertations and six candidate dissertations and have published over 100 articles, although before hardly any scientific work was carried out in the Chair of Physics. The relevant feature of the laboratory is its unified scientific leadership. At present, 73 scientific workers of the Institute participate in the investigations, of which three are doctors of science, 16 are candidates of science and 21 are post-graduates. The laboratory consists of three sections, each of which deals with a subject relating to the following two problems: physical and chemical properties, strength and failure of dielectrics and semiconductors; development of radio circuits for instruments incorporating semiconductors. In the individual sections of the laboratory, the electrical, mechanical, physical and chemical properties of single crystals of alkali-haloid salts, solid solutions, oxides of the metals of the second group of the periodic table are being studied. The results enabled the theoretically and practically important conclusion on the existence of an inter-relation between the electrical,

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The Problem Laboratory Stimulates Major Creative Work

mechanical and other characteristics of simple dielectrics and the energies of their crystal lattice, thus providing a theoretical basis for developing dielectrics with pre-determined properties. In the second on the physical and chemical properties of dielectrics, the mechanism of formation of a contact layer in dielectrics and semiconductors was studied. Extensive data on the conditions and causes of generation of cando-luminescence of industrial crystal phosphors due to the effect of flames were obtained by Docent V. A. Sokolov and formed the basis of a recent doctor dissertation. Considerable successes have been obtained in the High-voltage Division (headed by Candidate of Technical Sciences I. I. Kalyatskiy) relating to the electric strength of ionic solid dielectrics; it was found that short duration impulses produce in solid dielectrics a discharge which develops in a similar manner to gas discharges. It was also found that in the case of the point electrode being of positive polarity, the average speed of the discharge increases with decreasing temperature and with increasing energy of the crystal lattice of the dielectric; the results were presented in candidate dissertations (defended in 1958) by G. A. Andreyev,

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The Problem Laboratory Stimulates Major Creative Work

A. F. Astafurov and V. D. Kuchin. Under the leadership of Docent V. S. Dmitrevskiy and senior reader M. F. Pisartsev, the electro-physical properties of electrically insulating concretes have been investigated. This laboratory participates in the work relating to establishing the largest teaching and research high-voltage laboratory in Siberia. The High-voltage Hall of this laboratory is already equipped with test transformers for 200 and 350 kV, surge generators of 3 million volt, 1 million volt and 600 kV. A series of transformers for 1 million volt have already been installed and the erection has begun of a unique 5 million volt surge generator and of a 2.5 million volt electrostatic generator. This laboratory will be used for testing industrial equipment rated for voltages up to 220 kV. In the division on millimicrosecond techniques (headed by Candidate of Technical Sciences G. A. Vorob'yev), the volt-second characteristics of various dielectrics are being investigated. It was found that for equal electric strength of gaps the breakdown of the dielectrics occurs in the following sequence: solid dielectric, gas, liquid dielectric, a conclusion of great importance from the point of view of insulation coordination. Circuits and instruments

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The Problem Laboratory Stimulates Major Creative Work

were devised which enable recording on a film ultrashort (of 10^{-10} sec duration) voltage surges and also a fast-action arrestor for over-voltage protection of high voltage apparatus. Furthermore, generators for single high voltage surges with amplitudes up to 40 kV and durations up to 3.2×10^{-9} sec were developed.
Under the leadership of Docent I. A. Suslov, methods of calculation of video amplifiers and of designing miniature transistorized television cameras have been developed. The theoretical and experimental work of this laboratory is reflected in 206 papers and 6 books published by the personnel; at present 12 books and 76 papers are in the process of publication. In addition, 87 papers and communications were presented at conferences. The laboratory is in contact with numerous other Soviet scientific establishments and also with the Polytechnical Institutes of "Tsinkhua" (China) and Jassy (Roumania). The studies of the Power Engineering Department have established the possibility of using concrete as a dielectric in high voltage engineering. As a result of this, the cost of building a 22 m insulated tower for the 5 million volt surge generator was reduced considerably.

ASSOCIATION: Tomskiy politekhnicheskiy institut imeni S.M.Kirova (Tomsk Polytechnical Institute imeni S.M.Kirov)

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VOROB'YEV, A. A.

81958
S/181/60/002/04/18/034
B002/B063

24.7700

AUTHORS: Vorob'yev, A. A., Budylin, B. V.

TITLE: Spontaneous Formation of F-Centers in Irradiated Alkali Haloid Crystals After Annealing 19

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 4, pp. 663-664

TEXT: Crystals of NaCl, KCl, KBr, and KI were bombarded with thermal neutrons in a nuclear reactor for three days. The color of the specimens changed so strongly that even 1 mm thick layers were opaque. The crystals regained their transparency when heated to 200-450°C. But changes occurred again in the course of time. At the same time, the electrical conductivity of the crystals decreased, and their microhardness increased. The color changes were due to gamma- and beta radiation of the nuclei activated in the reactor. They vanished almost completely after 5 - 7 days. This effect may be utilized for the following experiment: A small amount of $_{83}Bi^{209}$ is isomorphously introduced into a KCl crystal. The former passes over into $_{83}Bi^{210}$ during the irradiation: $_{83}Bi^{209} + {_0}n^1 \rightarrow {_{83}}Bi^{210} + \gamma$.

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Spontaneous Formation of F-Centers in Irradiated Alkali Haloid Crystals After Annealing

81958
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B002/B063

The latter is a β-emitter which passes over into $_{84}Po^{210}$ with a half-life of five days. The latter is a strong α-emitter with a half-life of 138 days. About 10-12 days after their removal from the reactor the crystals show - after heating - only the effect of the α-radiation of polonium. There are 5 non-Soviet references.

SUBMITTED: July 20, 1959

Card 2/2

VOROB'YEV, A.A.; ANDREYEV, G.A.

Determing the energy of destruction following breakdown in solid dielectrics. Fiz. tver. tela 2 no.5:987-992 My '60. (MIRA 13:10)

1. Politekhnicheskiy institut, Tomsk.
(Dielectrics)

S/181/60/002/009/037/047/XX
B004/B070

AUTHORS: Vorob'yev, A. A., Vorob'yev, G. A., and Mel'nikov, M. A.

TITLE: Propagation of a Discharge in Monocrystals of NaCl and KCl

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 9, pp. 2019-2024

TEXT: Electric discharges in monocrystals of NaCl and KCl were studied. Table 1 gives a summary of the different conditions under which the experiments were carried out : discharge between a negative point electrode and a plane, between a positive point electrode and a plane, and between two point electrodes in a homogeneous field. Fig. 1 shows microphotographs of an incomplete discharge between a positive point electrode and a plane, and a negative point electrode and a plane. According to the calculations of Ref. 9, there is formed a molten channel of a diameter of some microns. Therefore, the duration t_d of the discharge was measured by means of an oscillograph, and the length l_d of the channel was determined with a microscope; the functions $l_d = f(t_d)$ and $v_d = dl/dt$ were obtained. Fig. 2 shows a diagram of the function $v_d = f(t_d)$ for

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positive and negative point electrodes. Since l_d increases with t_d, the observed phenomena may be explained as a single-avalanche discharge. The discharge proceeds along the [100] plane of the crystal for a negative point electrode; it proceeds along the plane [111] and, less often, along [110] for a positive point electrode. The average value v_m of the rate of propagation of the discharge was calculated (Table 2). v_m is considerably higher for a positive than for a negative point electrode. Therefore, there is an analogy between the discharge in the crystals investigated and that in a long stretch of air. The following relation was found to exist for positive point electrodes: $v_d = 0.1(db/t_{d\ min})e^{(bt/t_{d\ min})}$ (1), where d is the distance of the electrodes (0.4 - 1.2 mm), b a constant, $t_{d\ min}$ the minimum discharge time. Fig. 4 shows a microphotograph of the discharge between two points. The discharge channels are in the neighborhood of the negative point. Direction and rate of discharge depend on the structure of the field, which is influenced by the positive ion charge. On account of impact ionization, the ionic charge is so concentrated in

Propagation of a Discharge in Monocrystals of NaCl and KCl

S/181/60/002/009/037/047/XX
B004/B070

solid dielectrics that the propagation of the discharge depends on it. There are 4 figures, 2 tables, and 12 references: 11 Soviet and 1 German.

ASSOCIATION: Tomskiy politekhnicheskiy institut (Tomsk Polytechnic Institute)

SUBMITTED: February 10, 1960

Card 3/3

VOROB'YEV, A.A., doktor tekhn.nauk, prof.; MOGILEVSKAYA, T.Yu., inzh.

Possible desing of a grounding system. Izv. vys. ucheb. zav.; energ. 3 no. 7:42-44 Jl '60. (MIRA 13:8)

1. Tomskiy ordena Trudovogo Krasnogo Znameni politekhnicheskiy institut imeni S.M. Kirova. Predstavlena kafedroy tekhniki vysokikh napryazheniy.

(Electric currents--Grounding)
(Lightning protection)

20623

9.4300 (1145, 1147, 1155)
24.7800 1043, 1144, 1160

S/063/60/005/005/012/021
A051/A029

AUTHORS: Vorob'yev, A.A., Professor, Zavadovskaya, Ye.K., Professor, Boldyrev, V.V., Candidate of Chemical Sciences, Melik-Gaykazyan, I.Ya., Candidate of Physical and Mathematical Sciences, Savintsev, P.A., Candidate of Physical and Mathematical Sciences

TITLE: Physico-Chemical Problems of Dielectrics

PERIODICAL: Zhurnal Vsesoyuznogo Khimicheskogo Obshchestva im. D.I. Mendeleyeva, 1960, No. 5, Vol. 5, pp. 573-582

TEXT: Dielectrical materials should have a high thermal, chemical and radiation resistance, a high mechanical and electrical strength, in some cases they should have a low value of the angle of losses, a low electroconductivity and a high dielectrical constant (Ref. 1). Some of the more recent fields of application are scintillation counters, where the dielectrics with a large width of the forbidden zone of energy are used, or in explosives (Ref. 2), where the electronic and ionic processes which occasionally take

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Physico-Chemical Problems of Dielectrics S/063/60/005/005/012/021 A051/A029

place in the dielectrics are applied. In outlining the physico-chemical properties of dielectrics, the connection between these properties are discussed in reference to the energy of the lattice. It is pointed out that, since little is known of the physical processes in dielectrics when acted upon by an electrical field, chemistry and the science of electrical materials is mostly empirical. The physical properties of dielectrics in relation to their chemical composition and structure were studied. The dielectrical properties of simple substances with a known chemical composition were investigated (Ref. 1,4-24). It was found that the main properties of the dielectrics (thermal resistance, binding energy of the elctron in the lattice, mechanical strength, optical properties, etc.), were directly determined by the strength and nature of the particle bond in the lattice. Under the effect of external conditions the interaction energy between these particles can be overcome and the lattice destroyed. A number of graphs are presented indicating how the various properties are affected by the lattice energy, i.e., the energy value necessary to divide the crystal lattice, consisting of ions, to individual ions and separation of these from one another to an infinitely large distance at a temperature of absolute zero. The case of binary ionic compounds of the A_mB_n type, as described by Kapustinskiy (Ref. 25),

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Physico-Chemical Problems of Dielectrics

is given where the calculation of the energy of the lattices with a coordination number 6, is estimated according to formula (1): $U = 256.1 \frac{(a + b)W_A \cdot W_B}{R_A + R_B}$, where a is the number of cations, b the number of anions, W_A and W_B the valencies of the anion and the cation, R_A and R_B the radii of the corresponding ions for the structure of a lattice of the sodium chloride type. A later version of the formula, where also the repulsion, as well as the attraction of the ions is considered, is given as:

$$U = 287.2 \frac{W_A \cdot W_B(a + b)}{R_A + R_B} \left(1 - \frac{0.345}{R_A + R_B}\right) \quad (2).$$

The ionic crystals have a high value of lattice energy and thus also a high value of thermal and mechanical strength. In the case of isodesmic ionic lattices of the same structural type, the properties of the materials are connected with the energy of the crystal lattice determined by the chemical composition. Fig.1 is a graphical representation of the effect of the hardness according to Moos, melting point, electrical strength of the ionic crystals by the lattice energy, Fig. 2 shows the same relationship for alkali earth metal oxides. From equation 1 it is seen that with a decrease in the size of the particles, which make up

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Physico-Chemical Problems of Dielectrics

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the lattice, the lattice energy increases. Fig. 3 represents the relationship between the change in volume of an elementary nucleus of a molecule (Ref. 3) in various compounds according to data from X-ray analyses, and the lattice energy for crystals of alkali-halide compounds. Fig. 4 gives the relationship of the number of ions n in one cm^3 to the lattice energy for crystals of alkali-halide salts. The value of n was determined from:

$n = \frac{N \cdot d}{2(A_1 + A_2)}$ (3), where N is = $6.06 \cdot 10^{23}$, d the specific gravity, A_1 and A_2 atomic weights of the ions. The specific thermal capacity c_p, at a constant pressure, is given in Fig. 5 in relation to the lattice energy, and Fig. 6 shows the relationship of the melting heat to the lattice energy. Experiments showed that the optical properties of ionic crystals also depend on the lattice energy. With an increase in the latter, the absorption of light changes in the infrared, visible and ultraviolet regions according to certain rules. The electronic polarizability in relation to the lattice energy for alkaline halides is shown in Fig. 8 (Ref. 30, 31). A decrease or an increase of the dielectrical constant and of its components will be noted due to the shift in the ions corresponding to the change in the ion polarizability of the ions and their concentration with a change in the lattice energy. Fig. 9 repre-

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Physico-Chemical Problems of Dielectrics

sents the change in the electronic component of the dielectrical constant with a change in the lattice energy for crystals of the alkali-halide compound series. The relationship of the electroconductivity to the temperature of ionic crystals is described by the formula:

$\sigma = \sigma_1 e^{-u_1/kT} + \sigma_2 e^{-u_2/kT}$, where u is the activation energy of the liberation processes of the ions in the lattice. Experimental data showed that a significant increase of the high-temperature range of the activation energy takes place with an increase in the lattice energy of the alkali-halide salt crystals. The sum of the activation energies at low and high temperatures was found to depend on the lattice energy. The conclusion is drawn here that the electroconductivity of the crystals is connected with the energy of the crystal lattice in a law sequence. Other properties, such as the effective mass of the electron and the magnitude of the oscillating quantum, are also thought to depend on the lattice energy. It is pointed out here that these relationships must be accurately established. The electrical strength of the dielectric is thought to increase with an increase in the lattice energy (Fig. 10). Other properties, such as the thermal resistance of the

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Physico-Chemical Problems of Dielectrics

ionic crystals are in a reverse relationship to the lattice energy, but this phenomenon is assumed to be illusionary, since the decomposition of these substances is also determined by the ionization potential, as well as the lattice energy. The reverse relationship is also observed in the case of the heterodesmic structures. Data obtained from Refs. 9, 10 on a comparison of the physico-chemical properties of liquid and gaseous organic dielectrics with their electrical strength in the aliphatic hydrocarbon series showed that the electrical strength changes sympatically with the change in the intermolecular bond strength and does not depend on the bond strength within the molecule. These results were used to form a graph of the spark-over of the organic dielectrics (Fig. 11). Further mention is made of the connection between the physico-chemical properties of dielectrics and the lattice energy when the structure is destroyed. The contraversial facts noted in real crystals, viz., the mechanical properties of these single crystals changing according to certain rules with the change in the lattice energy, are explained by the behavior of the defects, especially of dislocations, i.e., by the energy of the crystal lattice. One of the possible means for obtaining a controllable concentration of the defects in the lattice is the formation of solid solutions. Upon investigating the electrical properties of the solid

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solutions CaO-ZrO_2, a defect in their structure was noted (Ref. 47). A complex investigation of the physical properties of the solid solutions KCl-RbCl, KCl-KBr, NaCl-NaBr was carried out. It was proven that the general characteristic, which determines the physical properties of a complex dielectric, was the heat of formation. It is expected that a drop in the interaction forces would involve a drop in the strength and an increase in the defect of the solid solution. The relationship between the heat of formation of the solid solution and the average number of particles n included in the volume of the elementary nucleus (for an ideal single crystal n = 8) leads to the conclusion that the more heat absorbed in the formation of the solid solution, i.e., the lower the energy of interaction of the particles in the crystal lattice of the crystal, the more defective is its structure. The connection between the defectiveness of the structure and the lattice energy leads the authors to assume that the laws obtained for the single crystals are also applicable to the polycrystals used commercially. Finally, the authors discuss the connection between the physico-chemical properties of solid solutions of alkali-halide salts. It is said that the introduction of admixtures into the crystal can lead to a change in the interaction between the particles of the crystal lattice of the substance. Experimental data on the physico-chemical

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Physico-Chemical Problems of Dielectrics

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properties of solid solutions of ionic compounds are compared and certain assumptions are therefrom derived on the interaction of ions in the investigated systems. The most important value characterizing solid solutions is their heat of formation and reference is made to the formula used by Grimm (Ref. 61) for caluclating the energy of the crystal lattice. The heat of formation of the solid solution is estimated experimentally as the difference between the heats of dissolution of the solid substance and the mechanical mixture of components having the same weight and composition. The connection between the heat of formation and the electrical properties of the alkali-halide solid solutions is noted. The electrical strength of NaCl-NaBr, KBr-KJ, KCl-KBr, NaBr-KBr is lower than that of the components. Solid solutions formed by heat absorption have a weakened structure and are characterized by a lowered electrical, schematic and thermal strength, high dielectrical losses and a defective structure. The electrical characteristics of dielectrics are connected with other properties, e.g., in the case of ionic crystals with the lattice energy, in homeopolar crystals with the energy of atomization, in molecular crystals with the energy of intermolecular bonds and in solid solutions with the amount of heat liberated in their formation. All these values are the higher, the higher the mechanical, thermal, chemical and elec-

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Physico-Chemical Problems of Dielectrics

trical strength of the dielectrics. The authors point out that in selecting new materials for dielectrics compounds with highly-charged atoms (boron, silicon, etc.), should be combined with non-deforming atoms creating rigid bonds (nitrogen, fluorine, etc.). It is worthwhile to investigate the possibilities of using temperatures and pressures obtained in explosive processes and electrical explosions when producing dielectrics to overcome the high activation barriers of the reaction. The problem of selecting new dielectrical materials is a matter for the chemist, as well as the physicist. There are 15 figures, 4 formulae, 1 table and 81 references: 62 Soviet, 12 English, 6 German, 1 unidentified.

X

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81747
S/089/60/008/05/07/008
B006/B056

21.2100

AUTHORS: Vorob'yev, A. A., Didenko, A. N., Kovalenko, Ye. S.

TITLE: Acceleration of Electrons 11 in a Circular Traveling-wave Accelerator 19

PERIODICAL: Atomnaya energiya, 1960, Vol. 8, No. 5, pp. 459 - 461

TEXT: The suggestion to use a closed circular curved waveguide (the cross section of which is shown on p. 459) as accelerator system was made by Vorob'yev (Ref. 1); in this waveguide an electromagnetic wave with a non-vanishing φ-component of the electric field propagates. The charge of the waveguide is such that within the range of the mean radius the phase velocity of the wave is $v_{ph} \approx c$. The propagation of the waves in curved waveguides which are unlimited in the axial direction have already been investigated in an earlier paper (Ref. 2). Proceeding from the results then obtained, the authors in the present paper investigated the possibilities of a control of the particle trajectories by the wave field itself. From the results obtained in Ref. 2 the X

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Acceleration of Electrons in a Circular Traveling-wave Accelerator

conclusion may be drawn that 1) the curvature of the waveguide reduces the phase velocity of the cophasal waves, and 2) that the influence exerted by the curvature upon the dispersion properties of a system closed in the axial direction is at $v_{ph} = c$ considerably greater than in an axially not closed system. These results are discussed. Several questions relating to the selection of the waveguide parameters are briefly discussed. Contrary to an ordinary synchrotron, the high frequency field in this waveguide accelerator is highly inhomogeneous in axial and radial direction (all components depend in a complex manner on r and z). The dynamics of the particles in the cyclic waveguide accelerator is, however, similar to those in a cyclotron, and the complex wave field does not disturb the normal operation of the accelerator. The suggestions for the control of particle trajectories in the curved waveguide by means of the traveling wave field, which had been made by Vorob'yev already in Ref. 6, are finally discussed (stability conditions - equation (5)). These possibilities of trajectory control by the traveling wave field as well as the possibility of avoiding some technical difficulties occurring in the construction of cyclic

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Acceleration of Electrons in a Circular Traveling-wave Accelerator

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B006/B056

high-energy electron accelerators make the use of curved waveguides in cyclic accelerators interesting. There are 1 figure and 6 Soviet references.

SUBMITTED: March 9, 1959

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S/048/60/024/01/06/009
B006/B014

AUTHORS: Vorob'yev, A. A., Vorob'yev, G. A.

TITLE: Rules Governing Pulsed Breakdown of Solid Dielectrics

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1960, Vol. 24, No. 1, pp. 75-83

TEXT: The article under review, which was read at the Second All-Union Conference on the Physics of Dielectrics (Moscow, November 20-27, 1958), gives an account of the present stage of research concerning the subject mentioned in the title. In the fifties the Tomskiy politekhnicheskiy institut (Tomsk Polytechnic Institute) developed a method which is used to study pulsed breakdown of solid dielectrics as well as a method employed for the production and recording of pulsed voltages with durations of down to 10^{-9} sec. G. A. Vorob'yev and V. D. Kuchin measured the dependence of electric strength of NaCl, KCl, KBr, and KI single crystals upon the duration of voltage action. It is shown that the minimum was strongly shifted toward shorter times. This effect was explained by M. A. Mel'nikov. Mel'nikov also took the volt-second

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B006/B014

Rules Governing Pulsed Breakdown of Solid Dielectrics

characteristic of the same crystals with exposures from 10^{-9} sec on (Fig. 2). The corresponding results as well as those obtained from a number of other publications are discussed in this article. K. M. Kevroleva carried out investigations of crystal hydrates, and obtained volt-second characteristics similar to those of alkali halides. Ye. A. Konorova studied the electric strength within the range $1 \cdot 10^{-6} - 5 \cdot 10^{-8}$ sec without finding any change. Similar investigations carried out by Mel'nikov showed that the disruptive strength increased by 15 per cent when the shortest exposure within the range $1 \cdot 10^{-6} - 5 \cdot 10^{-9}$ sec was used. Further, he studied the volt-second characteristics of polymers (Fig. 5). Again, he noticed that the disruptive strength increased by 15-20 per cent when the shortest exposure was applied. A. V. Astafurov measured the volt-second characteristics of rock salt, river ice, paraffin, and organic glass on breakdown in great thicknesses (Fig. 6). Next, the authors give further results concerning characteristics obtained at the Tomsk Polytechnic Institute and give a survey of details reported in numerous publications on the breakdown delay. The authors discuss results obtained by A. F. Val'ter, L. D. Inge, Mel'nikov, Vorob'yev, Kevroleva, Astafurov, and many Western authors.

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Rules Governing Pulsed Breakdown of Solid Dielectrics

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The duration of breakdown delay is composed of the delay time and the duration of the development of the discharge t_f. As confirmed by the data of the accompanying table, the mean velocity v_m of propagation of a discharge may be satisfactorily described by the formula $v_m = d/t_f$, where d is the sample thickness. The sentence of this equation is formulated and discussed. K. K. Sonchik determined the delay time for NaCl, KCl, KBr, and KI single crystals. He found that v_m increases with increasing overvoltage, increasing lattice energy, and positive polarity of the peak. In the following, the authors discuss a few details concerning the dependence of the breakdown voltage on the thickness of the sample, and some rules discovered by various authors (Sonchik, Vorob'yev, Mel'nikov, N. M. Torbin) are described. The following rules are summarized: 1) At high values of d a polarity effect is observable; 2) positive polarity of the peak shows a higher v_m than negative polarity, v_m rises with increasing overvoltage, 3) t_f increases with d, 4) the second stage of discharge in alkali-halide crystals is shorter by several orders of magnitude than t_f. 5) The volt-second characteristic of alkali-halide single crystals takes a bucket-like course. 6) In solid dielectrics v_m is of the order 10^6 cm/sec

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Rules Governing Pulsed Breakdown of Solid Dielectrics

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and decreases with a rise in temperature. 7) The breakdown voltage increases in homogeneous and nonhomogeneous fields more slowly than with the thickness of the dielectric. In the case of many solid dielectrics it can be described by the same type of equations. In conclusion, a number of problems are mentioned, which so far have not been solved. There are 8 figures, 1 table, and 28 references, 20 of which are Soviet.

ASSOCIATION: Tomskiy politekhnicheskiy institut (Tomsk Polytechnic Institute)

Card 4/4

82839
S/048/60/024/008/016/017
B012/B067

9.3100

AUTHORS: Vlasov, A. G., Vorob'yev, A. A., Kislov, A. N., Meshcheryakov, R. P.

TITLE: Investigation of the Losses in Electrons Due to Scattering in the Residual Gas in the Accelerating Chamber

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1960, Vol. 24, No. 8, pp. 1006-1012

TEXT: In the present paper the theoretical calculations of the losses in accelerated particles due to scattering in the residual gas were experimentally examined. A suggestion is made for calculating these losses. First, only the definite results of calculations according to the methods by N. M. Blachman and E. D. Courant (Refs. 5,6), J. M. Greenberg and T. H. Berlin (Refs. 7,8) and A. N. Matveyev (Refs. 9,10) are studied and compared in a Table. This comparison shows that the various methods lead to different results. The control method and the experimental apparatus are then described. Fig. 1 shows the measuring block diagram. The results of measurements are given and compared with the results of theoretical calculations. In conclusion the following is stated: character and quantitative comparison of the curves shown in Fig. 6 indicate that the losses in electrons due to scattering in the residual gas can be calculated according to the method of Greenberg and Berlin as well as according to that of Matveyev with sufficient accuracy since the results differ only by 1.5 ÷ 1.7 times from one another. According to the method of Blachman and Courant the losses in protons due to scattering in the gas may be estimated, whereas for the electrons the values obtained by this method are too low. The sufficient agreement between the experimental and the theoretical results also confirm the correctness of the method of measurement chosen. V. G. Shestakov assisted in the measurements. The collaborators of the NII TPI and FTF assisted the authors in this work. There are 6 figures, 1 table, and 15 references: 8 Soviet and 7 British.

APPROVED FOR RELEASE: 03/14/2001 CIA-RDP86-00513R001860810020-5"

82839
S/048/60/024/008/016/017
B012/B067

Investigation of the Losses in Electrons Due to Scattering in the Residual Gas in the Accelerating Chamber

ASSOCIATION: Nauchno-issledovatel'skiy institut pri Tomskom politekhnicheskom institute im. S. M. Kirova (Scientific Research Institute at the Tomsk Polytechnical Institute imeni S. M. Kirov)

Card 3/3

VOROB'YEV, Aleksandr Akimovich; PINTAL', Yu.S., red.; VORONIN, K.P., tekhn. red.

[High and superhigh voltages] Elektricheskie vysokie i sverkhvysokie napriazheniia. Moskva, Gos. energ. izd-vo, 1961. 95 p. (MIRA 14:11)

(Electricity)

PHASE I BOOK EXPLOITATION SOV/5832

Anan'yev, L. M., A. A. Vorob'yev, and V. I. Gorbunov

Induktsionnyy uskoritel' elektronov -- betatron (Inductive Accelerators of Electrons -- Betatrons) Moscow, Gosatomizdat, 1961. 349 p. 6000 copies printed.

Ed.: A. F. Alyab'yev; Tech. Ed.: Ye. I. Mazel'.

PURPOSE: This book is intended for students in schools of higher education and for scientific personnel and engineers concerned with nuclear physics and with the design of related machinery and instrumentation.

COVERAGE: The book begins with an explanation of the elementary electron theory of inductive acceleration and the physical processes in a betatron. The design of a betatron installation, its optimum parameters, and the design and calculation of betatron units, e.g., electromagnets, circuit diagrams, vacuum systems, and adjustment elements, are described. Published materials and the authors' experience in the development, construction, adjustment, and use of circular-orbit accelerators

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APPROVED FOR RELEASE: 03/14/2001 CIA-RDP86-00513R001860810020-5"

and betatrons have been systematized and used in the book. No personalities are mentioned. There are 151 references: 83 Soviet, 59 English, and 9 German. References accompany each chapter, except Ch. VII.

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E194/E255

9.4300

AUTHORS: Vorob'yev, A.A., Vorob'yev, G.A., and Kostrygin, V.A. (Tomsk)

TITLE: On the dependence of the breakdown time and the breakdown voltage of dielectrics on their thickness

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Energetika i avtomatika, 1961, No.2, pp. 62-64

TEXT: Tests show that there are many identical relationships between the impulse breakdown of solid dielectrics and of air, and there is reason to return to the hypothesis of breakdown of solid dielectrics by impact ionisation with electrons. It is of interest to study the relationship between the breakdown voltage and delay time of the dielectric as a function of thickness. In air, when pd $\geq$ 1000-1500 mm Hg.cm and the overvoltage is several percent, streamer discharge occurs and at atmospheric pressures the delay time is of the order of 10^{-8} sec. At low air pressures when pd $<$ 200 mm Hg.cm the delay time is of the order of 10^{-5} sec. This increase in delay time is due to a change in the mechanism of breakdown. At low values of pd, Townsend's electron avalanche

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On the dependence of the breakdown time and the breakdown voltage of dielectrics on their thickness

breakdown occurs. In the first ionisation theory of breakdown of solid dielectrics, due to A.F. Ioffe, it was shown that the electric strength should increase with reduction of thickness: it was later noted that in thin solid dielectrics the delay time may be large because of its statistical nature or because of the large number of avalanches necessary to form a conducting path between the electrodes. Early experiments on rock salt of micron thickness confirm the increase in electric strength and delay time in thin layers and show that breakdown of solid dielectrics commences with impact ionisation. Fig.1 shows the dependence of the delay time (in secs) on the thickness, d, in μ (left ordinate, KI; right ordinate, NaCl, KCl, KBr). In this figure the delay time is plotted on the y axis and the thickness on the x axis for rock salt and crystals of KCl, KBr and KI. As the thickness is reduced the delay time increases. Using the data of this figure and other data on discharge delay in crystals of 0.1 mm thick and more, a curve is constructed in Fig.2 for the relationship between

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On the dependence of the breakdown time and the breakdown voltage of dielectrics on their thickness

the delay time (10^{-5} sec) and the thickness, d, cm. The sudden change in breakdown mechanism at a critical thickness of about 10^{-3} cm is noted and briefly discussed. The relationship between the delay time (10^{-4} sec) and the thickness, d, mm, was studied experimentally for air at atmospheric pressure and the results are plotted in Fig.3. The overvoltage was 10-15%. The electrodes were radiated with weak ultraviolet light to avoid statistical delay effects. Here again, at a thickness of 1.6 mm, there is a sudden change in the delay time due to change in the mechanism of breakdown. Curves of this kind are typical for dielectrics in which breakdown commences with impact ionisation. According to Paschen's law, starting from a certain value of pd, where d and λ are very near to one another U_{br} commences to increase as pd is reduced. Fig.4 shows the relationship of E_{br} (MV/cm) and U_{br} (kV) and thickness (δ, cm) for rock salt; as the thickness is reduced E_{br} increases and possibly if the thickness were still further reduced U_{br} might increase. It would be of great

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On the dependence of the breakdown time and the breakdown voltage of dielectrics on their thickness

theoretical interest to verify this experimentally. The results presented are in agreement with the hypothesis of impact ionisation breakdown of solid dielectrics.
There are 4 figures and 9 references: 8 Soviet and 1 English.
The English language reference reads as follows:
Ref.8: F. Seitz. On the theory of electron multiplication in crystals. Phys. Rev., 1949, 76, 9, 1376.

SUBMITTED: October 18, 1960

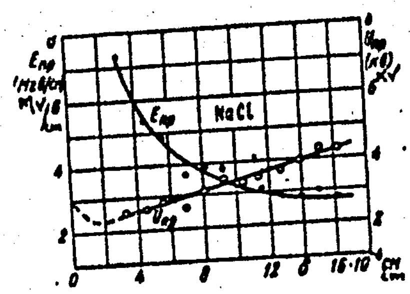

Fig.4

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On the dependence of the breakdown ...

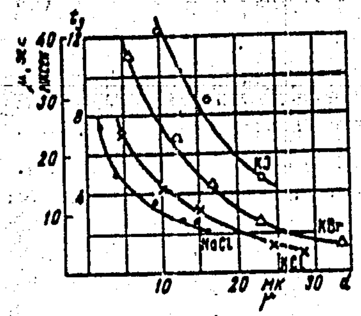

Fig. 1

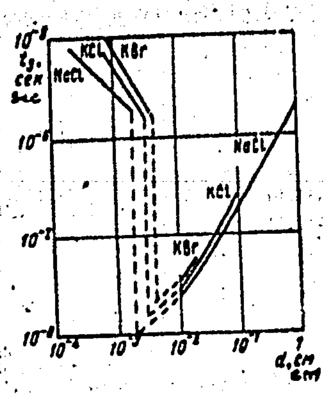

Fig. 2

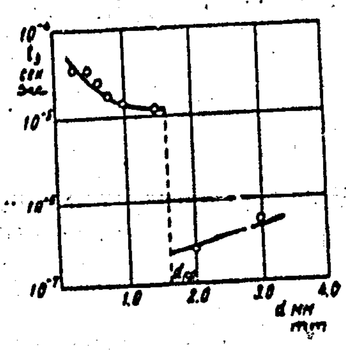

Fig. 3

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VOROB'YEV, A.A.; KOVALENKO, Ye.S.

Cyclic accelerator with trajectory control effected by means of a high-frequency field. Izv.vys.ucheb.zav.; fiz. no.5:36-38 '61. (MIRA 14:10)

1. Tomskiy politekhnicheskiy institut imeni S.M.Kirova.
(Particle accelerators) (Electric fields)

VOROB'YEV, A.A.; VOROB'YEV, G.A.; MESYATS, G.A.; USOV, Yu.P.

Spark gap commutation time. Izv.vys.ucheb.zav.; fiz. no.5:174-175 '61. (MIRA 14:10)

1. Nauchno-issledovatel'skiy institut pri Tomskom politekhnicheskom institute imeni S.M.Kirova.
(Commutation (Electricity))

30772
S/181/61/003/011/004/056
B102/B138

24.7800 (1164, 1385, 1559)

AUTHORS: Vorob'yev, A. A., Vorob'yev, G. A., and Torbin, N. M.

TITLE: Discharge formation processes in solid dielectrics

PERIODICAL: Fizika tverdogo tela, v. 3, no. 11, 1961, 3272-3277

TEXT: Breakdown effects were studied in NaCl, KCl and KBr single crystals. Breakdown was induced by applying a point with positive or negative potential to a crystal face. In NaCl discharge propagates along the [100] direction if the point has negative polarity, along [111] if it has positive polarity (minimum breakdown voltage) and along [110] in the case of positive overvoltage. With growing overvoltage anode sparkover thus changes its direction according to [111] → [110] → [100]. Discharge propagates with $v_{br} = d/t_f$ where d is the thickness of the crystal and t_f the discharge formation time. In order to gain data of great interest for the theory of electric breakdown in solid dielectrics the authors measured the currents passing through the sample before, and in the moment of, breakdown and the time required for the formation of a breakdown. In most experiments the point was of positive polarity and the other electrode, a plate, of

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Discharge formation processes in solid ... 30772
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negative. The discharge-forming current i_f increases with increasing sample thickness according to $i_f = ke^{md}$ where k and m are constants. $m = 0.2\ mm^{-1}$ and $k = 4.2 \cdot 10^4$ a (NaCl), $2.5 \cdot 10^4$ a (KCl) and $1.8 \cdot 10^4$ a (KBr) for positive point polarity. For negative polarity $k = 13.5 \cdot 10^4$ a for NaCl. From this it may be seen that the higher the lattice energy the higher must be the discharge-forming current. The energy of discharge formation is given by $W_m = \int_{t_1}^{t_2} uidt$, or, in the case of breakdown with a square pulse ($u = u_{sq} = \text{const}$) $W_m = u_{sq}\int_{t_1}^{t_2} idt$. An estimation of the spark channel in NaCl radii yields the following results:

d,mm	2	5	7	10
$W_m \cdot 10^{-5}$ joule	0.3	1.27	3.21	9.85
r, μ	0.64	0.83	1.11	1.63

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Discharge formation processes in solid ... S/181/61/003/011/004/056 B102/B138

The channel diameters measured in incomplete breakdown were between 2 and 4 μ. The channel radii of streamer sparkover were found to be $\sim 10^{-4}$cm. The density of the discharge-formation current was 10^4-10^5 a/cm^2. The radius of the luminescent zone in an incomplete breakdown. Light emission starts at currents of 10^{-3}a and is probably due to thermal ionization. Discharge propagates at a rate of $1.4 - 1.3 \cdot 10^6$ cm/sec. Conclusions: The channel walls of an incomplete breakdown are melted through by the discharge-forming current. Highest breakdown voltage for negative point polarity and the polarity dependence of the direction of discharge indicate that impact ionization occurs during the formation of the discharge. The fact that discharge propagates faster if the point is positive indicates that discharge formation in rock salt is a process similar to streamer discharge in air. Breakdown voltage and formation current are higher where the lattice energy is higher. The high current densities and the presence of luminescence indicate that thermal and photoionizations may also be possible during breakdown in solid dielectrics. There are 2 figures, 3 tables, and 12 references:

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Discharge formation processes in solid ... S/181/61/003/011/004/056
B102/B138

7 Soviet and 5 non-Soviet. The four references to English-language publications read as follows: C. Zener. Proc. Roy. Soc. (A), 145, 523, 1934; A. Hippel. Phys.Rev., 54, 1096, 1938; H. H. Racl. GCR, 44, 8, 445, 1941; D. W. Gilman, J. Stauff. Appl. Phys., 22, 2, 120, 1956.

ASSOCIATION: Tomskiy politekhnicheskiy institut im. S. M. Kirova (Tomsk Polytechnic Institute imeni S. M. Kirov)

SUBMITTED: May 4, 1961

Card 4/4

VOROB'YEV, A.A.

High-energy electron accelerators; from materials of the 1959 Geneva Conference. Izv. vys. ucheb. zav.; elektromekh. 4 no. 1:130-142 '61. (MIRA 14:4)

(Particle accelerators)

VOROB'YEV, A.A.; VOROB'YEV, G.A.; KOSTRYGIN, V.A.

Relation between the time lag and the path length in air.
Zhur. tekh. fiz. 31 no.9:1135-1137 S '61. (MIRA 14:8)

1. Nauchno-issledovatel'skiy institut yadernoy fiziki, elektroniki i avtomatiki pri Tomskom politekhnicheskom institute imeni S.M. Kirova.

(Electric discharges)

ANAN'YEV, Lev Martem'yanovich, kand. tekhn.nauk; VOROB'YEV, Aleksandr Akimovich, doktor tekhn. nauk; GORBUNOV, Vladimir Ivanovich, kand. tekhn. nauk; KROPCHEV, S.A., red.; RUBINOVA, L.Ye., tekhn.red.

[Betatron and its uses] Betatron i ego primenenie. Tomsk, Tomskoe knizhnoe izd-vo, 1962. 83 p. (MIRA 15:11)

1. Tomskiy politekhnicheskiy institut imeni S.M.Kirova (for Anan'yev, Vorob'yev, Gorbunov).

(Betatron)

PHASE I BOOK EXPLOITATION SOV/6212

Budylin, B. V., and A. A. Vorob'yev

Deystviye izlucheniy na ionnyye struktury (The Effect of Radiation on Ion Structures). Moscow, Gosatomizdat, 1962. 166 p. 5000 copies printed.

Ed.: V. A. Podoshvina; Tech. Ed.: N. A. Vlasova.

PURPOSE: This book is intended for specialists in atomic and nuclear physics, physical chemistry, and radiation.

COVERAGE: The book describes the effects produced by radiation in matter and investigates the changes occurring in the structure and mechanical properties of solid bodies and crystal lattices as a result of radiation. No personalities are mentioned. References follow each chapter.

TABLE OF CONTENTS:

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VOROB'YEV, A.A.

PHASE I BOOK EXPLOITATION SOV/6333

Bochkarev, V. V., ed.

[illegible]

[illegible] and A. A. Smirnov; Tech. Ed.: [illegible]

PURPOSE: This book is intended for specialists in nuclear instrumentation.

COVERAGE: The book is a collection of [illegible] measurement of the activity and [illegible]

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L 19660-63 EWT(1)/EWP(q)/EWT(m)/EWP(B)/BDS AFFTC/ASD/ESD-3/IJP(C) JD/JG
ACCESSION NR: AR3006994 S/0058/63/000/008/E071/E071

SOURCE: RZh. Fizika, Abs. 8E495 62

AUTHOR: Vorob'yev, A. A.

TITLE: Radiation changes and endurance of alkali halide crystals

CITED SOURCE: Sb. Fiz. shchelochnogaloidn. kristallov, Riga, 1962, 304-316. Diskus., 317-318

TOPIC TAGS: alkali halide crystal , radiation damage, radiation endurance, color center

TRANSLATION: Review of the research done on radiation effects in alkali-halide compounds with variable anion or cation, aimed at obtaining information on the radiation endurance of bodies. The following questions are considered: dependence of rate of formation of color centers and of the rate of their decay on the radiation dose,

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chemical composition of the crystal, and irradiation conditions; the coefficient of absorption of the electrons and the lattice energy; the coefficient of attenuation of the X-rays and the lattice energy; the characteristic energy losses of the electrons in alkali-halide compounds; optical absorption in ionic crystals following irradiation; spontaneous occurrence of color centers in irradiated crystals following annealing; change in hardness and plastic properties of crystals; regeneration of properties of irradiated crystals upon annealing; change in electric conductivity of alkali-halide crystals irradiated with X-rays or neutrons; effect of irradiation on the electric strength of the crystals. Conclusions are drawn with respect to the nature of radiation endurance of solids and methods for estimating this endurance. Bibliography, 21 titles. A. Timofeyev.

DATE ACQ: 06Sep63 SUB CODE: PH ENCL: 00

Card 2/2

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IJP(C)/SSD Pt-4 GG/JD
ACCESSION NR: AR3006987 S/0058/63/000/008/E049/E049

SOURCE: RZh. Fizika, Abs. 8E347

28
B

AUTHOR: Vorob'yev, A. A.; Vorob'yev, G. A.

TITLE: Ionization processes in the electric breakdown of alkali halide salt crystals

27

CITED SOURCE: Sb. Fiz. shchelochnogaloidn. kristallov. Riga, 1962, 361-364

TOPIC TAGS: electric breakdown, alkali halide crystal, ionization, Townsend mechanism, streamer mechanism

TRANSLATION: Experimental results and the main laws of the electric breakdown of NaCl, KCl, KBr, and KI, obtained at the laboratories of the Tomskiy politekhnicheskiy institut (Tomsk Polytechnic Institute), are briefly reported. Discharges from the positive sharp

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L 19667-63

ACCESSION NR: AR3006987

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point extend in the directions [111] and [110], and from a negative point along [100]. The average rate of discharge in the case when the point has a positive polarity is larger than in the case of a negative point. Measurement of the currents flowing during formation of the discharge shows that the formation of incomplete breakdown channels in dielectrics is due to the melting of the dielectric by the current of the produced discharge. It is proposed that if the dielectric has a small thickness (d) (from several to several dozen microns) the discharge has a multiple-avalanche character. When d decreases from tenths of a millimeter to several microns, one observes at a certain value d_{cr} (on the order of 10^{-3} cm) a change in the discharge time t_{disch}, thus indicating a change in the discharge mechanism in the solid dielectrics from the avalanche-streamer type $d > d_{cr}$ to the multi-avalanche-streamer type $d < d_{cr}$, in the same manner as in gases on going over from the Townsend

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L 19667-63

ACCESSION NR: AR3006987

mechanism of breakdown to the streamer mechanism. The data obtained make it possible to assume that the crystal breakdown begins with impact ionization. N. Torbin.

DATE ACQ: 06Sep63 SUB CODE: PH ENCL: 00

Card 3/3

S/139/62/000/001/019/032
E032/E114

AUTHOR: Vorob'yev, A.A.

TITLE: Optical absorption in alkali-halide crystals and the lattice energy

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, no.1, 1962, 118-124

TEXT: The author reports a review of published information on the fundamental optical absorption and additional absorption in ionic crystals containing colour centres. The long-wave fundamental absorption edge of ionic crystals in the ultraviolet part of the spectrum and the short-wave edge in the infrared are displaced towards longer wavelengths for lower lattice energies U. The additional absorption bands which appear in crystals of alkali-halide salts containing n- or p-type colour centres are displaced in the direction of the longer wavelengths for crystals with lower lattice energies. This displacement can be described by a formula of the form

$$\lambda_{max} = 512.2^{\alpha} A U^{-\alpha}$$

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where A and α are constants. It is shown that the lattice energy determined from the ionic radii and charges reflects the relation between the optical characteristics, the chemical composition and the structure of the crystals more fully than the dependence on the lattice constant. These results are said to be in agreement with the work reported by the present author in Ref.15 (AN SSSR, v.108, 1956, 47).
There are 2 figures and 7 tables.

ASSOCIATION: Tomskiy politekhnicheskiy institut imeni S.M. Kirova
(Tomsk Polytechnical Institute imeni S.M. Kirov)

SUBMITTED: April 7, 1961