

BINKO, I. (Chekheslovakiya); KOLARZH, Ya. (Chekheslovakiya); MYULLER, K.  
(Chekheslovakiya); PONCHIK, I. (Chekheslovakiya); RUZHICHKA, I.  
(Chekheslovakiya)

Some little-known oriental tannins. Kozh.-obuv. prom. no.5:35-39  
My '59. (MIRA 12:6)

(Tannins)

NEKRASOV, L.N.; MYULLER, L.

Cathodic reduction of oxygen on platinum in alkaline solutions studied by means of a rotating disk electrode with a ring. Dokl. AN SSSR 149 no.5:1107-1110 Ap '63.  
(MIRA 16:5)

1. Moskovskiy gosudarstvennyy universitet im. M.V.Lomonosova.  
Predstavleno akademikom A.N.Frumkinym.  
(Oxygen) (Reduction, Electrolytic)

MYULLER, L.; NEKRASOV, L.N.

Electrolytic reduction of oxygen on a smooth platinum in acid solutions studied by means of a rotating disk electrode with a ring. Dokl. AN SSSR 154 no.2:437-440 Ja'64.

(MIRA 17:2)

1. Moskovskiy gosudarstvennyy universitet im. M.V. Lomonosova. Predstavleno akademikom A.N. Frumkinym.

MYDUSEV, I. I., BERAGOV, I. N.

Effect of surface oxides on the electroreduction of oxygen  
on platinum in an alkaline solution. Dokl. AN SSSR 167 no. 11:  
416-419 1964.

I. Moskovskiy yuzhnoyevskiy universitet imeni Komenskogo,  
Predstavleno akademikom A.S. Gerasimovym.

MYULLER, L.; NEKRASOV, L.N.

Electrochemical behavior of hydrogen peroxide on platinum.  
Zhur. fiz. khim. 38 no.12:3028-3030 D '64.

(MIRA 18:2)

1. Moskovskiy gosudarstvennyy universitet imeni M.V. Lomonosova,  
Khimicheskiy fakul'tet.

MYULLER, L. & SOBOL', V.V.

Effect of two-charge cations on the process of oxygen reduction  
on platinum in alkaline solution. Elektrokhimiya 1 no.1:111-112  
Ja '65. (MIRA 18:5)

1. Moskovskiy gosudarstvennyy universitet.

83571

S/056/60/038/005/004/050  
B006/B070

24.6300  
AUTHORS:

Balli, D., Myuller, L. ,

TITLE:

Investigation of the Structure of the Main X-Ray K-Absorption Edge in Selenium

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 38, No. 5, pp. 1381-1382

TEXT: In order to investigate the K-absorption spectrum of crystalline and amorphous selenium, the authors used a spectrometer with a bent crystal having a diameter of 41.6 cm; the absorbers were vacuum-evaporated or powder films 4 - 160  $\mu$  thick. The position of the main absorption edge for crystalline selenium was found to be at  $K = 12652.6$  ev (977.86 X), which agrees with the results of other authors. According to the method of Sandström, the width of the main absorption edge was found to be 17.2 ev (1.33 X), which is essentially different from the value of 7.9 ev obtained by W. Zinn following the method of Ross. The "white" line was found to be separated from the main edge by 5 ev, and the "black" line by 13 ev; this agrees with the results of Ref. 3. There appears a noticeable "structure" of the main absorption edge with increasing thickness of the  
Card 1/2

X

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Investigation of the Structure of the Main X-Ray K-Absorption Edge in Selenium

S/056/60/038/005/004,050  
B006/B070

absorber. This structure was observed by E. Ya. Vaynshteyn et al. on the short-wave side and explained by him; the authors of the present work have found such a structure also on the long-wave side (cf. Fig.). When the thickness of the absorber was increased to  $160 \mu$ , the point of inflection of the K-absorption edge was shifted by 1.8 ev toward the short-wave side. The results of investigations for amorphous selenium are collected in a table. The observed shift of about 4 ev for  $\Delta K$  agrees with the results of Ref. 9. In going from the crystalline to the amorphous state, the width of the main absorption edge increases by  $(4.65 \pm 0.5)$  ev. The selenium investigated had a purity of 99.9%. Even small impurities complicate the observed effects. There are 1 figure, 1 table, and 9 references: 1 Soviet, 4 US, 1 Japanese, 1 French, 1 British, and 1 Danish.

ASSOCIATION: Institut atomnoy fiziki Rumynskoy Narodnoy respubliki  
Bukharest (Institute of Atomic Physics of the Rumanian  
People's Republic, Bucharest)

SUBMITTED: October 16, 1959

Card 2/2



LIVSHITS, G.; MOLOTILOV, B.V.; MULLER, N.N.; SAVOST'YANOVA, N.A.

Mechanism of ordering in Ni3 Mn alloys with varying molybdenum.  
Fiz.met. i metalloved. 3 no.3:477-482 '56. (MLRA 10:3)

1. Moskovskiy institut stali.  
(Nickel-magnese-molybdenum alloys--Metallography)

AUTHORS: Livshits, B. G., Myuller, M. M.

SOV/103-10-3-11/20

TITLE: The Investigation of the Phase Equilibrium in the System Cobalt - Chromium - Aluminum (Issledovaniye fазovogo ravnovesiya v sisteme kobal't - khrom - alyuminij)

PERIODICAL: Nauchnyye doklady vysshey shkoly. Metallurgiya, 1958, Nr 3, pp 201 - 206 (USSR)

ABSTRACT: In the present paper the diagram of the phase equilibrium in the system Co-Cr-Al was determined. Within the range of concentration of the triangle C -Cr-Al the ranges of the  $\alpha+\theta$  -phase were investigated based on the results obtained; this was done by constructing the three isothermal sections at 1250°, 1000° and 800°. Furthermore the phase equilibrium at 1250°, 1000° and 800° C was investigated. The samples investigated were maintained at the respective temperatures for 1, 5, 16 and 128 hours. The investigations were carried out by micro-structural analyses and x-ray structural analyses, as well as by determining their microhardness. All alloys investigated may be divided into two groups:

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The Investigation of the Phase Equilibrium in the  
System Cobalt - Chromium - Aluminum

SOV/1-3-5-5-55.40

in homogeneous and heterogeneous alloys. The latter have two and three phases. The results obtained made possible the determination of the limiting phase ranges in the investigation of the temperatures for the cobalt corners of the diagram Co-Cr-Al. When the temperature is decreased from 1250° to 1000°C the phase range  $\alpha+\theta$  widens with an increase of the aluminum content, the mono-phase range of  $\theta$  decreases with an increase of the chromium content, and the phase range of  $\epsilon$  is larger at 1250° than at 1000°. There are 1 figure, 1 table, and 4 references, 1 of which is Soviet.

ASSOCIATION: Laskovskiy Institut stali (Moscow Steel Institute)

SUBMITTED: October 1, 1957

Card 2, 2

PHASE I BOOK EXPLOITATION SOV/AT82

Moscow, Institut stali  
 Proizvodstvo i obrabotka stali i splavov (Production and Treatment of Steel and Alloys) Moscow, Metallurgizdat, 1960. 462 p. (Series: Ita: Stoomik, 39) 2,100 copies printed.

Ed. I. Ye. A. Borko; Ed. of Publishing House: S. L. Zinger; Tech. M. A. M. R. Kleyman; Editorial Council of the Institut stali: M. A. Glinkov, Professor, Doctor of Technical Sciences, V. V. Yulypin, Professor, Doctor, Candidate of Technical Sciences, A. V. Kovitskiy, Professor, Doctor of Technical Sciences, A. A. Kidin, Professor, Doctor of Technical Sciences, B. Lyubimov, Professor, Doctor of Technical Sciences, I. M. Pavlov, Corresponding Member, Academy of Sciences USSR; and A. N. Pochtanov, Professor, Doctor of Technical Sciences.

PURPOSE: This book is intended for technical personnel in industry, scientific institutions and schools of higher education, dealing with open-hearth and electric-furnace steelmaking, metal rolling, physical metallurgy, metallography, and heat treatment. It may Card 1/10

also be used by students specializing in these fields.

COVERAGE: The book contains results of theoretical and experimental investigations of metallurgical and heat-engineering processes in open-hearth and electric furnaces. Data are included on the following: desulfurizing of pig iron outside the blast furnace; interaction of oxides of the carbide-forming metals with the open-hearth, the change of content of gases in the atmosphere of the hearth furnace in various periods of its operation; other articles deal with the electric melting of steels; the dependence of the friction of the nonuniformly deformed metal in rolling; the study of the rolling process; the coefficient of rolling; the dependence of the rolling coefficient in rolling on a number of factors, and other problems in the pressworking of metals. Articles on physical metallurgy and the theoretical principles and techniques of the heat treatment of steel are also included. No personalities are mentioned. References accompany most of the articles. There are 207 references, both Soviet and non-Soviet.

Card 2/10

- ✓ Livshits, B. G., and M. M. Knyazev, Candidates of Technical Sciences [Department of Metallurgy]. Investigation of the Phase Equilibrium in the Co-Cr-Al System 267
- ✓ Kidin, I. M., Yu. A. Babulin, Candidate of Technical Sciences, and I. S. Lezhnevich, Engineer [Department of Physical Metallurgy and Heat Treatment]. Kinetics of the Isothermal Transformation of Austenite Generated During Induction Heating, in Ball-Bearing Steel 284
- ✓ Bernatsyn, M. L., Docent, Candidate of Technical Sciences, and M. E. Kuznetsov, Engineer [Department of Physical Metallurgy and Heat Treatment]. Kinetics of the Transformation of Austenitizing on the tendency of steel toward temper brittleness 297
- ✓ Knyazev, M. M., and B. I. Krimer, Candidate of Technical Sciences [Department of Metallurgy]. Properties of Co-Cr-Al Alloys 306
- ✓ Kidin, I. M. Relationship Between Carbon Concentration in Card 7/10

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S/148/60/000/007/011/015  
A161/A029

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AUTHORS: Gorelik, S.S.; Myuller, N.N.

TITLE: Dependence of <sup>21</sup>Binary Chromium Alloys <sup>18</sup>Recrystallization Temperature  
on Alloying Components

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallur-  
giya, 1960, Nr 7, pp 146-155

TEXT: The temperature of beginning recrystallization shows approximately the heat resistance of metal, and the effect of different additives is of practical interest. The effect of B, Be, Al, Ti, Fe, Zr, Nb, Mo, W, and Sb on the temperature of recrystallization beginning was studied here, as well as of chromium smelted by different methods. The composition of the studied alloys and Cr are given (Tables 1 and 2). The alloys were smelted in alundum crucibles in an induction furnace in an argon atmosphere and poured into a copper ingot mold; an unalloyed Cr ingot was prepared in the same way. The distribution of alloy elements was determined by spectrum analysis, the microstructure by electrolytic pickling in 10%-HCl, the beginning recrystallization temperature by the X-ray method which is

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S/148/60/000/007/C11/015  
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## Dependence of Binary Chromium Alloys Recrystallization Temperature on Alloying Components

usually employed for investigating the recrystallization of high-melting and brittle materials /Ref 1/. The article includes details of experimental techniques. The data obtained led to the following conclusions.

1) Addition of small quantities of Mo, W, Fe, Al, Be, B, Ti, Nb, Ta, Zr and Sb [0.03-5% (atomic)] raises the beginning recrystallization temperature, or " $t_r^b$ " ( $t_R$ ), of Cr. 2) For binary alloys that have one phase in this concentration range, the increase of  $t_r^b$  was 20-100°C. It is proportional to the effective atomic diameter difference of Cr and the alloying element. In aging binary alloys  $t_r^b$  raises by 200-250°C. Aging Cr-Ti, Cr-Ta, Cr-Nb and Cr-Sb have the highest  $t_r^b$  (1,000-1,060°C) and a recrystallization temperature/fusion temperature ratio above 0.60. The abrupt increase of  $t_r^b$  in these alloys is due to the inhibiting effect of the second phase on the growth of forming crystals. 3) In single-phase binary Cr alloys containing several atomic per cent of the alloying element,  $t_r^b$  depends on the way this element affects the strength of the interatomic bond. If the bond strength drops,  $t_r^b$  decreases and may be

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Dependence of Binary Chromium Alloys Recrystallization Temperature on Alloying Components

below that of Cr, as for example in alloying with iron. If the additive raises the interatomic bond, the recrystallization temperature rises, e.g. in alloying Cr with tungsten and molybdenum. Repeated remelting of Cr in a neutral atmosphere without crucible, and reduced saturation of Cr by gas and products of the reaction with the crucible material, lowers the recrystallization temperature from about 800 to 750°C. There are 3 figures, 4 tables, and 6 references: 4 are Soviet, 1 English and 1 German. X

ASSOCIATION: Moskovskiy institut stali (Moscow Steel Institute)

SUBMITTED: November 5, 1959

Card 3/3

S/032/60/026/009/003/018  
B015/B058

AUTHORS: Myuller, N. N., Bernshteyn, M. L.  
TITLE: Application of the Microscopic Method for Studying  
Structural Characteristics of Real Crystals  
PERIODICAL: Zavodskaya laboratoriya, 1960, Vol. 26, No. 9,  
pp. 1084 - 1086

TEXT: The structural characteristics of samples from refractory austenitic ЭИ395 (EI395) steel (16% Cr, 25% Ni, 6% Mo, 0.1-0.2% N<sub>2</sub>, up to 0.1% C), from the refractory ЭИ437 (EI437) alloy of the type "nimonik-80" and from metallic deformed chromium, were microscopically investigated. The EI395 steel was hardened at 1200°C, cold-formed, and subjected to aging for various periods at from 500°C to 700°C. After differential thermal pre-treatment, the polished sections were electrolytically etched. On the basis of photographs (Fig. 1) of the microstructure, it is stated among other things that the microscopic picture obtained is to be explained by the dislocations of plastic deformation. The EI437

Card 1/2



Application of the Microscopic Method for S/032/60/026/009/003/018  
Studying Structural Characteristics of Real B015/B058  
Crystals

alloy also underwent thermomechanical pre-treatment and electrolytic polishing. The structural pictures (Fig. 2) also show "pitting beads" at the grain boundaries, like in EI395 steel, and it is stated that at first gliding only takes place on grains suitably oriented in correspondence. The etched spots are in no connection with a possible phase formation. Metallic deformed chromium underwent "thermal etching", i.e., heating in the MBП-2 (MVP-2) furnace in helium- or argon atmosphere at 1500°C for 12 or 24 hours. The influence of inclusions on gliding can be seen in Fig. 3 and it follows therefrom among other things that the deforming influence of inclusions on the configuration of the gliding structure is also visible at some distance from the inclusion. The change of the direction of gliding at the grain boundaries of metallic chromium is shown in Fig. 4. The present experiments showed that a propagation of deformation from one grain to the other does not take place in chromium in any case, which is in accordance with the brittle character of chromium rupture. There are 5 figures.

ASSOCIATION: Moskovskiy institut stali (Moscow Steel Institute)

Card 2/2

LIVSHITS, B.G., doktor tekhn.nauk; MYULLER, N.M., kand.tekhn.nauk

Investigating phase equilibrium in the system Co - Cr - Al.  
Sbor.Inst.stali no.39:267-283 '60. (MIRA 13:7)

1. Kafedra metallografii Moskovskogo ordena Trudovogo Krasnogo  
Znameni instituta stali im. I.V.Stalina.  
(Cobalt-chromium-aluminum alloys--Metallography)  
(Phase rule and equilibrium)

MULLER, M.M., kand.tekhn.nauk; KRIMER, B.I., kand.tekhn.nauk

Properties of cobalt-chromium-aluminum alloys. Sbor.Inst.  
stali no.39:306-314 '60. (MIRA 13:7)

1. Kafedra metallografii Moskovskogo ordena Trudovogo Krasnogo  
Znameni instituta stali im. I.V.Stalina.  
(Cobalt-chromium-aluminum alloys)

27239

S/143/61/000/003/010/015  
A161/A133

18.8100

AUTHORS: Myuller, N. N., Orlovskaya, Ye. Ye., Panchenko, Ye. V., Strug, Ye. M.

TITLE: On the anomalous change of chromium properties at room temperature

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, no. 3, 1961, 134 - 137

TEXT: The results are given of an experimental investigation with chromium of different degree of purity along with references to data of two English-language publications concerning analogous studies. A chart gives the content of impurities in a few of the studied chromium specimens, determined by spectral and gas analysis. The anomalous effect of volumetric changes in specimens with different impurity contents reached its maximum in the temperature range, of 20 - 46°C, and the observations confirmed the data of Fine, Greiner and Ellis (Ref. 1: J. Metals, 191, 56, 1951) in respect of the effect of impurities. Anomalous electric resistance behavior at different temperature points was also stated, as well as points of anomalous t.e.m.f. It is apparent that the anomalous electric resistance and t.e.m.f. variations are connected with a peculiar interaction of chromium electrons with the electrons of the impurity atoms and dislocations. The article includes three

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27239

On the anomalous change of chromium properties at ...

S/148/61/000/003/010/015  
A161/A133

graphs showing dilatometric curves of chromium smelted under different conditions, dependence of the electric resistance on temperature, and the dependence of t.e.m.f. on the temperature in chromium that had been melted in different ways. Conclusions: 1) Anomalous changes of chromium properties (contraction of volume, drop of electric resistance and of t.e.m.f.) has been revealed in the temperature range of 20 - 46°C; 2) The nature of the anomalous effect of property changes and the temperature point of anomaly are connected with the purity of chromium and the anomaly is the more pronounced the purer the chromium. There are 3 figures, 1 chart, and 3 references: 1 Soviet-bloc and 2 non-Soviet-bloc. The two references to English language publications read as follows: Fine, Greiner, Ellis. J. Metals, 191, 56, 1951; Pursey, J. Inst. Met., April 1958, p 362.

ASSOCIATION: Moskovskiy institut stali (Moscow Steel Institute)

SUBMITTED: August 31, 1960

Card 2/2

S/148/01/000/005/007/015  
E073/E575

187500

AUTHORS: Korshak S.S. and Myuller N.N.

TITLE: Features of the change in the fine structure of  
chromium and its alloys during deformation

PERIODICAL: Izvestiya vsshikh shkolya, Zvezdeniy, Chernaya  
metallurgiya, 1961, No. 7, pp. 129-131

TEXT: The authors established in earlier work (Ref. 1; Izv. vsshikh shkolya, Zvezdeniy, Chernaya metallurgiya, 1960, No. 7) that chromium of 99.92% purity melted without a crucible possesses a relatively high recrystallization temperature,  $t_r/T_{fus} = 0.48$ . This is considered higher than the corresponding ratio for other metals of the same degree of purity. There was a possibility that these features of recrystallization of chromium and of its alloys were due to the nature of its fine structure in the deformed state. Therefore, the authors carried out parallel investigations on the changes in the fine structure during deformation of chromium and of some of its alloys and also of iron. They analysed the widening of the X-ray lines in the deformed state so as to determine the role of the dispersion of the structure and  
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X

Features of the change in the

S. G. / 61 / 000 / 005 / 007 / 015  
E073/E535

the micro stresses on this widening. Analysis of the widening of the lines of chromium and its alloys was on specimens work hardened by deformation in a mortar and also on specimens work hardened by surface scratching by means of an abrasive wheel. The powder deformed in a mortar was used for producing specimens in the form of a layer on a glass fibre. The X-ray patterns were made in a cylindrical chamber D = 57.3 mm and as a reference standard powder of the alloy in the annealed state was used. Cr-Fe (22%) In addition to pure chromium specimens, Cr-Fe (22% Fe) and Cr-Ta (0.51% Ta) alloys were investigated. Under the same conditions of exposure, the widening of the lines of work hardened iron was determined. The iron powder was produced by filing. The widening was analysed by the approximation method using as an approximate function  $1/1 + ax^2$ . The calculation was carried out by comparing the widening of the lines  $(110)\alpha$  and  $(211)\alpha$ , using the radiation from a chromium alloy. The obtained results indicate that deformation of chromium is accompanied basically by dispersion of the structure and it leads to the creation of slight elastic stresses which are such that they do not have an influence on the widening of the X-ray diffraction lines. This conclusion is

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Features of the change in the ...

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E073/E535

correct also for the investigated Cr-Ta and Cr-Fe alloys and conclusive evidence of the correctness of this conclusion is the fact that analysis of deformed iron gave an opposite result, namely, all the widenings proved to be due to microstresses. The following conclusions are arrived at:

1 The Structural changes during deformation of chromium and its alloys mainly consist in refining of the structure. The microstresses are relatively low and do not have any influence on the widening of the X ray diffraction patterns. 2 The assumption is expressed that the high relative recrystallization temperature ( $T_r/T_{fus} = 0.48$ ) is associated with the low value of the microstresses and the weakened role of elastic distortions in accelerating recrystallization. The latter proceeds basically as selective recrystallization which is stimulated primarily by the tendency of the system to be in a state for which the surface energy of the system is at a minimum. There are 1 table and 3 references: 2 Soviet bloc and 1 non-Soviet bloc.

ASSOCIATION: Moskovskiy Institut stali (Moscow Steel Institute)  
SUBMITTED: January 20, 1961  
Card 3/3



MYULLER, N. N.; SOTNIKOVA, L. I.

Studying certain properties of copper cathodes deposited in  
presence of various surface active additives. TSvet. met. 35  
no.10:29-33 0 '62. (MIRA 15:10)

(Copper—Electrometallurgy)

MYULLER, N.N.; SOTNIKOVA, L.I.

Effect of additions of surface-active substances on the structure of  
cathodic copper. TSvet. met. 36 no.1:21-22 Ja '63. (MIRA 16:5)  
(Copper--Electrometallurgy) (Surface-active agents)

MYULLER, N.N.; SOTNIKOVA, L.I.

Effect of surface-active additions on the structure of  
cathodic copper. Trudy Giprotsvetmetobrabotka no.24:139-  
145 '65. (MIRA 18:11)

MYULLER, N.R.

Effect of dimesole and vitamin B<sub>12</sub> on the metastasis of different inoculated tumors. Vop. onk. 9 no.9:27-33 '63. (MIRA 17:9)

1. Iz laboratorii eksperimental'noy onkologii (zav.- zasluzhennyy deyatel' nauki prof. N.V. Lazarev) Instituta onkologii AMN SSSR (dir.- deystvitel'nyy chlen AMN SSSR prof. A.I. Serebrov). Adres avtora: Leningrad, P-129, 2-ya Berezovaya alleya, 3, Institut onkologii AMN SSSR.

LOGINOV, A.V.; MYULLER, H.R.

Cholenergic properties of chlortetracycline. Antibiotiki  
7 no.3: ~~83-88~~ № 162. (MIRA 15:3)

1. Kafedra fiziologii (zav. A.V. Loginov) Leningradskogo  
khimiko-farmatsevticheskogo instituta.  
(AUREOMYCIN) (CHOLINE)

MYULLER, N. R.

Role of histamine in cancerogenesis. Vop. onk. 8 no.7:105-111  
'62. (MIRA 15:7)

1. Iz laboratorii eksperimental'noy onkologii (zav. - zasl. deyat.  
nauki, prof. N. V. Lazarev) Instituta onkologii AMN SSSR (dir. -  
deystv. chl. AMN SSSR, prof. A. I. Serebrev)

(CARCINOGENESINS) (HISTAMINE)

MALYUGINA, L.L.; MYULLER N.R.

Some peculiarities of metastasization of rat sarcoma SSR following incculation under the skin of the tail. Vopr. onk. 9 no.6:56-59 '63. (MIRA 17:8)

1. Iz laboratorii eksperimental'noy onkologii (zav. - zaslu-zhennyi deyatel' nauki prof. N.V. Lazarev) Instituta onkologii AMN SSSR (dir. - deystvitel'nyy chlen AMN SSSR prof. A.I. Serebrov). Adres avtorov: Leningrad, P-129, 2-ya Berezhovaya alleya, d.3, Institut onkologii AMN SSSR.

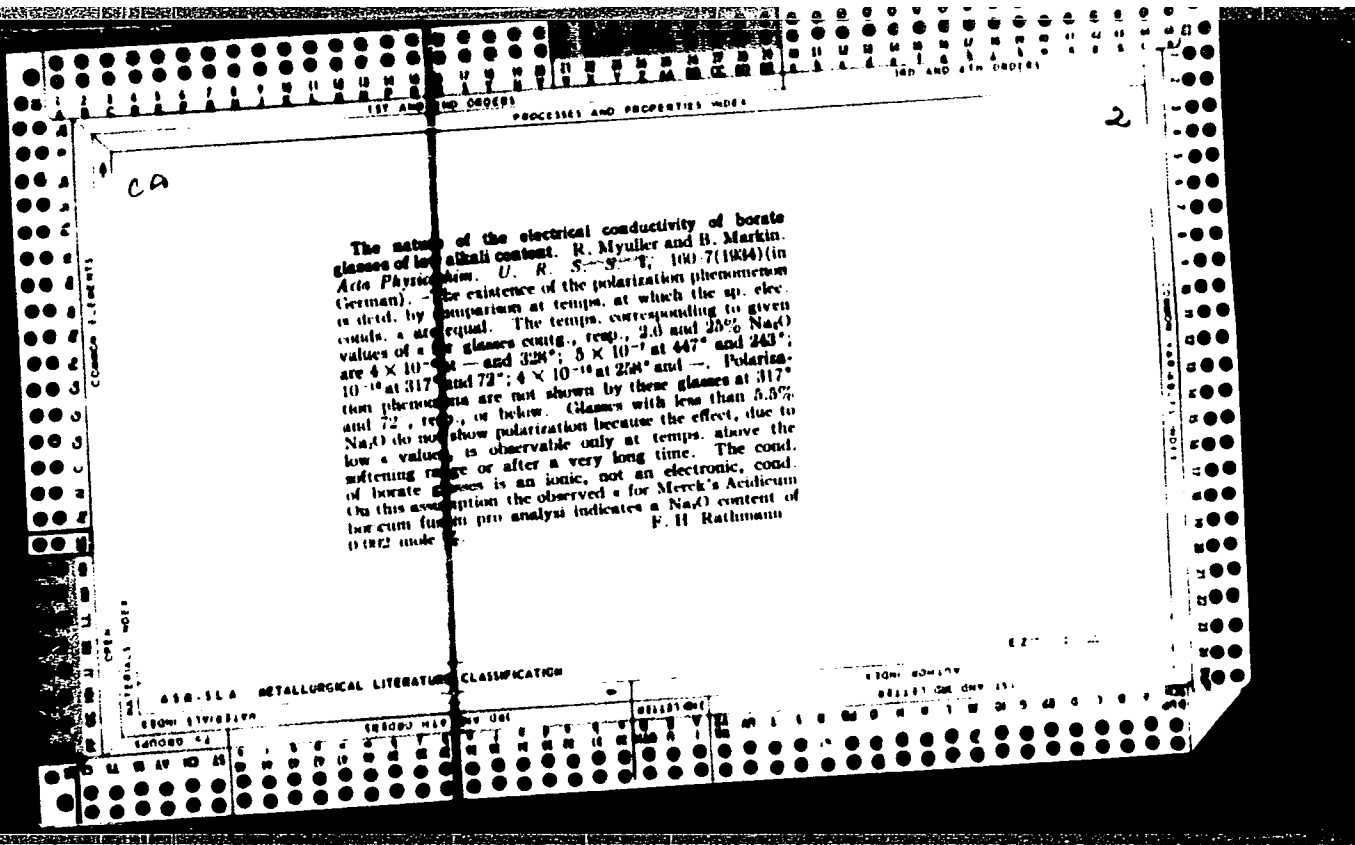
GERSHANOVICH, M.L.; KAUFMAN, B.D.; MYULLER, N.R.

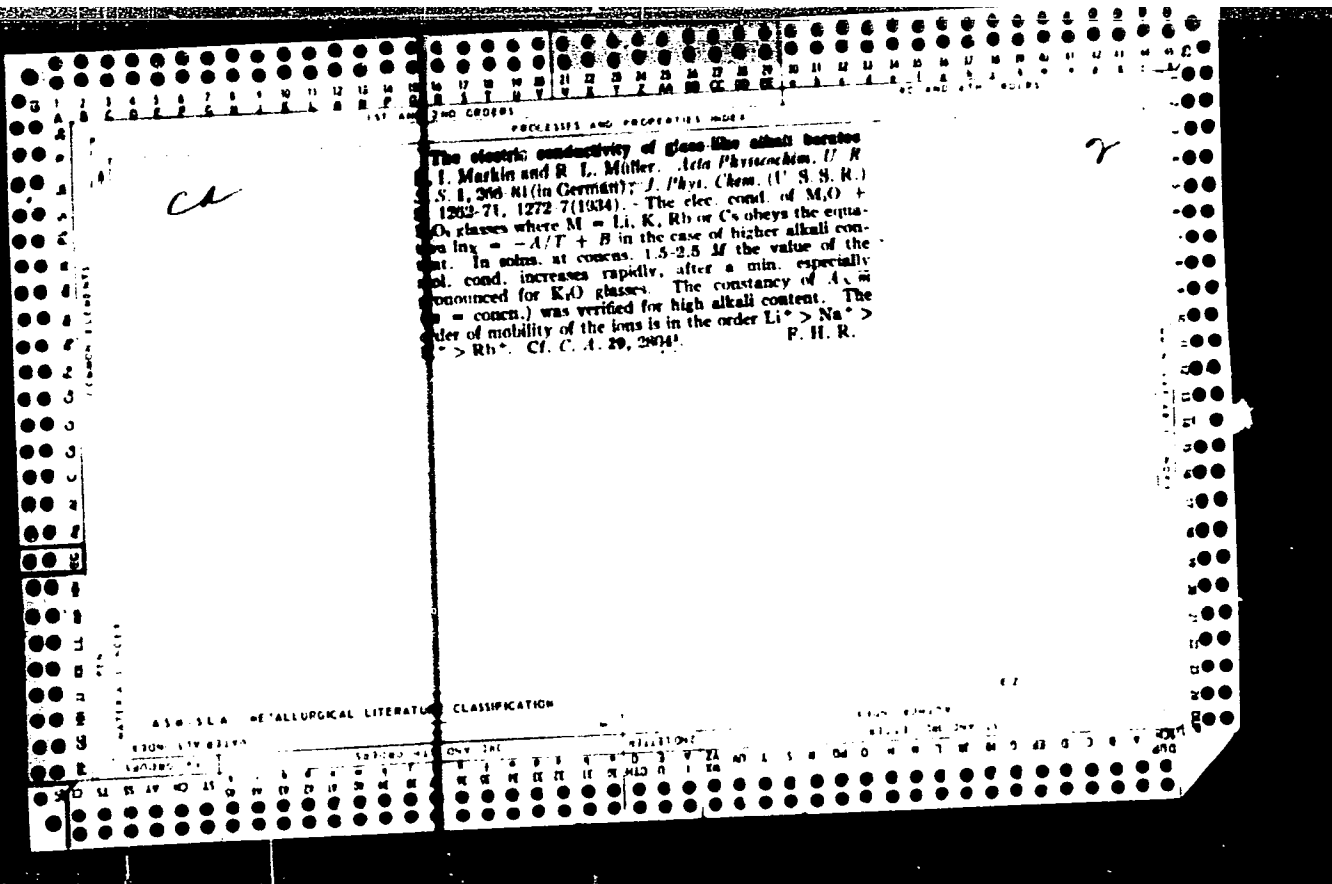
Conference on problems of drug therapy in an oncological clinic.  
Vop. onk. 11 no.12:98-101 '65. (MIRA 19:1)

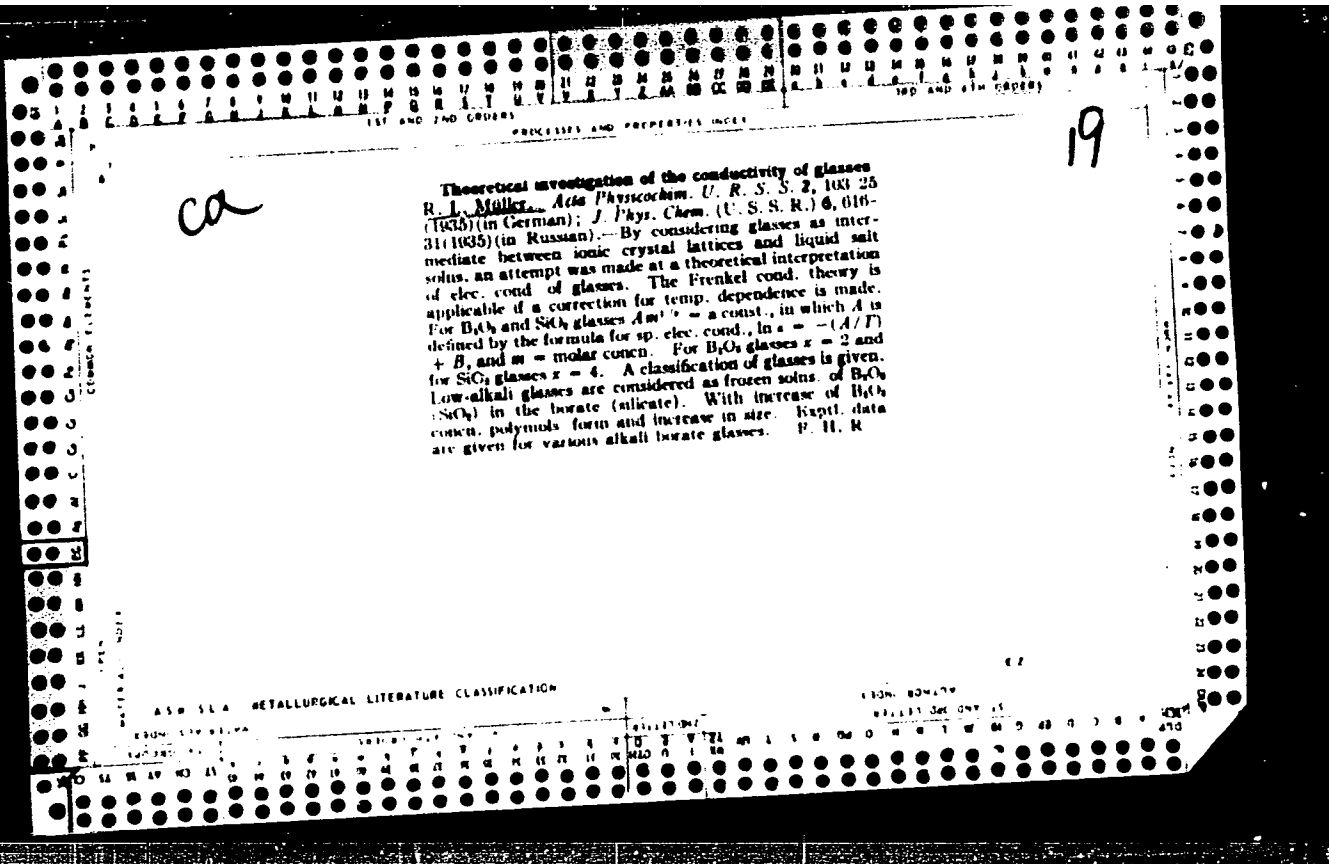


MYULIEN, O.F.; ALYAKHINSKIY, A.V., nauchn. rab.

[Overall mechanization of the handling of pulp on the  
the grinders] Kompleksnaya mekhanizatsiya transporta i  
rovki balansa k defibreram. Moskva, Tsentr. nauchno-  
issl. in-t informatsii i tekhniko-ekon. issledovaniy  
lesnoi, tselliulozno-bumazhnoi, derevobrabotivnoy  
promyshl. i lesnomu khoz., 1962. 17 p. (MIRA 1962)







a-1

BC

Rate of Dissolution of Glass in Gases.  
 R. J. Pliska and G. G. Ziegler (Acta Phys. Chem. USSR, 1957, 2, 685-692; cf. A., 1952, 447). The rates of dissolution of glasses of formula  $B_2O_3 \cdot xM_2O_3$ , where M is Li, Na, K, Rb, or Cs, have been investigated for a series of compositions between  $B_2O_3$  and  $2B_2O_3$ . For glasses where the molar fraction,  $q$ , of  $M_2O_3$  is  $> 0.4$  the rate is determined by diffusion and convection. When  $q$  is  $< 0.5$  the rate is independent of the rate of stirring of the liquid and has a temp. coeff. of 7-8% per  $1^\circ$ . It is deduced that the rate of dissolution is here determined by a chemical reaction at the solid-liquid interface which begins to be important in the range  $0.1 < q < 0.5$ . The formerly observed correlation between the molar conductivity and the rate of dissolution is fortuitous.  
 O. D. S.

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**2023. Kinetics of Solution of Alkali-Boron Glasses. R. L. Miller. *Acta Physicochimica*, 4, 1, pp. 99-110, 1958. In German.—A critical examination of data hitherto on rates of solution shows that there is almost complete lack of data on the kinetics of reciprocal action between the solvent and the substance undergoing solution. Into this group the author places the problems relating to glass-forming substances. From the available literature and experimental data for the velocities of solution of boron glasses the author's conclusion referring to the non-dissolution solution of glassy alkali-borates with the molar fraction  $q > 0.8$  is confirmed. Experimental determination of the energy of activation of solution of glassy borates gives a value of 10-15 k.cal. An attempt is made to clarify the physical nature of the energy of activation of solution. Simultaneously a definition is given for the energy of activation of the crystallization process. From a comparison of the experimentally deduced value of C in the expression for the velocity of solution  $V_m = C_0 - AT$  with the theoretically calculated values, it is concluded that the value of the coefficient according to Myamoto's theory on the solution process based on the kinetic gas theory is not applicable. The calculation of the constant C according to the adsorption theory of Frenkel and to a certain degree according to the sublimation theory of Polanzi and Wigner lead to more satisfactory results. [See Abstract 1063 (1958).] J. K.**

ASB-51A METALLURGICAL LITERATURE CLASSIFICATION

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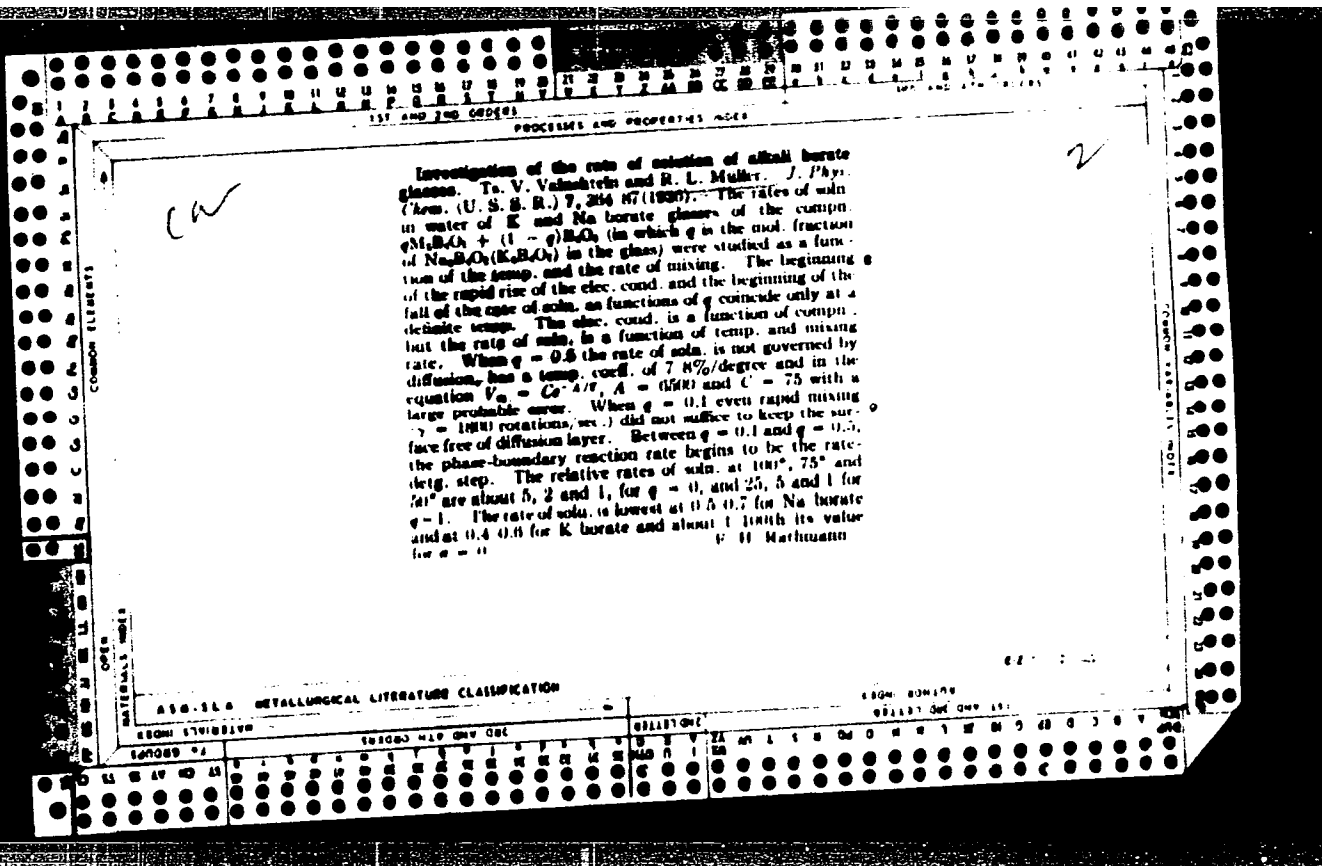
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An attempt to find an inclusive expression for the speed of solution of a solid body. R. L. Muller. *Acta Physico-chem. U. R. S. S.* 4, 481 (1956); cf. U. A. 29, 3549.

The speed of soln. is conditioned by the rate of mech. transport and by the rate of chem. reaction. A satisfactory expression for the measured rate must include terms corresponding to each of these processes. It is assumed that a concd. turbulent film of soln. exists in the neighborhood of the interface and that the thickness of the film is proportional to the speed of the current and to the time. Transport through this layer takes place by means of micro-eddies and micro-convection currents and not by diffusion. By equating the rate at which material is introduced and removed from the layer an expression is obtained for the measured rate in terms of the speed of the current and of the reaction rate. At low speeds the convective rate is measured; at high speeds the measured rate approaches the reaction rate in magnitude. Comparison is made with expt. P. S. Roller

ALSO SEE METALLURGICAL LITERATURE CLASSIFICATION





137 AND 138 (1973)

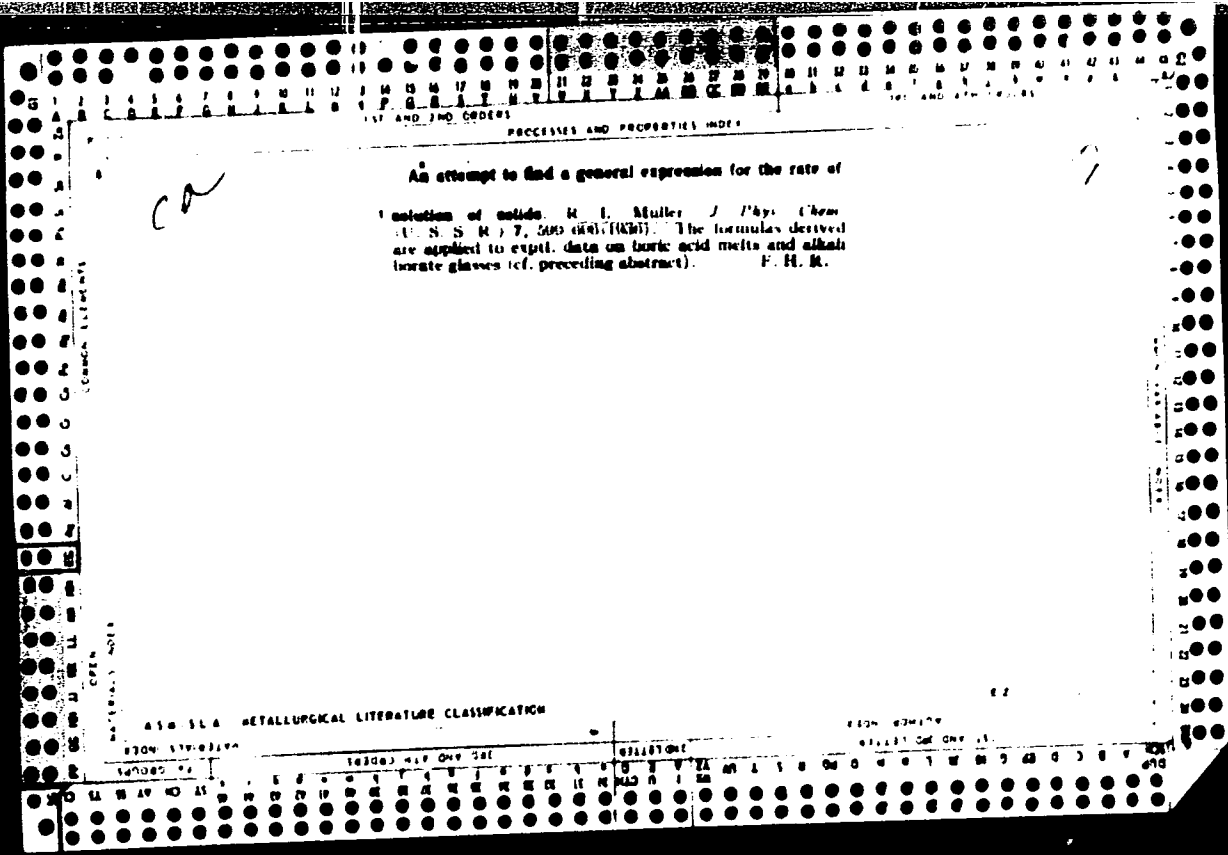
ADDRESS AND PROPERTIES INDEX

100

Kinetics of the solution of alkali borate glasses. K. L. Müller. *J. Phys. Chem. (U. S. S. R.)* 7, 390-401(1966); *J. Acta Physicochimica U. R. S. S.* 4, 99-119(1966).—  
 Calcn. of the const.  $C$  in  $V_{\infty} = C e^{-A/T}$  from exptl. data indicate that the theory of Miyamoto (C. A. 27, 2877) based on gas-kinetic theory is not applicable to some of borate glasses, while the Frenkel adsorption and the Polanyi-Wigner sublimation theories (*Physik. Z. Sowjetunion* 1, 498(1953); C. A. 28, 1828) are applicable.  
 P. H. Rathmann

ASB-3LA METALLURGICAL LITERATURE CLASSIFICATION

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The structure of solid glasses according to the data of electric conductivity. R. J. Miller, *Ann. N.Y. Acad. Sci.*, U. S. S. R., *Sov. Phys.*, 4, No. 4, 687-104 (in English, 615) (1968).—The conceptual role of the nature of the chemical bond of glass and its significance for the characteristics of the elec. char. properties of glasses are discussed. In the study of the dependence of the log of equil. elec. cond. on the wt. percentage of the oxides of alkali metals there is observed an exceptionally large increase of the elec. cond. (10<sup>10</sup> times for K glass) beyond a definite concentration. By substituting the wt. percentage content on the x-axis by valence, expressed in g.-atoms of alkali metals per cc, a common curve is obtained for all 3 kinds of alkalis. At small concentrations the distribution of the curves is observed at temp. intervals of 200-300°. These temps. correspond to the critical region of temps. in glasses with a small content of alkali, but they lie considerably below this region in glasses rich in alkali. The elec. cond. of glasses rich in alkali agrees with the proposed theory of electrolytic dissociation in refractory ionic glasses containing O. According to this theory (which is based on equil. data of the elec. cond. in alkali borosilicate glasses) the mobile cations are distributed at equil. in a thermodynamically nonequivalent glass-like system, being situated near the ionized or un-ionized O atoms (R-O<sup>-</sup>Na<sup>+</sup>) and (R-O-R). In the last case Na<sup>+</sup> the metal ion is attached to O by electrostatic Coulomb forces and, being comparatively firmly bound, can be regarded as bound to O. The group O<sup>-</sup>Na<sup>+</sup> can be re-

garded as "electrically unbound." During the dissociation of each a group the alkali metal ion can, as a result of thermal motion, be displaced by jumps in the at. lattice of glass from one atom of the un-ionized O to the other, and is bound to them by polarization forces. M. derived theoretically the following expression for the at. elec. cond. in glasses  $\Lambda = (x/[Mn]) = 6700x^2 \sqrt{y_0} e^{-E/RT}$ , where  $x$  is the sp. elec. cond.,  $s$  valence of the mobile cation,  $E$  energy of dissociation,  $R$  gas const.,  $T$  abs. temp. and  $y$  ratio of the no. of un-ionized O atoms to the no. of ionized O atoms ( $y = [O]/[O^-]$ ). It is concluded that the energy of electrolytic dissociation in glasses as well as the at. elec. cond. is detd. by the existence in the glass of a relation between the ionized and un-ionized O atoms. A basis for the chem. inhomogeneity of the 3-component alkali B glasses from the analysis of the results of measurements of the elec. cond. of these glasses is given. The course of the curves corresponding to the 3- and 2-component systems proves the similar nature of the changes of the elec. cond. of complex and simple glasses. The at.-ionic structural conceptions are applicable to B and silicate glasses. These conceptions permit explaining quantitatively the electrolytic dissociation observed in glasses. Lit. references. W. A. Hesse

488.554 METALLURGICAL LITERATURE CLASSIFICATION

1968 654170

A.C.S

Glass

**Electroconductivity of glass.** R. L. MULLINE, *University of Michigan, Ann Arbor, Mich.*, *J. Chem. Phys.*, **10**, 10 (1942).  
 Zepich, *Leningrad. Gosudarst. Univ. Ser. Khim. Nauk*, **5** (64), 159-74 (1940); *Khim. Refrat. Zhur.*, **6** (6) 20-31 (1941).—M. deals with the electroconductivity of glass as affected by the temperature and composition. He developed a method whereby the conductivity of glass varying between 10<sup>-3</sup> and 10<sup>-9</sup> can be determined with an error not exceeding 10 to 15%. The following types of glass were investigated: SiO<sub>2</sub>-Na<sub>2</sub>O, SiO<sub>2</sub>-CaO, and the ternary composition SiO<sub>2</sub>-Na<sub>2</sub>O-10% O<sub>2</sub>. In all instances the effect of the temperature could be expressed by a Br-*U* law, where *U* is the energy of displacement of the cations carrying the current in electrolysis and corresponds to the energy of removing an ion from a crystalline lattice. The electroconductivity increases with an increased content of alkali. Starting with a certain critical concentration, a rapid rise of the conductivity curve can be observed. The critical concentration corresponds to the cations approaching a distance equaling the diameter of a molecule of basic anhydride. The increase in electroconductivity is explicable by the electrostatic interaction of alkali ions. This is corroborated by the observed freezing decrease in the energy of ionic displacement, *E* (from 100 to 40 cal.). A study of the electric conductivity of 2-component systems showed that it is an additive property caused by the presence of two ionic species. Apparently, the structural properties peculiar to each of the 2-component systems is also preserved in the 3-component systems. Glasses containing 3 components should therefore be regarded as multivalent systems. Their optical anisotropy is evidence of the high degree of dispersion of the alkali alkali inclusion within the anhydrous part of the glass. The determination of the conductivity of glass, besides the theoretical interest, also has practical significance, especially for selecting proper glass for glass electrodes, cathode lamps, lamp contacts, etc. See "Structure . . ." *Chem. Abstr.*, **29** (11) 282 (1941).

MULLER, R. L.

USSR/Chemistry - Physical chemistry

Card 1/1 : Pub. 147 - 20/21

Authors : Muller, R. L.

Title : Discussion on the theory of specific heat of vitreous heterodynamic structures

Periodical : Zhur. fis. khim. 8, 1521-1522, Aug 1954

Abstract : A critical review of a book entitled, "About New Experimental Confirmations of the Specific Heat Theory Chain Type and Lamellar Structures", by V. V. Tarasov, is presented. The critic points out that only after all major problems of the specific-heat theory are solved will it be feasible to apply quantum functions to ion-atom valent vitreous systems. It is also pointed out that the vitrification temperature of silicate systems is high not as a result of greater ion bond energies, as claimed by the author of the book, but as a result of high-values of quasi-elastic valent-bond coefficients. Six references: 5-USSR and 1-German (1931-1953).

Institution : ... Mining Inst., Kemerovo

Submitted : February 13, 1954

MYULLER, R.L.

USSR/Physics - Conductivity of glass

FD-808

Card 1/1 Pub. 146-21/21

Author : Myuller, R. L.

Title : Nature of electric conductivity of glass

Periodical : Zhur. eksp. i teor. fiz., 27, 264, Aug 1954

Abstract : Criticizes article by M. S. Kosman and R. T. Paranyuk. Accuses Kosman of ignorance of the chemical composition of the tested glass, which led him to erroneous conclusions. Six references including one German.

Institution :

Submitted : February 2, 1954

MYULLER, R. L.

USSR/ Chemistry      Physical chemistry

Card : 1/1      Pub. 147 - 4/25

Authors : Myuller, R. L.

Title : About the specific heat of ion-atom valent solid-substances

Periodical : Zhur. fis. khim. 28/7, 1193 - 1209, July 1954

Abstract : Calculations, determining the specific heat of ion-atom valent solid-bodies, are presented. The role of degrees of freedom of low-frequency oscillations in solid bodies in the calculation of specific heat is found to be comparable with the progressive and rotary degrees of freedom which assume an important role in the calculation of molecular heat capacity of gaseous substances. The calculations can be useful in determining the specific heats of various solid materials (metallurgy) at normal temperatures provided the chemical composition of the substances are known. Thirteen references: 12 USSR and 1 USA (1932 - 1953). Tables; diagram.

Institution : Mining Institute, Kemerovo

Submitted : April 7, 1953

**USSR/Chemistry - Crystallography**

**Card 1/1 Pub. 147 - 16/25**

**Authors : Myuller, R. L.**

**Title : ~~XXXXXXXXXXXXXXXXXXXX~~  
The chemistry of glass forming high-melting substances determined according to specific heat data**

**Periodical : Zhur. fiz. khim. 28/10, 1831-1836, Oct 1954**

**Abstract : It was established experimentally that the phenomenon of glass formation observed in a specific group of high melting substances is closely connected with the characteristics of thermal migration of atoms in these substances in solid state. According to specific heat analysis the high-melting substances most inclined toward glass formation are the compounds formed by elements of the second D. I. Mendeleev periodical system of elements. Such compounds, when subjected to low temperatures, acquire rigid valent bonds with corresponding number of frigid degrees of freedom of the oscillatory motion. These compounds represent conservative systems of valent bond atoms with high excitation energies of valent oscillations. Boro-alumo-silicates were found to be typical representatives of such substances. Nine references: 8-USSR and 1-German (1931-1954). Tables.**

**Institution : The Mining Institute, Kemerovo**

**Submitted : March 13, 1954**



MULLER, R. L.

USSR/Chemistry - Physical chemistry

Card 1/1 : Pub. 147 - 12/22

Authors : Muller, R. L.

Title : Critical temperature zone of silica according to specific heat data and glass forming silicates

Periodical : Zhur. fiz. khim. 28/11, 1954-1965, November 1954

Abstract : The specific heat values of crystalline and amorphous silica were analyzed and the presence of a critical temperature zone, independent from the crystalline modification and structural characteristics, was determined. The aspects of the critical zone, characterized by excitation of valent and valent-deformation oscillations with simultaneous participation of from one to four valent bonds in the tetrahedral structure of the element ( $\text{SiO}_{4/2}$ ), are discussed. The effect of adding basic oxides to silica is explained. The natural frequencies of valent and mixed oscillations, computed from the specific heats by means of the Einstein function, are described. Eighteen USSR references (1921-1954). Tables; graphs.

Institution: Mining Institute, Kromerovo

Submitted : March 13, 1954

USSR/Chemistry - Physical chemistry

Card 1/1 : Pub. 147 - 11/27

Authors : Myuller, R. L.

Title : Critical temperature zone of B<sub>2</sub>O<sub>3</sub> according to specific heat data and glass forming borates

Periodical : Zhur. fiz. khim. 28/12, 2170-2177, Dec 1954

Abstract : An analysis of the specific heat of B<sub>2</sub>O<sub>3</sub> established the presence of a very narrow zone of critical temperatures in the latter in which the excitation energies of valent oscillations decrease very rapidly. At a temperature range of from 500 - 550° K uniform distribution of thermal energy was observed during all degrees of freedom of the valent oscillations. The narrowness of the critical temperature zone and the insufficient supercooling connected with it were found to be due to the difficulty of B<sub>2</sub>O<sub>3</sub> crystallization. The lower limit of the critical temperature zone of B<sub>2</sub>O<sub>3</sub> was established at 440° K. The introduction of basic oxides into B<sub>2</sub>O<sub>3</sub> strengthens the structure of valent chem. bonds which in turn prompts an increase of the lower limit of the critical temperature zone and the melting point of the substance. Eighteen references ; 15 USSR; 2 USA and 1 German (1931-1954). Tables; graphs.

Institution : Mining Institute, Kemerovo

Submitted : March 13, 1954

## USSR/Chemistry - Physical chemistry

Card 1/2 : Pub. 147 -14/27

Authors : Muller, R. L.

Title : Critical temperatures of low-melting glass established according to specific heat data

Periodical : Zhur. fiz. khim. 28/12, 2189-2194, Dec 1954

Abstract : Experiments showed that glass obtained during the supercooling of easily fusible liquids containing molecules with considerable dipole moments has a molecular structure. The freezing of the degrees of freedom of torsional vibrations of the molecules and their radicals was observed in the critical temperature zone of the tested glass. It was established that polymerized organic glass is characterized by a fibrous atom-valent structure and shows no signs of a molecular-dispersion structure. The freezing of the valent oscillatory degrees of freedom in the critical temperature zone of vitreous polymers was found to be analogous to the freezing in the case of infusible boron aluminum silicates. The difference between the latter and polymerized organic substances is explained. Six USSR references (1936-1954). Tables.

Zhur. fis. khim. 28/12, 2189-2194, Dec 1954

(Additional Card)

Card 2/2

Institution : Mining Institute, Karemovo

Submitted : April 23, 1954

117 R A -  
USSR/Physics - Electric conductivity

FD-309

Card 1/2 Pub. 153 - 8/25

Author : Muller, R. L.

Title : ~~Electrical conductivity of solid ionic-atomic valent substances~~  
I

Periodical : Zhur. tekhn. fiz., 25, February 1955, 235-245

Abstract : In the present work the author describes an experiment in chemical physical analysis of the electrical conductivities of ionic-atomic valent amorphous bodies, with the electrochemical viewpoint representing a subsequent development of existing electro-physical notions. In succeeding works the author will show that the views expounded in the present work are in agreement with experience and considerably expand the circle of experimental facts amenable to theoretical generalization. Author's conclusions: According to structural chemical and aggregate characteristics of a medium one must distinguish the electrochemistry of a) ionic-molecular, b) purely ionic, and c) ionic-atomic valent systems, to the latter variety belonging the electrochemistry of borosilicates and allied refractory vitreous substances; the specific

FD-303a

Card 12

characteristic of ionic-atomic valent systems distinguishing them from all others is their invariable cationic conductivity; ionic-atomic valent substances are close to solid ionic crystals in their electrochemical properties (weak degree of electrolytic dissociation for comparatively good mobility of dissociated cations), and close to liquid electrolyte solutions in nonpolar solvents according to their concentration dependence of electrical conductivity.

Institution : -

Submitted : May 29, 1954

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FD-304

USCF/Physics - Electrical conductivity

Card 1/2 Pub. 153 - 9/23

Author : Myuller, R. L.

Title : Electrical conductivity of solid ionic-atomic valent substance  
II Experimental theoretical expressions for the molar electrical conductivity of borosilicates

Periodical : Zhur. tekh. fiz., 25, February 1955, 246-255

Abstract : In the preceding work the author emphasized that cations in borosilicates are bound electrostatically with negatively ionized boron atoms or oxygen atoms of the atomic-valent grid, the energy of such electrostatic bonds being considerable (around 10 kilocalories per mole), to which is due the very low degree of electrolytic dissociation in borosilicates. In the present work he expounds a strictly founded theoretical derivation of the equation of molar electroconductivity of borosilicates after the introduction of changes that make more precise the resulting formula. He also expounds the theoretically reasoned transformation of the equation of molar electroconductivity applicable to glasses in the labile state (in the critical region of temperatures). He concludes

FD-3040

Abstract : that with change of temperature and composition of glasses one observes very considerable changes in the percentage of cations participating in the electrical conductivity, thus confirming the existence in glasses of very weak degree of electrolytic dissociation of polar structural elements and the decisive significance of the dissociation energy for conductivity.

Institution : -

Submitted : May 29, 1954



Myuller, R. D. L.

✓ Electric conductivity of solids with ionic-atomic valencies.  
 III. Polarisation by an external field. R. D. L. Myuller  
 Zhur. Tekh. Fiz. 25, 1856-60 (1955); Cf. ~~ibid.~~ ~~ibid.~~ ~~ibid.~~  
 CH The investigations are continued for borates and silicates of  
 Li, Na, and K. The polarization of such lattices with  
 ionic-atomic valencies leads to some phenomena that are not  
 encountered at the purely ionic lattices. Thus, together  
 with the elastic displacements of the bound ions in the po-  
 tential holes (sinks), there is a flowing ionic polarization of  
 the bound cations, so that they pass from one potential sink  
 into the other. Also simultaneously an orientation of the  
 polar complexes sets in, with a frequency  $1 \ll \nu \ll 10^{13}$   
 sec<sup>-1</sup>, and the fluctuation time is used to redistribute the  
 valence electrons at the structural atoms of the groups.  
 The activation of the ionic polarization explains the in-  
 crease of the dielec. loss. The mechanism of the activation  
 of the ionic polarization is discussed, and thus it is found  
 that the activation energies can be arranged in a series  
 $E_{Li} < E_{Na} < E_K$ . IV. Polarization-electrolytic phe-  
 nomena. *Ibid.*, 1687-74. Math. In borosilicate glasses  
 of definite chem. compn. there appears a stationary (residual)  
 specific elec. cond. This can be found experimentally by  
 aid of samples of active electrodes, if a concn. polarization  
 close to the electrodes is avoided. For the H-contg. glasses  
 the mobilities theoretically can be arranged in a series like  
 this:  $A_{Li} > A_{Na} > A_K$ . Werner Jacobson

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USSR/Physics - Semiconductors

FD-3131

Card 1/2 : Pyt. 153 - 6/19

Author : Myuller, R. L.

Title : Electrical conductivity of solid ionic-atomic valent substances. IV. Problem of polarizational-electrolytic phenomena

Periodical : Zhur. tekhn. fiz., 25, No 9 (September), 1955, 1567-1574

Abstract : In the preceding communication, III, the author emphasized that specific electrical conductivity as a physical quantity uniquely characterizing a substance of definite chemical composition and, first of all, of definite volumetric concentration of cations can be experimentally determined only under the condition where near-electrode concentrational polarization is absent, which is eliminated by means of inverse active anodes. In the present work the author considers only such electrical conductivity, i.e. in the case where near-electrode polarization is absent. He remarks that A. M. Venderovich (ibid., 23, 282, 1953) and G. I. Skanavi (Fizika dielektrikov, Moscow, 1950) extensively investigated the problem of drop in initial current with time in consequence of formation of volumetric polarization when surface-electrode polarization is absent. The author concludes that stationary ("settled," "residual") specific electrical conductivity is physically the most strictly based quantity for specific electrical conductivity that uniquely characterizes borosilicates of given chemical composition (and of preliminary thermal treatment), and is experimentally determined by means of reverse active electrodes under the condition where

Card 2/2

FD-3131

near-electrode concentrational polarization is absent. Nonstationary electrical conductivity, including conductivity determined by an alternating current, is in most cases a quantity that does not uniquely characterize the substance of given chemical composition. Correction for decreasing the external field by polarization phenomena changes slightly the theoretical value of the power quantity  $p_t$  in the expression for molecular electrical conductivity. Approximate computations of free energy of electrolytic dissociation in vitreous borates of alkali metals in nonpolar and in polar media indicate the lowering action of self-solvational effect upon free energy of electrolytic dissociation. The author also established a series of mobilities for boron glasses:  $\Lambda(\text{Li}) > \Lambda(\text{Na}) > \Lambda(\text{K})$ . Twelve references: e.g. R. L. Myuller, "The vitreous state and the electrochemistry of glass," Dissertation, Leningrad, 1940.

Institution : --

Submitted : March 19, 1954

Mueller, R L

*ML*

1602. The electrical conductivity of ionic solids. V. Electrical conductivity of borosilicates in the stable state. R. L. MUELLER (Zhur. Tekh. Fiz., 25: 1868, 1955; from Amer. Chem. Abstr., 59: 1396, 1956). Measurements were made of the electrical conductivities of borate, silicate, and borosilicate glasses of Li, Na, K, Rb, Cs, Ag, Ba, and Zn, and were compared with measurements by others. The equation originally obtained for the molar conductivity of borosilicates, as derived by statistical considerations, is correct. For the stable borosilicates the energy magnitude  $\Delta G = 2.4R$  can be calculated by aid of the temperature coefficient  $f$  from the empirical equation of the conductivity, which value in turn serves to calculate  $\Delta G$ , the free energy of the electrolytic dissociation of the cations. It is then noted that the dissociation in the system proceeds without entropy change ( $\Delta S = 0$ ).

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*fr* *ML*

FD-313C

USSR/Physics - Semiconductors

Card 1/2

Pub. 153 - 5/19

Author : Myuller, R. L.

Title : Electrical conductivity of solid ionic-atomic valent substances.  
III. Problem of polarization in an external field

Periodical : Zhur. tekhn. fiz., 25, No 9 (September), 1955, 1956-1566

Abstract : The author finds that the polarization of ionic-atomic valent bodies is characterized by peculiarities absent in purely ionic crystalline bodies, namely by: activated ionic polarization of bound cations as a result of their transition from one potential well to another of same structural element, and orientation of polar complex occurring with frequencies much less than  $10^{13}$ /sec and much greater than unity as a result of valent electrons in structural atomic groups, occurring during fluctuation in distribution. The activated ionic polarization explains the increased dielectric losses at low temperatures in borosilicates poor in alkali oxides and in substances allied to them. Orientation of fluctuating polar ionic-atomic complexes explains most probably the anomalously high polarizability and dielectric losses in bodies with structural perovskites and rutile. The existence of critical region of anomalously increased dielectric losses is due to the disappearance

Card 2/2

FD-3130

of rigid valent bonds at high temperatures and to the difficulty of fluctuation of oriented polar complexes at low temperatures in consequence of lowering of intensity of thermal valent oscillations.

Institution : --

Submitted : March 19, 1954

*Myuller, R.L.*

Category : USSR/Electricity - Dielectrics

G-2

Abs Jour : Ref Zhur - Fizika, No 1, 1957 No 1506

Author : Myuller, R.L.

Title : Electric Conductivity of Solid Ionic-Atomic-Valent Substances. VI. Electric Conductivity of Borosilicates in Labile State.

Orig Pub : Zh. tekhn. fiziki, 1955, 25, No 14, 2428-2439

Abstract : A critical review of methods used to determine the characteristic values of electric conductivity of glasses in the labile state. These values are given and it is established that in the labile state all these values are functions of the temperature. The causes of variations of electric conductivity during the hardening and crystallization of glass are also briefly examined (see also Referat Zh. Fizika, 1956, 25944).

Card : 1/1

Category : USSR/Electricity - Dielectrics

G-2

Abs Jour : Ref Zhur - Fizika, No 1, 1957 No 1507

Author : Myuller, R.L.

Title : Electric Conductivity of Solid Ionic-Atomic-Valent Substances. VII. Concerning the Temperature Dependence of the Electric Conductivity of Crystals

Orig Pub : Zh. tekhn. fiziki, 1955, 25, No 14, 2440-2446

Abstract : An experimental-theoretical investigation shows that the electric conductivity of crystalline borosilicates is caused by the motion of ions in the crystalline lattice over a wide range of temperatures. At low temperatures the electric conductivity is determined by the number of vacant sites formed as a result of the emergence of the ions to the surface of the crystallites. Such a transition is effected without a change in the entropy term. The poor reproducibility of the low-temperature electric conductivity is attributed to the dependence of the energy of formation of the vacant sites on the degree of dispersion of the substance. At high temperature the electric conductivity is related to the number of vacant sites appearing when the ions pass into the interstices, and this is accompanied by an entropy effect. The energy of the entropy formation of the vacant sites diminishes with the temperature. See also Referat. Zh. Fizika, 1956, 1506.

Card : 1/1



117.00000, R. L.

USSR/Chemical Technology. Chemical Products and Their Application -- Silicates.  
Glass. Ceramics. Binders, I-9

Abst Journal: Referat Zhur - Khimiya, No 2, 1957, 5158

Author: Myuller, R. L.

Institution: None

Title: On Vitreous State of Matter

Original

Publication: Steklo i keramika, 1956, No 4, 11-14

Abstract: Consideration of chemical classification of glass-forming substances that characterizes them in the liquid state from the standpoint of capability to form glass. It is pointed out that of substantial importance is not only a characteristic of the final state of the glass, but an atomic-kinetic characteristic of glass-forming body is needed during all the intermediate stages of its cooling. Glass is nonequilibrium solution supercooled to the stabilization temperature of certain complex structures that are intermediate between liquid state and crystalline equilibrium state. Glass of a given composition

Card 1/2

USSR/Chemical Technology. Chemical Products and Their Application -- Silicates.  
Glass. Ceramics. Binders, I-9

Abst Journal: Referat Zhur - Khimiya, No 2, 1957, 5158

Abstract: must be considered during the development of its transitory states,  
taking into account the initial liquid state and the not yet attained  
crystalline state.

Card 2/2

Myuller, R. L.

Subject : USSR/Chemistry AID P - 3924  
Card 1/1 Pub. 152 - 7/19  
Author : Myuller, R. L.  
Title : Valence theory of viscosity and fluidity in the critical temperature region for high-melting glass-forming substances.  
Periodical : Zhur. prikl. khim. 28, 10, 1077-87, 1955  
Abstract : On the basis of experimental data on the viscosity of silicates, values were established for the relation of temperature to the free energy of activation, as well as the entropy and heat of activation. Three tables, 3 diagrams, 9 references, 8 Russian (1945-55).  
Institution : Kemerovo Mining Institute  
Submitted : Mr 17, 1954

~~MULLER, R.L.~~ MULLER, R.L.

SUBJECT USSR / PHYSICS  
AUTHOR MULLER, R.L. CARD 1 / 2 PA - 1815  
TITLE Electric Conductivity of Solid Ion-Atomic Valence Substances.  
VIII. The Dependence of the Electric Conductivity of Boron- and  
Silicate Glasses on Concentration.  
PERIODICAL : Zurn.techn.fis.26, fasc.12, 2614-2627 (1956)  
Issued: 1 / 1957

On the occasion of the analyses of an electrolytic dissociation which is in thermodynamic equilibrium, the fact that the structure of the glass as a whole is thermodynamically not in equilibrium was neglected and the structural processes on the occasion of an electrolytic dissociation within the critical domain of temperature is underestimated. For these reasons it has hitherto not been possible to explain the physical nature of the observed dependence of the electric conductivity of glass on concentration. In the present work the dependence of the molar electric conductivity of boron silicates  $\Lambda = C \exp \left( - \frac{\Psi_0}{2RT} \right)$  on the concentration of the metallic ions was investigated in consideration of structural chemical peculiarities. The dependence of molar electric conductivity on concentration is determined in first approximation by the dependence of "dissociation energy"  $\Psi_0$  (in kcal per mol this is the energetic quantity of electric conductivity and serves as an approximated measure for the free energy of electrolytic dissociation). An exception is formed by the silicates of lead which must still be examined. On the basis of the modification of  $\Psi$  the molar

Mueller, R. L.

✓ The chemical structure of high-melting glasses. R. L. Mueller (Mining Inst., Kemerovo, U.S.S.R., *Zh. Fiz. Khim.*, 50, 196-20 (1956). The recommendation is made that the compn. of vitreous materials be considered in the light of the existing views on nonpolar and polar substances in the mixts, and the advantages of this approach are illustrated with  $PbO-N_2O_5$  glasses. W. M. Steinhilber

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W. M. Steinhilber

SOV/112-58-2-1861

Translation from: Referativnyy zhurnal, Elektrotehnika, 1958, Nr 2, p 10 (USSR)

AUTHOR: Myuller, R. L.

TITLE: Polarization of Atomic-Ionic Dielectric in an External Field  
(O polyarizatsii atomno-ionnogo dielektrika vo vneshnem pole)

PERIODICAL: Izv. Tomskogo politekhn. in-ta, 1956, Vol 91, pp 239-246

ABSTRACT: A review of papers on the structure of glass is presented. It is noted that existing statistical theories of physical properties of glass are somewhat abstract, as they do not allow for real physical and chemical structure of glass. High quasi-elastic forces of covalently linked atoms of glass-forming oxides determine the peculiarities of amorphous structure of glasses, as well as their physical and chemical properties. It is planned to replace mechanical examination of the reticular structure of refractory inorganic aluminum-boron-silicate with an analysis of phenomena from the viewpoint of the atomic, valent, and ionic bonds among elementary particles. The theory of thermal ionic polarization does not depict the mechanism of the process, because it

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Polarization of Atomic-Ionic Dielectric in an External Field

remains unclear whether cations make "considerable trips within such weak packings" without taking part in the through conductivity, or if their displacements are comparable with the dimensions of the particles themselves. The nature of potential values is not clear either. The ionic-atomic-valence theory suggested by the author offers answers to all above questions and presents chemical structural grounds for a theory of thermal ionic polarization. Bibliography: 42 items. (Gorny inst, Kemerovo (Mining Institute), Kemerovo.

A.M.A.

Card 2/2

SOV/112-58-2-1870

Translation from: Referativnyy zhurnal, Elektrotehnika, 1958, Nr 2, p 12 (USSR)

AUTHOR: Myuller, R. L.

TITLE: Effect of Metallic Ion Concentration on Electric Conductance of Borosilicates (Zavisimost' elektroprovodnosti borosilikatov ot kontsentratsii metallicheskikh ionov)

PERIODICAL: Izv. Tomskogo politekhn. in-ta, 1956, Vol 91, pp 353-361

ABSTRACT: Electric conductance of borosilicates is determined by concentration of ionized component parts of ion-atom-valence structural lattice; the influence of concentration on dissociation energy of ionogenic polar lattice points is of decisive importance. A slight change of molar electric conductance of borosilicates at low concentrations of alkaline ions is noted, as well as a steep rise of electric conductance at high concentrations. With low concentrations, the electric conductance is due to motion of dissociated cations outside the polar medium; with high concentrations, a through conductance is observed in the polar medium of ionized components of the valent atomic lattice. Intermediate

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**Effect of Metallic Ion Concentration on Electric Conductance of Borosilicates**

concentration region corresponds to the appearance of the through conductance due to formation of continuous bonds between ionized elements of borosilicate lattice. A new mathematical expression is suggested for the effect of concentration on the dissociation energy of alkaline cations in the borosilicate polar medium; also a generalized formula is suggested for the molar electric conductance of borosilicates. Bibliography: 27 items. Gorny in-t (Mining Institute), Kemerovo.

M. D. M.

Card 2/2

R. L. MYLLER

4  
4-47  
A. Solution of palladium in nitric acid. Specific peculiarities of the solution reaction for palladium metal. R. L. Myller and B. Ya. Alanaeva-Bureaup. *Zhur. Neorg. Khim.* 7, 1309-16 (1967).—The kinetics of the soln. of powd. Pd in HNO<sub>3</sub> was studied for different temps. and rates of stirring. The acid concn. (1.8-5.7N) and the rate of stirring have no noticeable effect on the rate of soln. The temp. coeff. for the rate of soln. is unusually high (20%/degree). The rate increased by a factor of 1800 when the temp. is increased by 50°. It was postulated that the soln. of Pd in HNO<sub>3</sub> is nondiffusive in character. The theoretical aspects of the process were discussed. J. Rovtar Leach.  
dim //

MYULLER, R.L.

Kinetics of gas formation by coals associated with the problem of metamorphism. R. L. Muller and V. S. Popov. *Zhur. Priklad. Khim.* 30, 271 (1957); *Ch. C.A.* 49, 7963, 12900c. -- The homogeneous solid phase process of coal metamorphism at low pressures is given as  $2-7$  kcal./mol.  $E_2 < E_1$ .  $5. E_1 < E_2 = 60-70$  kcal./mol., where  $E_2$  may be the energy of rupture of a single C-C or C-O bond that detaches the upper energy limit of the energy of activation  $E_1$  of isomeric group transformation in the solid phase.  $E_1$  also is given by  $E_1 = RT \ln \nu t - \ln \{ \nu_1 / \nu_2 \}$ , where  $\nu$  is the no. of C atoms in a given mass of coal,  $\nu = 10^{12}$ /sec. is the frequency of valence deformation-vibration, and  $t$  is the time. When the transformation of coal is represented by  $C_{10}H_8N \rightarrow C_{10}H_6O_2N + 4CO_2$  and  $C_{10}H_{10}O_2N \rightarrow C_{10}H_8O_2N +$

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CH<sub>4</sub>. It is noted that the rates of CH<sub>4</sub> formation at  $T = 308, 323,$  and  $348^\circ K.$  are 0.3, 9300, and 1.8 million cu.in./day. This is in close agreement with the rates of CH<sub>4</sub> formation in coal deposits by processes of coal metamorphism and the rate of CH<sub>4</sub> formation as an exponential function of the abs. temp. and the depth of the coal horizon. These support the derived equation and the assumed mechanism of CH<sub>4</sub> formation in coal deposits. I. Benicowitz.

MT

MYULLER, R.L.

Relationship between the electric conductivity and viscosity of  
glasses. *Fiz. tver. tela* 1 no.2:346-347 F '59.

(MIRA 12:5)

(Glass--Electric properties) (Viscosity)

5(4)

SOV/54-59-3-17/21

AUTHORS: Myuller, R. L., Markova, T. P., Repinskiy, S. M.

TITLE: ~~\_\_\_\_\_~~ Dissolution Kinetics of Germanium in Nitric Acid

PERIODICAL: Vestnik Leningradskogo universiteta. Seriya fiziki i khimii, 1959, Nr 3, pp 106 - 118 (USSR)

ABSTRACT: Pickling of the germanium monocrystal surface is necessary for the production of germanium transistors. The pickling agents contain oxidation components, e.g.  $\text{HNO}_3$ . An oxidation of germanium was assumed to take place in pickling, followed by a dissolution of the germanium oxide. The Soviet authors Yefimov and Yerusolimchik are mentioned in connection with a review of publications on the mentioned process. The kinetics of the dissolution of germanium in nitric acid is investigated here for the purpose of explaining processes in connection with pickling. The function between the dissolution rate of germanium in nitric- and nitrous acid and concentration, temperature and intensity of stirring is investigated. The investigation method was similar to that employed for glass-like systems (Ref 5).  
Each individual investigation was carried out at constant temper-

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Dissolution Kinetics of Germanium in Nitric Acid

SOV/54-59-3-17/21

ature. In preliminary pickling with nitric acid the germanium monocrystals were intensively treated until a reproducible and constant rate of solution had been attained (Fig 1). The monocrystals are lamellae with parallel orientation towards the crystallographic (111)-plane. Figures 1,2,3,4 show the germanium surface after intensive pickling, short preliminary pickling, mechanical treatment and treatment with aquaregia. The rate of dissolution was determined according to the formula

$$w = \frac{1}{72.60 S} \frac{\Delta g}{\Delta t} \text{ .gramsatom/cm}^2\text{sec} \quad (S - \text{total surface of the}$$

sample,  $\Delta g$  - amount by weight of germanium solving in the time  $\Delta t$ ). With a retarding rate of dissolution in the simplest case

$wN = C \cdot e^{-E/RT}$  holds for  $w$ ;  $C = 1.3 \cdot 10^{27}$  atom/cm<sup>2</sup>sec. The value of  $C$  is reduced by diffusion of the solving agent in the germanium surface. Germanium does not solve in the absence of oxidizing agents. From investigations of the rate of dissolution at varying concentration of  $\text{HNO}_3$ , of temperature and of intensity of stirring the following resulted: high concentration

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Dissolution Kinetics of Germanium in Nitric Acid

SOV/54-59-3-17/21

increases the rate of dissolution, a subsequent addition of  $\text{HNO}_3$  without stirring causes, however, a slowing down of dissolution. When stirring, a further addition of  $\text{HNO}_3$  increases the rate of dissolution and the process obtains an autocatalytic nature. An accumulation of reduction products of  $\text{HNO}_3$  on the boundary layer of the Ge-solution likewise increased the rate of dissolution. The values for  $w$  could be well reproduced and agreed with those of reference 2. The following dissolution mechanism of Ge is given: An oxidation of germanium is followed by subsequent hydration of the oxidation products. The oxidizing agents diffuse from the solution to the Ge-surface and the hydrates forming diffuse from there into the solution. The upper and lower limit of the rate of dissolution were determined experimentally and theoretically and found to be

$P_w = \left( - \frac{1}{\log w} \right) = 7$  and  $10$ . The upper limit corresponds

Card 3/4

to the diffusion rate of the hydrates into the solution, and

Dissolution Kinetics of Germanium in Nitric Acid

807/54-59-3-17/21

the lower limit to the limit rate of the diffusion of molecular oxygen from the air through the solution on the germanium surface. Stirring causes a certain reduction of these boundary values. The temperature coefficient of the rate of dissolution increases with rising temperature. There are 11 figures, and 17 references, 7 of which are Soviet.

SUBMITTED: May 11, 1959

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5(2)

SCV/78-4-1-1/48

AUTHORS:

Myuller, R. L., Kostrikin, V. M.

TITLE:

The First Attempt at Investigating the Chemical Kinetics of Ruthenium Distillation (Pervyy opyt izucheniya khimicheskoy kinetiki otgonki ruteniya)

PERIODICAL:

Zhurnal neorganicheskoy khimii, 1959, Vol 4, Nr 1, pp 25-27 (USSR)

ABSTRACT:

The kinetics of the distillation process of ruthenium during oxidation by sodium chlorate was investigated. The initial solution of ruthenium was produced by chlorinating the metallic alloy. The distillation was carried out in the air current at a rate of 1.7 l/min. The distillation of ruthenium depends considerably on the concentration of sodium chlorate. If the sodium chlorate content is raised by 7 to 8 times, the distillation percentage of ruthenium rises by about 10000 times. On a rise of the acidity of the hydrochloric acid solution from 0.1 to 0.5 the distillation drops to 1/20. The dependence of the logarithm of the effective rate constant of ruthenium distillation on the logarithm of the initial concentration of sodium chlorate and the initial concentration of hydrochloric acid were investigated and are shown in figures 2 and 3. At room temperature

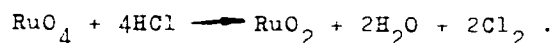
Card 1/3

SCV/78-1-1-3/48

## The First Attempt of Investigating the Chemical Kinetics of Ruthenium Distillation

the rate of distillation rises by about 8% on 1°C temperature rise. The effective activation heat lies at  $26.5 \leq \Delta H \leq 52.5$  kcal/mol.

The rate of ruthenium distillation is approximately proportional to the sixth power of the initial concentration of sodium chlorate. With a hydrochloric concentration  $> 0.2$  n the rate of ruthenium distillation is in the inverse proportion to the approximately fourth power of the initial solution of hydrochloric acid. The fourth power of the reaction with hydrochloric acid is probably caused by the reduction process of ruthenium:



The rate of ruthenium distillation from the solution rises with an increase of ruthenium tetraoxide content, a decrease of hydrochloric acid concentration and an intensification of the air current. There are 3 figures and 4 tables.

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The First Attempt of Investigating the Chemical Kinetics of Ruthenium  
Distillation

SOV/78-4-1-5/48

ASSOCIATION: Leningradskiy gosudarstvennyy universitet im. A. A. Zhdanova  
(Leningrad State University imeni A. A. Zhdanov)

SUBMITTED: October 20, 1957

Card 3/3

MULLER, R.L.; MARKOVA, T.P.; HEPINSKIY, S.M.

✓ Kinetics of the dissolving of germanium in nitric acid. Vest.  
LNU 14 no.16:106-118 '59. (MIRA 12:10)  
(Germanium) (Nitric acid)

Веществом к инфракрасной P. fizika dielektriki Ed 1962

Физика диэлектриков, труды студенческого семинара. (Physics of Dielectrics. Transactions of the Student Seminars on the Physics of Dielectrics) Moscow, Izdatvo AN SSSR, 1960. 224 p. Extra slip inserted. 5,000 copies Printed.

Sponsoring Agency: Akademiya nauk SSSR. Fizicheskii Institut Imeni P.N. Lebedeva.

Ed. of Publishing House: Ye.L. Starokhankaya, Tech. Ed.: I.M. Dorokhina, Editorial Board: (Resp. Ed.) G.I. Smanov, Doctor of Physics and Mathematics (Deceased), and E.V. Filippova, Candidate of Physics and Mathematics.

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

CONTENTS: The Second All-Union Conference on the Physics of Dielectrics held in Moscow at the Fizicheskii Institut Imeni P.N. Lebedeva (Physics Institute) Imeni P.N. Lebedeva in 1963 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. Photoelectrics, 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, No. 1, pp. 2, 1962. No personalities are mentioned. References accompany each report.

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Handwritten signature: Myukler, R.L.



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B022/B007

AUTHORS: Goryunov, A. A., Myuller, R. L., Kapustina, L. K.

TITLE: The Rate of the Removal of Ruthenium Tetraoxide From Aqueous Solutions by Means of an Air Current

PERIODICAL: Vestnik Leningradskogo universiteta. Seriya fiziki i khimii, 1960, No. 2, pp. 104-111

TEXT: In an earlier paper (Ref. 1), which is the first attempt at investigating the kinetics of distilling-off ruthenium in form of ruthenium tetraoxide, the distilling-off of ruthenium was found to consist of two independent processes, viz. the chemical process of the oxidation of ruthenium to  $Ru^{8+}$ , and of the physical process of the removal of the  $RuO_4$  formed, either by direct evaporation or by means of an air flow blown through the solution. In the presence of a reducing agent a reversible reduction process of  $RuO_4$  to lower oxides may occur. In the present case, the reducing agent used was hydrochloric acid. The investigation under review concerns the physical process of removing  $RuO_4$  by means of an air

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The Rate of the Removal of Ruthenium Tetraoxide  
From Aqueous Solutions by Means of an Air  
Current

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current from an aqueous solution in the absence of a reducing agent. The kinetics of the process mentioned in the title was investigated in an apparatus consisting entirely of glass (Fig. 1). Among other things, also a Komovskiy pump was used. Five series of measurements were carried out at temperatures of about 20, 40, 60, 80, and 100°C, and a velocity of air flow of about 5, 15, 30, 45 and 60 l/h. Figs. 2 and 3 show the results obtained for the rate of the removal of RuO<sub>4</sub> from solutions of nitric acid in form of diagrams. A summary of the experimentally determined half-periods and of the rate constants of the removal of RuO<sub>4</sub> from nitric acid solutions at various velocities of the air flow and temperatures of the reaction mixture is given (Table 1). The temperature dependence of the logarithm of the rate constant of the removal of RuO<sub>4</sub> from nitric acid solutions with an air current at different velocities of the air flow is given in Fig. 4. Table 2 gives the values of the coefficients A, B, of the activation energy E, and of the pre-exponential factor C<sub>0</sub> for the process mentioned. On the basis of the results obtained it may be concluded that the limitation of the process of removing RuO<sub>4</sub> by the evaporation rate of water under the non-steady conditions in the quick passage of air through

✓ B

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The Rate of the Removal of Ruthenium Tetroxide  
From Aqueous Solutions by Means of an Air  
Current

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the solution is absolutely possible. As to the decrease in activation energy with an increase in the quantity of air blown through, the latter may be explained by the use of non pre-heated air, contrary to the conditions used by M. V. Tobvin and Ye. V. Savinova (Ref. 7). There are 4 figures, 2 tables, and 7 references, 4 of which are Soviet.

✓ B

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AUTHOR:

Myuller, R. L.

S/181/60/002/06/47/050  
B006/B056

TITLE:

The Electric Conductivity of Solid Ion-atom-valency-substances. IX. The Degree of Dissociation and the Mobility of Cations in Glasses With a Single Type of Ions

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 6, pp. 1333-1338

TEXT: In the present paper the author endeavors theoretically to calculate the mobility of the ions  $w_0$  in a glass having only one kind of ions.  $w_0$  does not depend on the chemical composition of the glass and changes only little with temperature. It is essentially dependent on dissociation energy. The degree of the dissociation of the ions in the glass is determined by  $\Psi_\phi$ , a quantity, the numerical value of which is a near approach to the dissociation energy of the ions in the glass. For boron silicate glass with univalent cations,  $w_{0T}$  is of the order of  $5.6 \cdot 10^{-2}$  cm<sup>2</sup>/sec.v.  $\Psi_\phi$  depends on the concentration of the polar

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The Electric Conductivity of Solid Ion-atom-  
valency-substances. IX. The Degree of Dissocia-  
tion and the Mobility of Cations in Glasses  
With a Single Type of Ions

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B006/B056

structural nodes, and with respect to the glasses under investigation,  
 $\Psi_\phi$  in a stable state does not depend on temperature. As investigations  
show,  $\Psi_\phi$  decreases with increasing content of polar nodes in the glass.  
Theoretical considerations are confirmed by the experimental results.  
The theoretical value of  $(w\alpha)_T$  is determined by equation (3) ( $\alpha$  - degree  
of dissociation); the experimental value  $(w\alpha)_e$  is calculated from  
measurements of the specific electric conductivity according to  
equations (4) and (6), respectively. Experimental values, taken from  
Refs. 3-5, are given for boron silicate- and silicate glasses<sup>12</sup> in  
Tables 1 and 2. The results obtained are compared and discussed. It  
may be assumed that the decrease of  $\Psi_\phi$  with a growing content of  
polar nodes is connected with the solvating effect of the polar nodes  
upon the dissociated ions and vacancies. The nature of the quantities  
 $P_e$  (defined by equation (6)) and  $\Psi_\phi$  does not change when the glass

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X

The Electric Conductivity of Solid Ion-atom-  
valency-substances. IX. The Degree of Dissocia-  
tion and the Mobility of Cations in Glasses  
With a Single Type of Ions

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B006/B056

passes from the stable solid state into the liquid state; Table 3 shows  
this for sodium- and potassium silicate glass. P. P. Kobeko and O. V.  
Mazurin are mentioned. There are 3 tables and 12 references: 9 Soviet,  
1 American, 1 British, 1 Dutch, and 1 French.

ASSOCIATION: Leningradskiy gosudarstvennyy universitet im. A. A.  
Zhdanova (Leningrad State University imeni A. A. Zhdanov)

SUBMITTED: October 1, 1958 (initially) and June 30, 1959 (after  
revision)

Card 3/3

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S/181/60/002/06/48/050  
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AUTHOR: Myuller, R. L.

TITLE: The Electric Conductivity of Solid Ion-atom-valency-  
substances. X. The Electric Conductivity of Glasses Which  
Contain Two Types of Alkali Ions

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 6, pp. 1339-1344

TEXT: If in a glass the half of all alkali ions of one type is re-  
placed by such of another type, a considerable reduction of electric  
conductivity and of dielectric losses may be observed. This effect has  
already repeatedly been experimentally investigated, and the attempt  
was also made theoretically to explain the observed minima of conductivity  
and of the dielectric losses. There was, however, no general theory,  
and to set up such a theory the present paper makes a contribution. The  
paper contains a critical analysis of the influence exerted by ions  
upon the electric conductivity by using results obtained by earlier in-  
vestigations. Tables 1 and 2 represent the ion concentrations for  
various glasses (which are characterized by numbers). Fig. 1 shows th-

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dependence of the conductivity of sodium borate glasses on the volume concentration of sodium ions; here it is found that e.g. the introduction of about 40 weight% barium oxide into the glass reduces the conductivity of the latter at 1000 [Na] = 10 to 100th. Fig. 2 shows the dependence on conductivity (here always denoted by  $\kappa$ ) of sodium borate glasses of the concentration (in mole %) of sodium oxide. Each of the two diagrams contains two curves, of which the one holds for a glass without, and the other for a glass with barium oxide. The curve of the former shows a weakly marked minimum, whereas in the latter case  $-\log \kappa$  increases monotonically with increasing sodium content. Fig. 3 shows  $-\log \kappa = f([\text{Na}_2\text{O}])$  with and without barium oxide. Here the two curves overlap at 8 weight%  $\text{Na}_2\text{O}$ . In the following, the author discusses the minimum effect in detail, especially the results obtained by investigations carried out by German authors. He points out that an explanation of the minimum effect in the case of two-cationic glasses by spatial-mechanical slowing-down cation motion is incorrect. The minimum effect may, however, be explained by the association of polar

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nodes (cf. papers IX and XI of this series). The author mentions N. P. Bogoroditskiy, I. D. Fridberg, G. I. Skanavi, K. I. Martyumov, A. F. Val'ter, and M. A. Gladkikh. There are 3 figures, 3 tables, and 13 references: 10 Soviet, 8 German, and 1 American.

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AUTHORS: Myuller, R. L.

TITLE: The Electric Conductivity of Solid Ion-atom-valency  
Substances. XI. The Degree of Dissociation and the Mobility  
of Cations in Glasses Which Contain Two Types of Ions

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 6, pp. 1345-1352

TEXT: In the present paper the author derives an equation for the molar electric conductivity of glasses<sup>o</sup> containing two kinds of monovalent cations. According to this equation, electric conductivity, in the case of a differentiated association of polar structural nodes, is practically limited by the flux of cations of that type which predominates in the glass. The existing experimental data confirm that no spatial-mechanical hindrance occurs in the motion of cations in complex borate- and silicate glasses. Experimental data concerning the electric conductivity of two-cationic borate- and silicate glasses confirm the existence of an entropy effect in the dissociation of cations, which causes a coupling between the

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latter and the growth of  $P_e$  and  $\Psi_\phi$  according to the compensation law  
(Ref. 5). An analogous correlation between  $P_e$  and  $\Psi_\phi$  may be observed also  
in glasses within the critical temperature range, and the connection  
existing within this range with the occurrence of an entropy factor of  
dissociation is known (Ref. 6). Tables 1 and 3 contain a large number of  
experimental data concerning borate glasses, and Table 2 contains such  
concerning sodium-potassium-silicate glasses. The data are discussed in  
detail. In transition from pure single-cationic glasses to complex two-  
cationic glasses a dispersion of the associated polar groupings may be  
observed, which cause an increase of the dissociation energy of ions and of  
the statistical entropy factor. In borate glasses which, at the same time,  
contain polarized silver- and thallium ions, a reciprocal capture of polar  
structural nodes causes them to be mixed, which, in turn, causes the  
minimum effect of electric conductivity to vanish; here, the quantities  
 $P_e$  and  $\Psi_\phi$  do not depend on the concentration ratio of ions. (The electric

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conductivity of borate- and alkali silicate glasses containing two kinds of cations, the concentration of which is  $\approx 8 \cdot 10^{-3}$  mole/ml, shows a minimum effect whose physical nature is determined by  $P_e = B_{10} \cdot \lg[M]$  and

$\Psi_\phi = 4.6 A_{10} R$ , where  $A_{10}$  and  $B_{10}$  are the coefficients of the conductivity equation  $\ln \kappa = -A/T + B$  converted to the decadic logarithmic system [ $M$ ] - cation concentration). O. V. Mazurin, Ye. S. Borisovskiy and Frenkel' are mentioned. There are 3 tables and 9 references: 8 Soviet and 1 German.

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