KAZANKOV, S., instruktor-aviamodelist (g.Moskva); POCHEPAYEV, V., chempion Moskvy po kordovym skorostnym modelyam (g.Moskva); MASHOVETS, S., krushkovets gorodskogo Doma pionerov (g.Moskva); KUNIN, S., krushkovets gorodskogo Doma pionerov (g.Moskva)

Preparing for new competitions. Kryl.rod. 11 no.11:3 N '60. (MIRA 13:10)

(Moscow--Airplanes--Models)

FD-3127

USSR/Physics - Superconductors

MASH VETS, T.V.

Card 1/2 Pub. 153 - 2/19

Author : Mashovets, T. V.; Ryvkin, S. M.

Title : Influence of heat treatment upon lifetime of non-ground current carriers in germanium (the kinetics of the formation of defects during heat treatment)

Periodical : Zhur. tekh. fiz., 25, No 9 (September), 1955, 1530-1543

Abstract : The authors investigated the influence of heat treatment at relative "low" temperatures (400-550°C) upon the lifetime of non-ground current carriers in germanium. The lifetime decreases with increase of temperature and duration of the heat treatment, which is explained by the occurrence of defects that play the role of centers of recombination. On the basis of a study of the kinetics governing the process of the occurrence the authors obtain data on their energy structure. They show that the process governing the occurrence of defects in the investigated region of temperatures differs from the process governing the occurrence of "thermal defects" ordinarily appearing in germanium at higher temperatures. The authors' aim has been to investigate the occurrence during heat treatment of so called thermal traps (recombination centers) and also the nature (i.e. energy structure) of defects associated with these

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FD-3127

traps. They thank D. N. Nasledov for his interest and also V. M. Tuchkevich and A. A. Lebedev for preparation of specimens for measurement. Fourteen references, mostly Western.

Institution : --

Submitted : February 28, 1955

MASHOVETS, T. V.

MASHOVETS, T. V.: "The effect of hot working on the life expectancy of non-basic current carriers in germanium." Acad Sci USSR. Leningrad Physicotechnical Inst. Leningrad, 1956. (Dissertation for the Degree of Candidate in Physicomathematical Sciences.)

SO: Knizhnaya Letopis', No. 26, 1956

PA - 2118

AUTHOR MASHOVETS, T.V., RYVKIN, S.M.

TITLE On the Nature of Recombination Centers created in Germanium on the Occasion of Heat Treatment at "Low Temperatures" (O prirode tsentrov rekombinatsii, voznikayushchikh v germanii pri "nizkotemperaturnoy" termoobrabotke).

PERIODICAL Zhurnal Tekhn.Fiz., 1957, Vol 27, Nr 2, pp 238-241 (U.S.S.R.)

Received 3/1957 Reviewed 3/1957

ABSTRACT First reference is made to the authors' work in Zhurn.Tekhn.Fiz., 1955, Vol 25, p 1530 and its results are summarised. It was found that the processes of the creation of thermodefects in Germanium within the range of "higher" and "lower" temperatures differ. It remained unexplained with what (the admixtures or with structural defects) the low temperature thermocenters of recombination investigated by the authors are connected. To find this out was the task of the present work. Above all it was necessary to determine the position of the levels of the low temperature thermocenters of recombination in the energetical scheme of germanium. This was accomplished by investigating the dependence of life on temperature. It may be concluded that the defects, with which the low temperature recombination centers are connected, are copper atoms. The connection between the defects and the copper atoms was checked in the course of a further series. Results obtained for two samples are shown in form of a table. Summary: 1) The low temperature thermocenters of recombination which are created in consequence of heating at 450 - 550°C and of a subsequent hardening, are connected with a copper-lead admixture.

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PA - 2118

On the Nature of Recombination Centers created in Germanium on the Occasion of Heat Treatment at "Low Temperatures".

2) In view of the fact that the recombination centers are uniformly distributed within the entire volume of the sample, it must be assumed that a growth of their concentration with temperature is due to the change of the solubility of copper and not to their diffusion from outside.
3) The center-forming energy $U_0 \simeq 1.5$ eV, which is determined by the dependence of the steady concentrations of the recombination centers on temperature, is an activation energy for the solution process of the copper. 4) The modification process of the solubility of copper is determined by other and minor time constants than the process of copper diffusion. 5) The $U_s \simeq 2.0$ eV and $U_1 \simeq 3.5$ eV determined in the previous (Zhurn.Tekhn.Fis.1955, Vol 25, p 1530) work characterise the position of the copper atom in germanium in the state of a solid solution (U_s) and outside the solution (U_1). It is, by the way, possible that the aforementioned energies characterise just the germanium atom in the internode space and in the node, if it is assumed that, for the formation of a recombination center, the copper atom must occupy a place in the node instead the germanium. (1 illustration)

ASSOCIATION	Physical-Technical Institute of the Academy of Science of the USSR, Leningrad.
PRESENTED BY	
SUBMITTED	4. 10. 1956
AVAILABLE	Library of Congress.
Card 2/2	

AUTHOR: Mashovets, T. V. 57-28-6-2/34

TITLE: On Recombination on Three Levels of Copper Atoms in Germanium in Consideration of the Statistics of Their Being Filled With Electrons (O rekombinatsii na trekh urovnyakh atomov medi v germanii s uchetom statistiki ikh zapolneniya elektronami)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 6, pp. 1140-1150 (USSR)

ABSTRACT: At present two methods of purifying Germanium from copper by means of thermal treatment are known:
1) By heating the germanium in the presence of some elements in which the solubility of copper is greater than in germanium (Sn, Pb, Au) (references 2 and 3).
2) By heating by the passage of a current through the germanium sample. In this case the copper is electrolytically removed into the electrodes (references 4 and 5). In the present paper the author experimentally investigated the influence exercised by "ordinary" thermal treatment upon recombination. Summary: 1) On the basis of

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On Recombination on Three Levels of Copper Atoms in Germanium in Consideration of the Statistics of Their Being Filled With Electrons

57-28-6-2/34

assuming a reciprocal successive filling up of the 3 acceptor levels of the copper admixture in germanium the dependence of the position of the Fermi level μ and of the specific resistance ϱ on the concentration of copper N_a was calculated for a donor concentration of $N_d = 5 \cdot 10^{13} cm^{-3}$. 2) It is assumed that the influence exercised by the thermal treatment of germanium under "usual" conditions is reduced to the increase of the concentration of the substituting copper atoms. 3) It was shown that by comparing the theoretical and experimental dependences of $\tau = f(N_a)$ 6 capture cross sections (3 for electrons and 3 for holes) can in principle be determined on the 3 levels of the copper atoms. As, however, the contribution made by level I towards recombination is small compared to that made by levels II and III, it is found to be possible in practice to determine 4 capture cross sections (for the levels II and III). The best

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On Recombination on Three Levels of Copper Atoms in Germanium in Consideration of the Statistics of Their Being Filled With Electrons

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agreement between calculated and experimental dependence $= (N_a)$ exists in the case of the following values of capture cross sections: $A_{n2} = 1{,}8 \cdot 10^{-17}\ cm^2$, $A_{n3} = 3{,}6 \cdot 10^{-17}\ cm^2$, $A_{p2} = 1{,}8 \cdot 10^{-16}\ cm^2$, $A_{p3} = 3{,}6 \cdot 10^{-16}\ cm^2$. The main contribution is made up to concentrations of $N_a = 10^{14} cm^{-3}$ by levels III, whereas in the case of higher concentrations N_a recombination on the levels II begins to predominate. 4) Besides, the utmost limit of the cross section values of electron capture can be evaluated by level I, which is found to amount to 10^{-15}. Thus it is possible that, in spite of the small contribution towards recombination made by level I within this domain, there is no considerable difference in the orders of magnitude of the capture cross section. 5) The calculation method employed in this paper can be

On Recombination on Three Levels of Copper Atoms in Germanium in Consideration of the Statistics of Their Being Filled With Electrons

57-28-6-2/34

used for any admixture provided that each individual atom substituting the germanium atom in the lattice forms several levels in the forbidden zone. The author thanks S. M. Ryvkin and V. Ye. Khartsiyev for their valuable advice and N. Shcherbakova for her assistance in carrying out calculations. There are 5 figures, 3 tables, and 11 references, 5 of which are Soviet.

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

SUBMITTED: October 29, 1957

1. Germanium—Purification 2. Copper—Separation
3. Electrodes—Performance 4. Electron capture
5. Mathematics

Card 4/4

MASHOVETS, T.V.

PHASE I BOOK EXPLOITATION SOV/3584

Akademiya nauk SSSR. Otdeleniye fiziko-matematicheskikh nauk

Fizika tverdogo tela; sbornik statey, II (Solid State Physics; Collection of Articles, II) Moscow, Izd-vo AN SSSR, 1959. 328 p. 3,500 copies printed.

Ed.: A.F.Ioffe, Academician; Ed. of Publishing House: V. S. Filipovich; Tech. Ed.: R.A. Zamarayeva.

PURPOSE: This collection of articles is intended for physicists investigating the structures and properties of solids.

COVERAGE: This volume II of a two-volume collection of articles dealing with problems of solid state physics, was prepared by the Department of Physics and Mathematics, Academy of Sciences, USSR. The authors report on the physical properties of semiconductors such as germanium, cadmium sulfide, cadmium selenide, gallium arsenide, silicon, and various metal alloys. The electrical conductivity of these substances is studied. The effects of irradiation and acoustic phonons on semiconductors are also investigated. Several articles are devoted to the theory of electrical breakdown. X-ray studies were made on polycrystalline substances, and one study of the gold-barium system was carried out. No personalities are mentioned. References accompany each article.

TABLE OF CONTENTS:

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~~24(6), 21(8)~~

67393
SOV/181-1-9-11/31

AUTHORS: Vitovskiy, N. A., Mashovets, T. V., Ryvkin, S. M.

TITLE: Determination of the Number of Acceptor Levels of Defects Occurring in Germanium Under the Action of Gamma Irradiation

PERIODICAL: Fizika tverdogo tela, 1959, Vol 1, Nr 9, pp 1381 - 138 (USSR)

ABSTRACT: The radiation-induced formation of structural defects stable at room temperature had already been investigated several times, but not all the problems related therewith are as yet solved satisfactorily. The present paper offers a contribution by discussing the possibilities of a complete analysis of the energy levels of the defects and by publishing experimental results concerning the temperature dependence of the Hall coefficient R of n-type germanium irradiated by Co^{60}-γ-rays. An analysis of these results permits a precise determination of the number of acceptor levels belonging to one γ-radiative defect. To investigate the temperature dependence of the carrier concentration in the presence of multiple-charged centers, the authors theoretically investigated a level scheme of a defect (Fig 1), with n in the conduction band considered to be composed of four parts (Fig 2a). In this connection the

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Determination of the Number of Acceptor Levels of Defects Occurring in Germanium Under the Action of Gamma Irradiation SOV/181-1-9-11/31

following was assumed: every defect produced by radiation has l acceptor- and k donor levels; "ordinary" donors (atoms of the V group) and M defects exist in such a way in germanium with the concentration N_d, that $N_d > Ml$. n_1 : n rises weakly in consequence of transitions of electrons from donor levels to the conduction band; n_2: full ionization of the donor levels, $n_2 = N_d - Ml$ n_3: stronger rising of n in consequence of transitions of electrons from higher defect levels to the conduction band $n_3 = \sqrt{N_c M}\ e^{-\Delta E_{M_1}/2kT}$ n_4: full ionization of the upper levels, $n_4 = N_d - N(l-1)$. The temperature dependence of n can thus be represented by the function $\lg n = f(\frac{1}{T})$ (theoretically in Fig 2a, experimentally in 2b). A table gives the results of several measuring series. It is found that for γ-induced defects $l = 4$, with ΔE_{M_1} being 0.18 ev. The defect formation cross section was found to be $\sigma \simeq 4.0 \cdot 10^{-27} cm^2$.

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67393

Determination of the Number of Acceptor Levels of Defects SOV/181-1-9-11/31
Occurring in Germanium Under the Action of Gamma Irradiation

Directives for further investigations are briefly shown. Finally, the authors thank B. M. Konovalenko and I.D.Yaroshetskiy for exposure of the samples and Sh. M. Mirianashvili for his assistance in measurements. There are 2 figures, 1 table, and 3 references, 1 of which is Soviet.

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

SUBMITTED: March 24, 1959

Card 3/3

VITOVSKIY, N.A.; MASHOVETS, T.V.; RYVKIN, S.M.; SONDAYEVSKIY, V.P.

Energy spectrum of defects arising in Ge under the effect of gamma radiation. Fiz. tver. tela 3 no. 3:998-1001 Mr '61. (MIRA 14:5)

(Crystals—Defects) (Germanium) (Gamma rays)

24.7700

S/058/62/000/006/083/136
A057/A101

AUTHOR: Mashovets, T. V.

TITLE: Investigation of the recombination process in thermocenters in germanium

PERIODICAL: Referativnyy zhurnal, Fizika, no. 6, 1962, 28, abstract 6E233 (In collection: "Fotoelektr. i optich. yavleniya v poluprovodnikakh", Kiyev, AN USSR, 1959, 138 - 140)

TEXT: A calculation method of the dependence of the position of the Fermi level and of the basic parameters of Ge upon the concentration (N_a) of the substituting Cu admixture is presented under consideration of the presence of multiple-charged Cu levels. It is demonstrated how can the theoretical dependence of the Fermi level position and specific resistance upon N_a be calculated. A method is described for the determination of 6 recombination cross sections (3 for electrons and 3 for holes) on three Cu levels, which is necessary to obtain the theoretical dependence of the life time (τ) on N_a. According to data obtained by thermal treatment the dependence of τ upon N_a was determined ex-

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Investigation of the...

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A057/A101

perimentally. The comparison of calculated and experimental curves allowed the determination of 4 recombination cross sections related to two upper Cu levels (the contribution of the lower levels to the recombination is negligibly small). The presented method can be used for any substituting admixture with several levels.

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[Abstracter's note: Complete translation]

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S/181/62/004/003/041/045
B101/B102

AUTHORS: Vitovskiy, N. A., Lukirskiy, D. P., Mashovets, T. V., and Ryvkin, S. M.

TITLE: Energy spectrum of some impurity atoms in germanium and silicon

PERIODICAL: Fizika tverdogo tela, v. 4, no. 3, 1962, 816 - 818

TEXT: In a previous paper (FTT, 1, 1381, 1959) the authors suggested a method of determining the total number of acceptor (or donor) levels pertaining to one structural defect and lying in the forbidden band of a semiconductor. The method consists in measuring the temperature dependence of the Hall constant in specimens with known ratio of the concentration of the "ordinary" carriers (of the elements of the groups III and V) to the defect concentration. Such measurements were made in gold-doped n-type Ge, copper-doped n-type Ge, and gold-doped p- and n-type Si. Specimens with known impurity concentrations are obtained by diffusion. In the measurement, the concentration M of the atoms added must be such that $Ml < N_d$, or $Mk < Na$, where l is the number of the acceptor levels, k

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the number of the donor levels, N_d, N_a are the concentrations of the "ordinary" donors or acceptors, respectively. The results (Fig. 1) which show a concentration n_0 of the ordinary donors prior to doping which corresponds to complete ionization, and n_2 after doping.indicate that at liquid-nitrogen temperature filling of the ordinary donors (V-group elements) sets in. The concentration which increases with temperature (Iа and IIб) corresponds to the ionization of the uppermost level of the impurity atom and the concentration n_1 (Fig. 1) to the complete emptying of this level. The relation $l = (n_0 - n_2)/(n_1 - n_2)$ for Cu in Ge is 3.1; for Au in Ge (2 specimens) $l = 2.8$ and $l = 3.1$. With n-type and p-type Si the curves I and II coincide at high temperatures (approximately 500°K) from which it follows that in silicon gold forms one acceptor level ($l = 1$) and one donor level ($k = 1$). The calculated activation energies for the upper acceptor levels of Cu and Au in Ge, and the acceptor and donor levels of Au in Si agree with published data. There are 2 figures and 5 references: 2 Soviet and 3 non-Soviet. The three references to English-language publications read as follows: H. H. Woodbury a. W. W.

Energy spectrum of some...

S/181/62/004/003/041/045
B101/B102

Tyler, Phys. Rev., 105, 84, 1957; R. Newman, Phys. Rev., 94, 278, 1954; C. B. Collins, R. O. Carlson, a. Gallagher, Phys. Rev., 105, 1168, 1957.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute imeni A. F. Ioffe of the AS USSR, Leningrad)

SUBMITTED: December 30, 1961

Fig. 1. Temperature dependence of the carrier concentration in germanium. (a) doped with Cu; (б) doped with Au.

Card 3/4

VITOVSKIY, N.A.; LUKIRSKIY, D.P.; MASHOVETS, T.V.; MYAKOTA, V.I.

Energy spectrum of defects in silicon caused by electron irradiation. Fiz. tver. tela 4 no.5:1140-1145 My '62.
(MIRA 15:5)

1. Fiziko-tekhnicheskiy institut imeni A.F. Ioffe AN SSSR, Leningrad.
(Silicon crystals—Defects)
(Radiation)

44144

S/181/62/004/010/032/063
B108/B104

24.7600

AUTHORS: Vitovskiy, N. A., Mashovets, T. V., and Ryvkin, S. M.

TITLE: The energy spectrum of the gamma radiation defects in silicon

PERIODICAL: Fizika tverdogo tela, v. 4, no. 10, 1962, 2845-2848

TEXT: The temperature dependence of the Hall constant was studied on n- and p-type silicon samples before and after their exposure to Co^{60} gamma radiation. Irradiation ($1.4\cdot10^{17}$ quanta/cm^2; $1.15\cdot10^{18}$ quanta/cm^2) [illegible] reduced the conductivity of silicon. The measurements carried out in the range 55-450°K showed, that irradiation gives rise to two levels in the upper half of the forbidden band that are capable of accepting electrons: E_c - 0.18 ev and E_c - 0.5 ev. The production cross-sections of these levels are approximately $1.4\cdot10^{-26}$ cm^2 and $1.8\cdot10^{-27}$ cm^2, respectively. In the lower half of the forbidden band there was one level (E_v + 0.23 ev) with a production cross-section of about $1.2\cdot10^{-27}$ cm^2. There are 2 figures and 2 tables.

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The energy spectrum of the gamma... S/181/62/004/010/032/063
B108/B104

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: May 30, 1962

Card 2/2

S/181/62/004/010/033/063
B102/B112

AUTHORS: Vitovskiy, N. A., Mashovets, T. V., and Ryvkin, S. M.

TITLE: Determination of the activation energy of impurity center levels and of structural defects in semiconductors

PERIODICAL: Fizika tverdogo tela, v. 4, no. 10, 1962, 2849 - 2853

TEXT: A study was made of the temperature dependence of the carrier concentration in semiconductors with impurities and defects, the spectra of which are complicated by their being several types of levels. According to measurements log $n = f(1/T)$ is, in this case, a complicated curve comprising plateaus of different lengths and sections with different inclinations. The activation energy of all possible levels is calculated to obtain a quantitative theoretical description. For simplicity a semiconductor is considered having two levels in the forbidden band. At absolute zero one of them should be partially filled with electrons, and the other should be filled completely (Fig. 2). The results can then be generalized for an arbitrary number of levels. If, in the entire temperature range the relation $\Delta E_2 - \Delta E_1 > kT$ is valid where ΔE_i are the level activation energies, then the neutrality condition of the system can be given by

$$Ne^{\frac{\mu}{kT}} = m_1 - \frac{M_1}{1+\gamma_1 e^{-\frac{\Delta E_1+\mu}{kT}}} + \frac{M_2}{1+\frac{1}{\gamma_2} e^{\frac{\Delta E_2+\mu}{kT}}}, \qquad (1);$$

the solution is

$$n = \frac{m_1 - \gamma_2 N_{cE_1}}{2} \pm \frac{1}{2}\sqrt{(\gamma_2 N_{cE_1} - m_1)^2 + \gamma_2 4 N_{cE_1}(M_2 + m_1)}, \qquad (5).$$

$$N_{cE_1} \equiv Ne^{-\frac{\Delta E_1}{kT}}.$$

The curve log n = f(1/T) is divided into 6 sections (2 plateaus, 2 sloping and 2 transition sections), n is calculated for each section and the state density is studied. With the aid of

$$\Delta E_2 = \frac{d \lg n}{d\left(\frac{1}{T}\right)} \frac{2.3 \cdot 2k}{\left[1 - \frac{m_1}{\sqrt{(m_1 \text{[illegible]})}}\right]} - \frac{3}{2} kT. \qquad (9)$$

Card 2/4 * Error in original

ΔE_2 can be determined experimentally from the high-temperature inclined section, if m_1 and (M_2+m_1) in the point $\gamma_2 N_{cM_2} = m_1$ is determined from

$$n = \sqrt{(m_1 + M_2)\gamma_2 N_{cM_2}} = \sqrt{(m_1 + M_2) m_1}. \qquad (7)$$

and d(log n)/d(1/T) is determined from the curve. The statistical weights γ_1/γ_2 of the levels need not be known but γ_2 can be calculated from (7). These relations are valid if $M_2 \lesssim m_1$. If $M_2 \gg m_1$ then the activation energy can be calculated directly from the inclination of the curve with the aid of

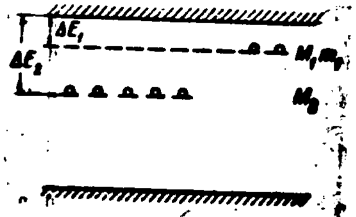
$$\frac{d \lg n}{d\left(\frac{1}{T}\right)} = -\frac{1}{2}\left(\frac{\Delta E_2}{k} + \frac{3}{2} T\right), \qquad (11).$$

This is calculated for a practical case. Finally, a further possibility is pointed out of calculating ΔE_2 from the temperature dependence of the carrier density: the curve $\log(n-m_1)=f(1/T)$ can be constructed and the tangent whose inclination gives the activation energy directly can be drawn at the point corresponding to Eq. (7). N_c denotes the effective state density in the conduction band, M_i are the level concentrations and m_i is the electron concentration on the M_1 level. There are 3 figures.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute imeni A. F. Ioffe AS USSR, Leningrad)

SUBMITTED: May 30, 1962

Fig. 2



L 13899-63 EWP(q)/EWT(m)/BDS AFFTC/ASD JD

ACCESSION NR: AP3003878 S/0181/63/005/007/1833/1841

AUTHOR: Vitovskiy, N. A.; Konovalenko, B. M.; Mashovets, T. V.; Ryvkin, S. M.; Yaroshetskiy, I. D.

19

TITLE: Gamma-ray-generated defects in germanium 21

59
57

SOURCE: Fizika tverdogo tela, v. 5, no. 7, 1963, 1833-1841

TOPIC TAGS: gamma-ray semiconductor irradiation, radiation defect, monopolar annealing, bipolar annealing, germanium irradiation, germanium defect, germanium

ABSTRACT: In the latest stage of research on the subject, dating back to 1959, a large number of n- and p-type specimens was investigated. N-type germanium was doped with antimony and had a donor concentration between $2 \cdot 10^{12}$ to $8 \cdot 10^{15}$ cm^{-3}; p-type germanium was doped with gallium and had an acceptor concentration between 10^{12} to 10^{15} cm^{-3}. The source was Co^{60} at a dosage of $2 \cdot 10^{11}$ $kv/cm^2 \cdot sec$ and temperature of 100;. The work was aimed at clarifying the saturation of irradiated specimens which occurs after polarity reversal, whereby further exposure to radiation, however prolonged, no longer affects the slope of the thermal dependence of carrier concentration. The latter remains equal to the activation energy. While the saturation process is evident up to very high concentrations

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ACCESSION NR: AP3003878

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of radiation defects, a substantially different situation is obtained in monopolar annealing of interstitial atoms, ultimately leading to a variety of limiting states of specimens exposed to gamma radiation. A bipolar annealing effect occurring during the irradiation process is considered responsible for the drop in the defect-formation rate with increased dosage of radiation. Both monopolar and bipolar annealing effects were found above room temperature. "The authors are indebted to S. R. Novikov for interesting discussions." Orig. art. has: 9 figures.

ASSOCIATION: Leningradskiy fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR (Leningrad Physicotechnical Institute, AN SSSR)

SUBMITTED: 31Jan63 DATE ACQ: 15Aug63 ENCL: 00

SUB CODE: PH NO REF SOV: 006 OTHER: 003

Card 2/2

VITOVSKIY, N.A.; MASHOVETS, T.V.; RYVKIN, S.M.; KHASEVAROV, R.Yu.

Change of the electric and photoelectric properties of gallium arsenide irradiated by 1 Mev. electrons. Fiz. tver. tela 5 no.12:3510-3523 D'63. (MIRA 17:2)

1. Fiziko-tekhnicheskiy institut imeni A.F.Ioffe AN SSSR, Leningrad.

L 10791-65 EWT(1)/EWG(k)/T Pz-6 IJP(c)/ASD(a)-5/ASD(m)-3/AS(mp)-2/
AFWL/ESD(t) AT
ACCESSION NR: AP4039649 S/0181/64/006/006/1654/1656

[illegible]

TITLE: A possible method of precise determination of activation energies of 15 impurity levels and of defects in semiconductors

SOURCE: Fizika tverdogo tela, v. 6, no. 6, 1964, 1654-1656

TOPIC TAGS: activation energy, impurity level, defect, semiconductor, Hall coefficient

ABSTRACT: The authors suggest a method of determining the activation of impurity levels from nonlinear segments of the temperature dependence of the Hall coefficient. Two arbitrary temperature intervals are selected in which the changes in concentration and the degree to which the level is filled with electrons are known. These values may then be related by a simple equation (they form a simple proportion), and a graphic solution yields the value of the activation energy (ΔE_M). It is then easy to compute the absolute concentration and from this to determine the electron concentration at the desired level. The authors have shown that when

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ACCESSION NR: AP4039649

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the conditions

$$P_v e^{-\frac{\Delta E + E_M}{kT}} \ll m_0$$

$$P_v e^{-\frac{\Delta E + E_M}{kT}} < \frac{m_0^2}{4(M - m_0)}$$

(where P_v is the effective density of states in the valence band, M is the concentration of centers belonging to the examined level, and m_0 is the electron concentration at the same level at absolute zero) are not fulfilled, the determination of E_M by the ordinary method, from the slope of the dependency expression log R = f(1/T), leads to substantial errors. "The authors thank I. D. Yaroshetskiy for his valuable suggestions." Orig. art. has: 1 figure, 1 table, and 7 formulas.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physico-technical Institute, AN SSSR)

SUBMITTED: 13Dec63

ENCL: 00

SUB CODE: EM, SS

NO REF SOV: 002

OTHER: 002

Card 2/2

L 10521-65 EWT(m)/EPF(c)/EPF(n)-2/EWP(b) Pr-4/Pu-4 IJP(c)/AEDC(a)/
AS(mp)/ASD(m)-5/AFWL/SSD/ESD(gs)/ASD(a)-5/ESD(t) JD/GG

ACCESSION NR: AP4039684 S/0181/64/006/006/1883/1892

AUTHORS: Vitovskiy, N. A.; Mashovets, T. V.; Ryvkin, S. M. 19

TITLE: High-temperature annealing of gamma radiation defects in n-type germanium 17

SOURCE: Fizika tverdogo tela, v. 6, no. 6, 1964, 1883-1892

TOPIC TAGS: annealing, gamma radiation defect, germanium, defect level, activation energy, high temperature effect

ABSTRACT: The authors measured the temperature dependence of the Hall effect in samples before and after irradiation and at various stages of annealing. Sequential isothermic annealing was carried out on two series of samples containing donor concentrations (antimony) of $4 \cdot 10^{13}$ and $2 \cdot 10^{14}$ cm^{-3} respectively. Annealing was done in an oil bath at 90, 100, 120, 200, and 300C. Each series included samples irradiated at +100 with different doses of gamma rays from Co^{60}. The authors show that the basic process of high-temperature annealing in samples irradiated at room temperature is bipolar annealing of the donor and acceptor components of the gamma-radiation defects. The activation energy of annealing was shown to be the same for the E_c -0.20 ev and the E_v +0.11 ev levels (1.2 ± 0.1 ev). Unipolar annealing occurs along with the bipolar process. The unipolar annealing of donors is always

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L 10521-65
ACCESSION NR: AP4039684

2

relatively more rapid than unipolar annealing of acceptors. Unipolar annealing of acceptors was observed only when such annealing of donors created an excessive concentration of acceptors and when the absolute rate of acceptor annealing exceeded the absolute rate of donor annealing. The authors show that, as a result of high-temperature annealing in gamma-irradiated germanium, two new levels are formed: an E_c -0.13 ev and an E_v +0.22 ev. These indicate a reorganization of the radiation defect during annealing. "The authors thank I. P. Shershneva, graduate student at LGU, for making a number of measurements." Orig. art. has: 6 figures, 4 tables, and 1 formula.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN SSSR, Leningrad (Physicotechnical Institute AN SSSR)

SUBMITTED: 13Dec63 ENCL: 00

SUB CODE: MM, TD NO REF SOV: 009 OTHER: 004

Card 2/2

L 24165-65 EWT(m)/EPF(c)/EPF(n)-2/EWP(t)/EWP(b) Pr-4/Pu-4 IJP(c) JD/GG

ACCESSION NR: AP5003463 S/0181/65/007/001/0308/0310

26
25

AUTHOR: Mashovets, T. V.; Khanasvarov, R. Yu.

19 27

TITLE: Energy structure of gamma-radiation defects in germanium

SOURCE: Fizika tverdogo tela, v. 7, no. 1, 1965, 308-310

TOPIC TAGS: germanium defect, impurity photoconductivity, radiation defect, gamma irradiation, defect level

ABSTRACT: An investigation has been made of the spectral distribution of impurity photoconductivity in specimens containing defects with different charge states and the influence of annealing of irradiated specimens on spectral distribution of photoconductivity. The specimens were cut out from different monocrystals with an initial concentration of donors (antimony) ranging from 4×10^{13} to 3×10^{14} cm^{-3}. Irradiation was conducted at 10C. In addition to the spectral dependence of impurity photoconductivity of specimens before irradiation, after irradiation, and after annealing, the dependence of charge-carrier concentration on temperature was obtained. The rate of irradiation of specimens and the temperature of measurements were selected in

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L 24165-65

ACCESSION NR: AP5003463

such a way that the filling of defect levels with electrons was realized as follows: 1) all defect levels located below the levels of chemical donors were filled with electrons; 2) the $E_c - 0.20$ ev level was partially filled; 3) the $E_v + 0.27$ ev level was partially filled; 4) the $E_v + 0.22$ ev level was partially filled; and 5) the $E_v + 0.11$ ev level was practically filled. Analysis of the energy diagrams showed that the $E_c - 0.27$ ev, $E_v + 0.32$ ev, and $E_v + 0.16$ ev levels are always present in all specimens before irradiation and remain after annealing. It is possible that these levels could be attributed to some constantly present impurities. The $E_c - 0.20$ ev, $E_c - 0.34$ ev, $E_v + 0.27$ ev, $E_v + 0.22$ ev, and $E_v + 0.11$ ev levels are produced during irradiation, the last two only during prolonged irradiation. The stability of radiative defects with regard to annealing increases with increasing radiation dose. Orig. art. has: 1 table. [JA]

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute, AN SSSR)

L 24165-65

ACCESSION NR: AP5003463

SUBMITTED: 08Aug64 ENCL: 00 SUB CODE: NP, SS

NO REF SOV: 006 OTHER: 002 ATD PRESS: 3175

Card 3/3

L 56010-65 EWT(m)/EPF(c)/EPF(n)-2/EWT(t)/EWP(b) Pr-4/Pu-4 IJP(c) JD/GG

ACCESSION NR: AP5017330 UR/0181/65/007/007/2229/2231

32

31

B

AUTHOR: Mashovets, T. V.; Khansevarov, R. Yu.

TITLE: Energy spectrum of defects appearing in indium antimonide at low-temperature γ-irradiation 21 21

SOURCE: Fizika tverdogo tela, v. 7, no. 7, 1965, 2229-2231

19

TOPIC TAGS: gamma irradiation, irradiation defect, indium antimonide defect, defect formation threshold energy, impurity photoconductivity

ABSTRACT: Results are presented of an investigation of the energy spectrum of defects appearing in n-type indium antimonide irradiated with a dose of 2.4×10^{10} quanta·cm^{-2}·sec^{-1} of γ-rays from a Co^{60} source at 77K. The specific resistance, the concentration of current carriers, and the spectral dependences of impurity photoconductivity were measured on specimens before and after irradiation at 77K. The considerably increased photoconductivity of the specimens in proportion to the irradiation was attributed to the rise in the concentration of radiation defect levels. During irradiation the conductivity changed from n to p type when the specimens passed over the region of total compensation. After the change in conductivity, the hole concentration at first increased, then approached a limiting value.

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L 56010-65

ACCESSION NR: AP5017330

The rate of the electron concentration decrease was 3×10^{13} electr·cm^{-1}·photon^{-1}. Discontinuation of the rise of the radiation defect concentration levels was due to an equilibrium between the processes of the generation and annealing of the defects. It is possible 1) that the annealing rate in centers whose E_v + 0.038 ev level is free of electrons is considerably higher than the annealing rate in centers with filled levels, and 2) that the moment of equilibrium establishment between generation and annealing is determined not by the magnitude of concentration of E_v + 0.038 ev levels but by the number of empty places on them. Orig. art. has: 2 figures. [JA]

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR, Leningrad (Physicotechnical Institute, AN SSSR)

SUBMITTED: 15Feb65 ENCL: 00 SUB CODE: NP, SS

NO REF SOV: 001 OTHER: 006 ATD PRESS: 4034

csc

Card 2/2

L 32636-66 EWT(m)/EWP(t)/ETI IJP(c) JD/GG

ACC NR: AP6018527 SOURCE CODE: UR/0181/66/008/006/1690/1697

56

53

B

AUTHOR: Mashovets, T. V.; Khansevarov, R. Yu.

ORG: Physicotechnical Institute im. A. F. Ioffe, AN SSSR, Leningrad (Fiziko-tekhnicheskiy institute AN SSSR)

19

TITLE: Low-temperature gamma irradiation and annealing of indium antimonide

SOURCE: Fizika tverdogo tela, v. 8, no. 6, 1966, 1690-1697

27 27

TOPIC TAGS: indium compound, indium antimonide, irradiation, annealing, resistivity, Hall constant, photoconductivity, radiation damage, crystal defect

ABSTRACT: In view of the scarcity of published data on the effect of gamma irradiation on InSb, the authors irradiated n-type InSb at 77K (dose rate 2.4×10^{10} photons/cm^2-sec) with initial electron density $2.9 \times 10^{13} - 1.6 \times 10^{14}$ cm^{-3} and p-type InSb with initial hole density $5.3 \times 10^{13} - 3.3 \times 10^{14}$ cm^{-3}. The resistivity, Hall constant, and the spectral distribution of the photoconductivity were measured before and during irradiation, and during the subsequent annealing. The test results are used to determine the rate of defect formation and the extremal positions of the Fermi level as functions of the irradiation dose. The results indicate that the defects produced by irradiation act as ionized scattering centers, and that the rate of defect formation is a rather complicated function of the irradiation dose. Some hypotheses are advanced concerning the energy level scheme of the irradiated indium antimonide. It is concluded that

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L 32636-66

ACC NR: AP6018527

3

there are several simultaneously acting mechanisms affecting the course of annealing of the radiation defects, and that the rate of this annealing depends on the initial carrier density in the semiconductor. Investigation of the isochronous annealing of defects in the interval 77 — 300K yielded results that agree with published data, thus indicating that these processes are governed by the main defects always produced after irradiation. Two levels, E_c - 0.083 and E_v + 0.048 ev, are credited to radiation defects and are classified as donor and acceptor levels, respectively. The authors thank S. M. Ryvkin for interest, V. V. Galavanov for supplying many samples, and L. V. Nikina for help with the measurements. Orig. art. has: 7 figures and 4 tables. [02]

SUB CODE: 20/ SUBM DATE: 16Oct65/ ORIG REF: 007 OTH REF: 003/
ATD PRESS: 5024

Card 2/2

NASHKOVETS, V., inzhener.

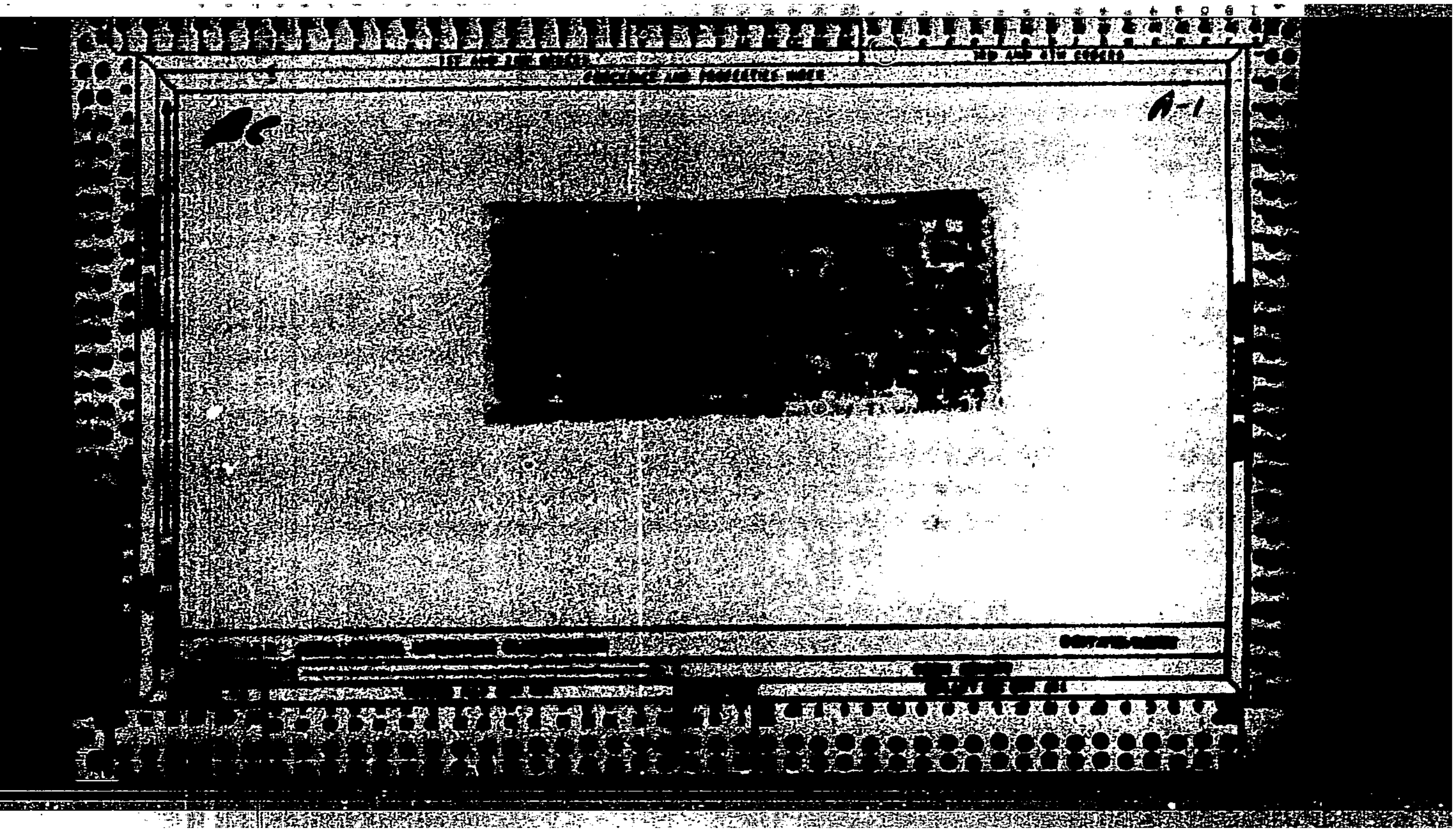
Planning the repair of port cargo-handling installations.
Mor.flot.15 no.11:7-9 N '55. (MIRA 9:2)

1.Nachal'nik otdela mekhanizatsii Leningradskogo porta.
(Loading and unloading) (Harbors)

MASHOVETS, V., inzhener.

Better organization for the technical operation of harbor machinery. Mor.flot 16 no.5:5-7 My '56. (MLRA 9:8)

1. Partiynaya organizatsiya TSentral'nogo komiteta Kommunisticheskoy partii Sovetskogo Soyuza Leningradskogo porta.
(Harbors) (Conveying machinery) (Cargo handling)



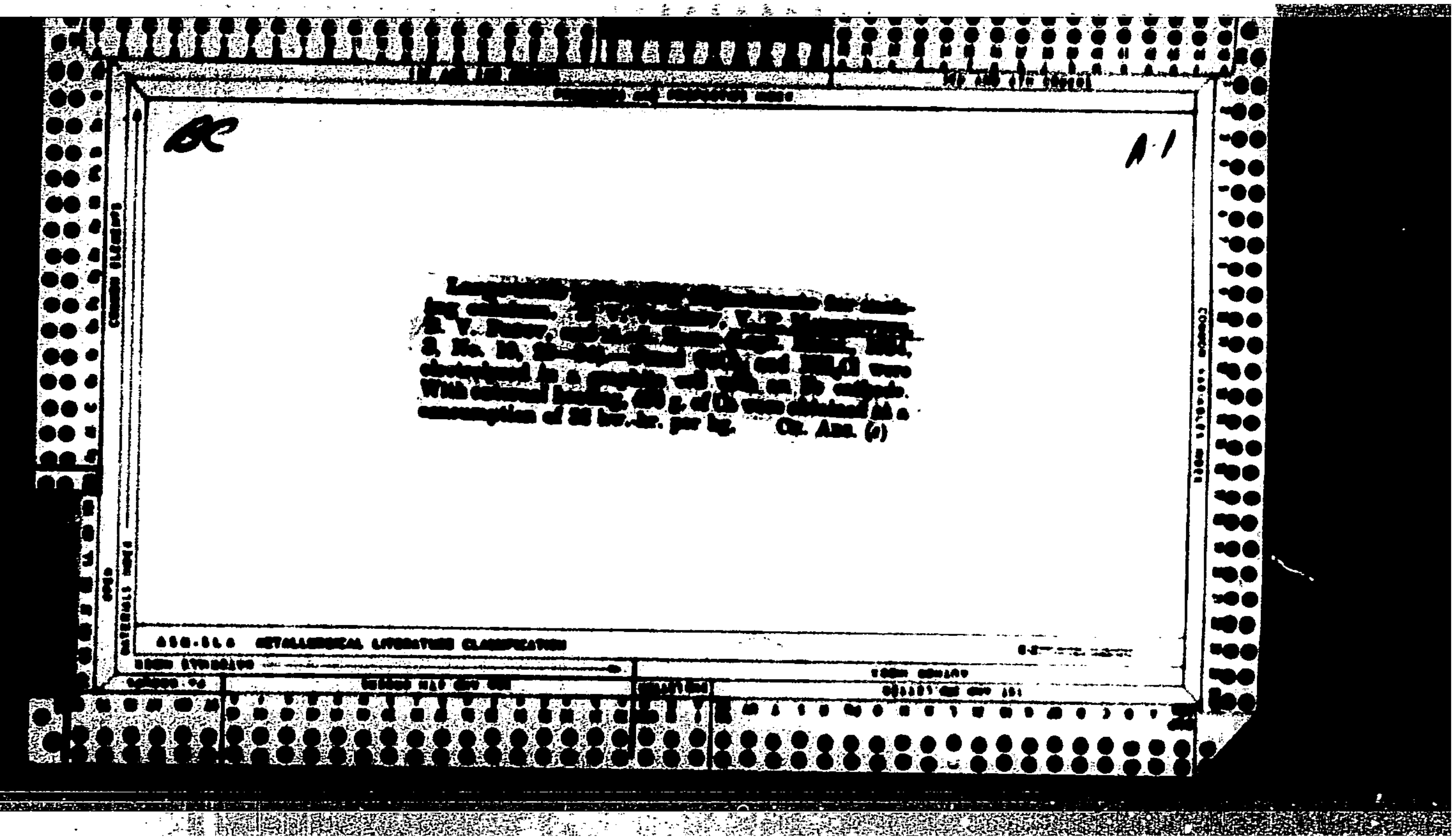
A-1

[redacted]

B-1-4

B

Polyrecuper (air heating apparatus for blast furnaces). W. [illegible] 1938, Nr. 1-2, 21-26). The stoves (3-4) are enclosed in one cylindrical shell. Methods of construction are proposed.



8c

A-1

[illegible] E. V. [illegible] 8, No. 10, [illegible] and HCl were determined by a [illegible] With [illegible] g. of Cl was obtained at a consumption of 35 kw.-hr. per kg. Ch. Abs. (d)

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

PROCESSES AND PROPERTIES INDEX

BC

a-1

Density of mixtures of some molten electrolytes. V. P. [illegible] and Z. F. Lundina (Coll. Trans. 1st U.S.S.R. Conf. Non-aq. Solutions, Kiev, 1935, 191—202).—The *d* of $MgCl_2$, NaCl, and KCl falls linearly with rise of temp. from [illegible]° to 1000°. The *d*-composition curves of the systems $MgCl_2$–NaCl and –KCl, KCl–$BaCl_2$, and $MgCl_2$–KCl–NaCl have been determined. R. T.

ASO-SLA METALLURGICAL LITERATURE CLASSIFICATION

1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

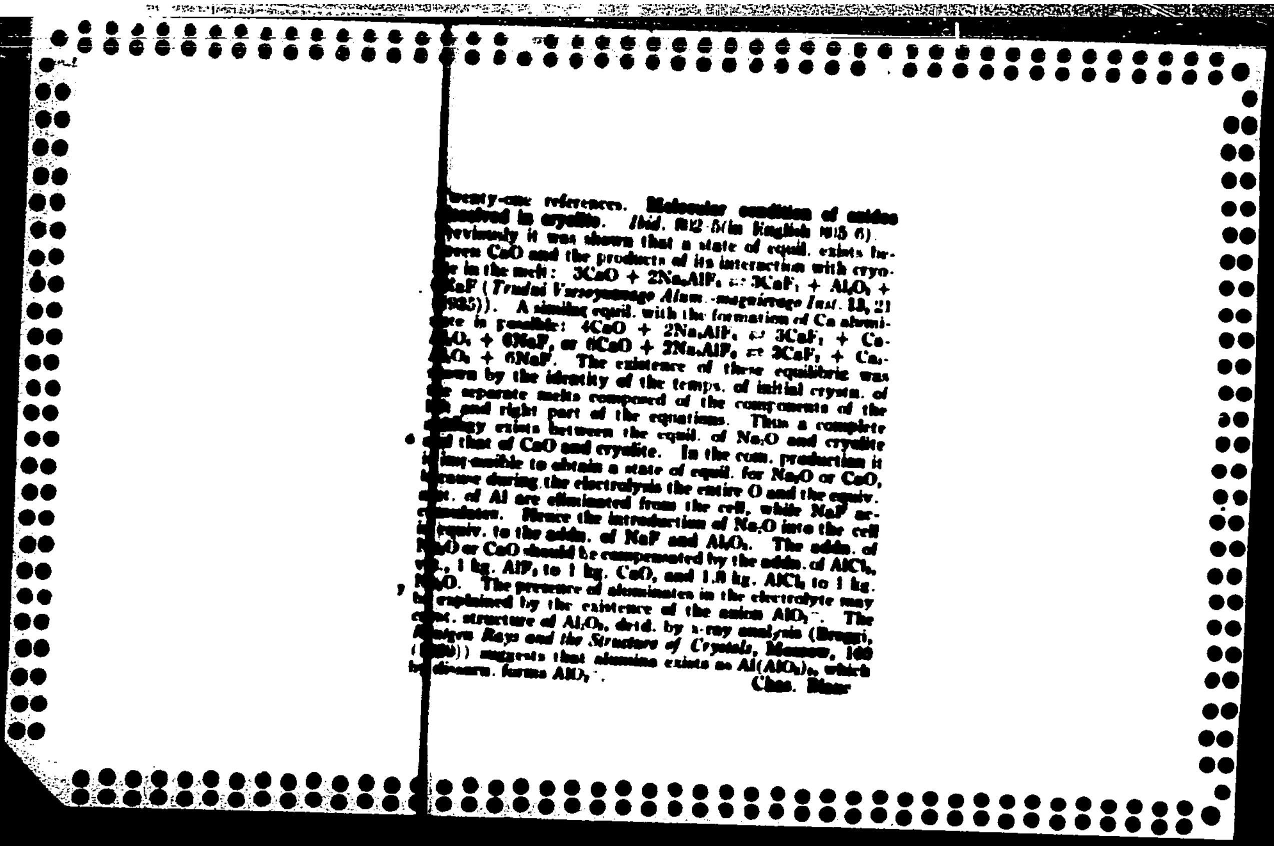
3RD AND 4TH ORDERS

Ca

Changes of the melting point and the "degeneration" of cryolite by fusion in air. V. P. Mashovets. *J. Applied Chem.* (U. S. S. R.) 9, 780-[illegible] ([illegible] 801)([illegible]).—The conflicting literature data on the results of detns. of the m. p. of cryolite and the mixts. of cryolite with Al_2O_3, were critically discussed, led to a study of the changes in the chem. compn. and the temps. of incipient crystn. of cryolite on prolonged heating. Samples of Greenland and prepd. cryolites were heated in loosely covered Pt crucibles of different diams. in an elec. Pt furnace at 1000° for various periods of time up to [illegible] hrs. At intervals of about 1 hr. the heating was discontinued, and the temp. of solidification was measured by means of a Pt-Ir thermocouple by the visual method. The results show that with the elapsed heating time the temp. of incipient crystn. of cryolite decreases at an increasing rate until a min. is reached, and then rapidly rises. The rate of the decrease varies even for the same specimen, depending on the conditions of expts. and the diam. of the Pt crucible. The analysis of melts at various stages and the changes in the temp. of crystn. suggest a thermal "degeneration" of cryolite on contact with the O, derived from the atm. or the moisture, with a loss of F and the formation of Al_2O_3: (1) $2Na_3AlF_6 + 1.5O_2 = Al_2O_3 + 6NaF + 3F_2 - 222.2$ Cal., or (2) $2Na_3AlF_6 + 3H_2O = Al_2O_3 + 6NaF + 6HF - 143.8$ Cal. The process of degeneration may also be conceived by other reactions with the formation of $NaAlO_2$: (3) $Na_3AlF_6 + O_2 = NaAlO_2 + 2NaF + 2F_2 - 223.1$ Cal., or (4) $Na_3AlF_6 + 2H_2O = NaAlO_2 + 2NaF + 4HF - 104.1$ Cal. The reactions 1 and 3 or 2 and 4 differ only in the distribution of O and F between Al and Na. In their effect on the m. p. they give the same results, because this distribution is detd. by an equil. $Na_3AlF_6 + 2Al_2O_3 \rightleftarrows 3NaAlO_2 + 2AlF_3$, or $Na_3AlF_6 + 3NaAlO_2 \rightleftarrows 2Al_2O_3 + 6NaF$. The aq. extns. of all samples of degenerated cryolite gave an alk. reaction. The mechanism of thermal degeneration of cryolite was proved by the identity of the temps. of initial crystn. of the degenerated cryolite and the synthetic prepns. with the compns. of the corresponding degrees of cryolite degeneration. Further proof of the displacement of F by O with the liberation of F or HF, and not that of AlF_3, is furnished by the observation of the excessive destruction of the porcelain parts of the app. (Arndt and Kalass, *C. A.* 18, 3516). Furthermore, Lundina (not published) observed that no change in the solidification temp. takes place on heating cryolite in a specially constructed hermetically sealed Pt crucible. Phys.-chem. studies of cryolite melts should be performed with the exclusion of air or in an atm. of dry inert gas.

E J

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION



wenty-one references. **Molecular condition of oxides ssolved in cryolite.** *Ibid.* 812-5(in English 815-6). eviously it was shown that a state of equil. exists between CaO and the products of its interaction with cryolite in the melt: $3CaO + 2Na_3AlF_6 \rightleftarrows 3CaF_2 + Al_2O_3 + 6NaF$ (*Trudui Vsesoyuznogo Alum.-magnievogo Inst.* 13, 21 (935)). A similar equil. with the formation of Ca aluminate is possible: $4CaO + 2Na_3AlF_6 \rightleftarrows 3CaF_2 + CaAl_2O_4 + 6NaF$, or $6CaO + 2Na_3AlF_6 \rightleftarrows 3CaF_2 + Ca_3Al_2O_6 + 6NaF$. The existence of these equilibria was own by the identity of the temps. of initial crystn. of e separate melts composed of the components of the ft and right part of the equations. Thus a complete alogy exists between the equil. of Na_2O and cryolite d that of CaO and cryolite. In the com. production it impossible to obtain a state of equil. for Na_2O or CaO, ecause during the electrolysis the entire O and the equiv. t. of Al are eliminated from the cell, while NaF accumulates. Hence the introduction of Na_2O into the cell equiv. to the addn. of NaF and Al_2O_3. The addn. of Na_2O or CaO should be compensated by the addn. of $AlCl_3$, ., 1 kg. AlF_3 to 1 kg. CaO, and 1.8 kg. $AlCl_3$ to 1 kg. Na_2O. The presence of aluminates in the electrolyte may explained by the existence of the anion AlO_2^-. The yst. structure of Al_2O_3, detd. by x-ray analysis (Bragg, *ntgen Rays and the Structure of Crystals*, Moscow, 100 ()) suggests that alumina exists as $Al(AlO_3)$, which by dissocn. forms AlO_2^-.

Chas. Blanc

C3

1

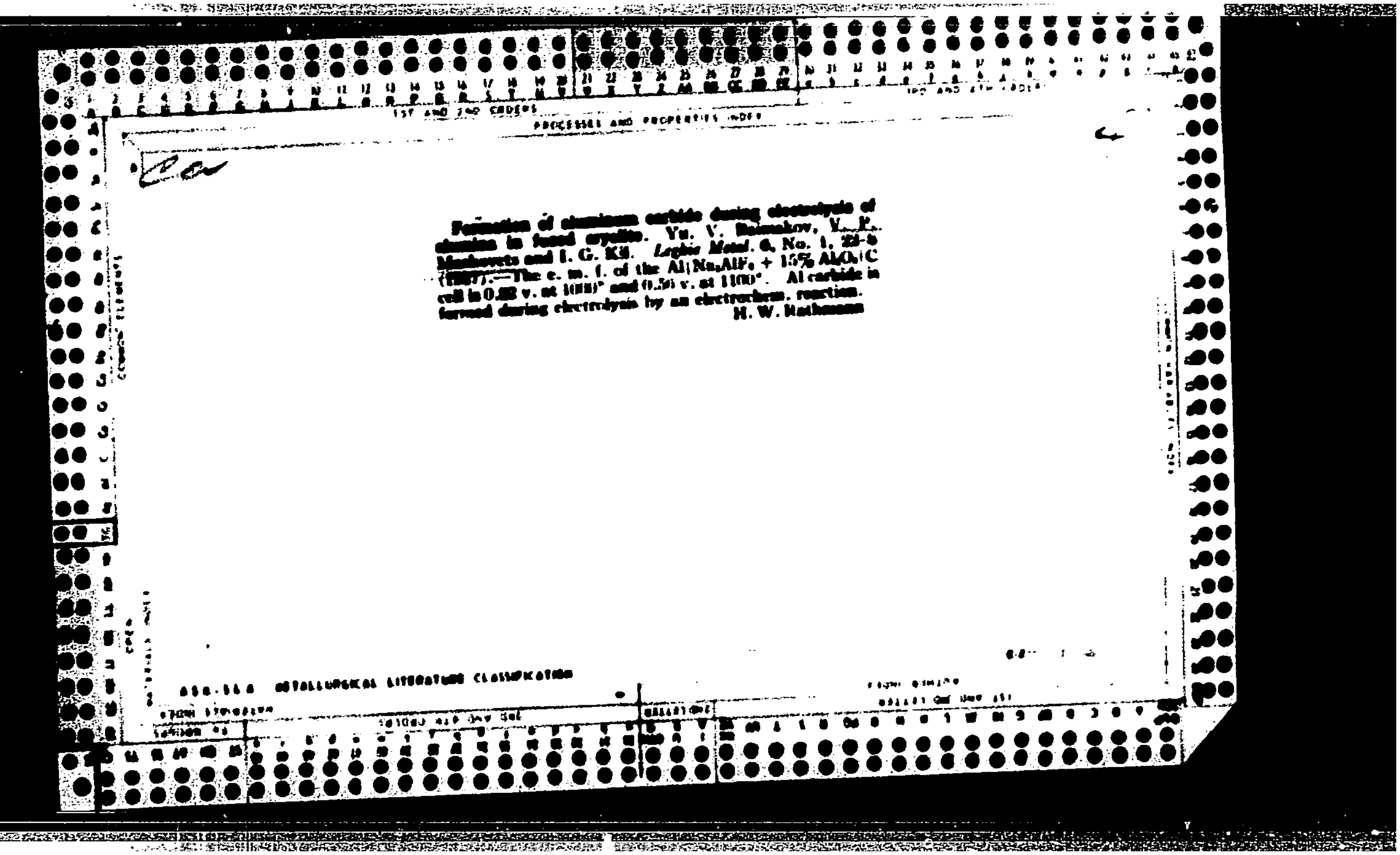
THE CHANGE IN THE MELTING POINT AND DETERIORATION OF CRYOLITE WHEN FUSED IN AIR.—W. P. Mashovets (J. Applied Chem., 9, 691, 1936). The wide variations reported by different workers in the determination of the melting-point of cryolite and cryolite-alumina mixtures are pointed out. It was found that, if fused cryolite is held for a prolonged period exposed to the atmosphere, the solidification temperature and the character of the solidification curve are both altered. Deterioration of the cryolite is due to the reaction with oxygen or water vapour in the air.

METALLURGICAL LITERATURE CLASSIFICATION

C/S

1

THE MOLECULAR STATE OF THE OXIDES DISSOLVED IN CRYOLITE. V. P. Mashovets (J. Applied Chem. [illegible]). An equilibrium between calcium oxide, dissolved in molten cryolite, and the reaction products of this oxide with cryolite (CaF_2, Al_2O_3 and NaF) is found experimentally. There is also an eq. between sodium oxide, taken as the aluminate, $NaAlO_2$, and its reaction products with cryolite, Al_2O_3, and NaF.



1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

3RD AND 4TH ORDERS

Ca

Formation of aluminum carbide during electrolysis of alumina in fused cryolite. Yu. V. Baimakov, V. P. Mashovets and I. G. Kil. *Legkie Metal.* 6, No. 1, 22-5 (1937).—The e. m. f. of the Al|Na_3AlF_6 + 15% Al_2O_3|C cell is 0.22 v. at 1000° and 0.30 v. at 1100°. Al carbide is formed during electrolysis by an electrochem. reaction.

H. W. Rathmann

ASB-SLA METALLURGICAL LITERATURE CLASSIFICATION

1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

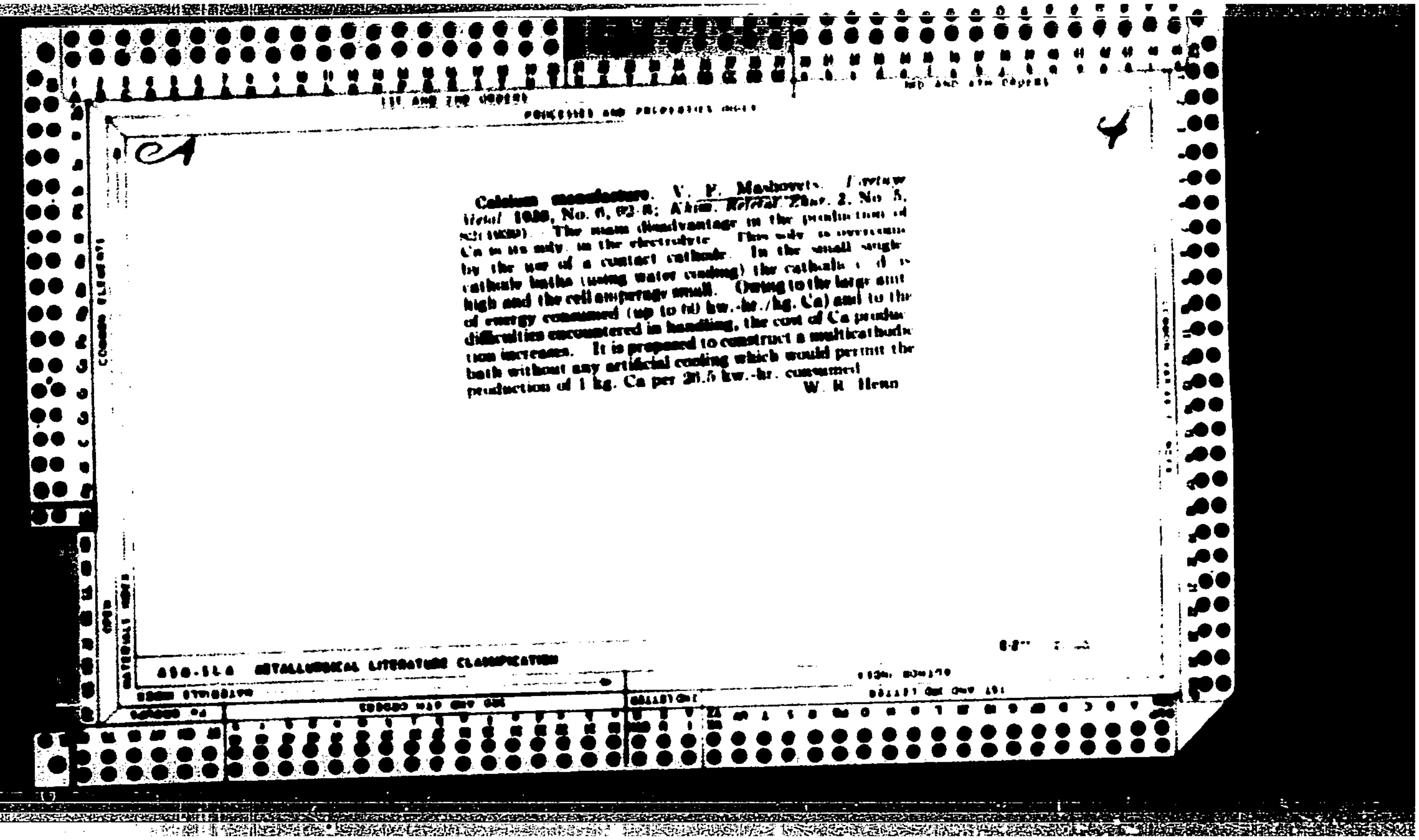
3RD AND 4TH ORDERS

CA

4

Multiple-cathode electrolytic apparatus, especially for the preparation of calcium. V. P. Mashovets, Z. V. Vasil'ev and S. A. Semenkovich. Russ. 52,049, April 30, 1938. Constructional details.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION



Calcium manufacture. V. P. Mashovets. *Tsvetnye Metal.* 1939, No. 6, 92-8; *Khim. Referat. Zhur.* 2, No. 5, 82 (1939). The main disadvantage in the production of Ca is its soly. in the electrolyte. This soly. is overcome by the use of a contact cathode. In the small single-cathode baths (using water cooling) the cathode c.d. is high and the cell amperage small. Owing to the large amt. of energy consumed (up to 60 kw.-hr./kg. Ca) and to the difficulties encountered in handling, the cost of Ca production increases. It is proposed to construct a multicathode bath without any artificial cooling which would permit the production of 1 kg. Ca per 26.5 kw.-hr. consumed

W. R. Henn

1ST AND 2ND ORDERS

3RD AND 4TH ORDERS

CA

PROCESSES AND PROPERTIES INDEX

4

The resistance of aqueous electrolytes in relation to shape, dimensions and position of the electrodes. I. V. P. Mashovets and V. M. [illegible]. *Trudy Vsesoyuz. Alyumin.-Magn. Inst.* 1960, No. 19, 189-200.—Three methods for the calcn. of the ohmic resistance of electrolytes confined between electrodes in the form of 2 coaxial cylinders are described and equations detg. the dependence of resistance on lengths and radii of the electrodes are derived. Exptl. measurements on the electrolyte 0.1 *N* $CuSO_4$ soln., with 2 Cu electrodes were made at 20° to confirm the theoretical results. The radii of the outer electrodes were 5 and 3.5 cm. and those of the inner electrodes 0.5, 1.5 and 2.5 cm. Two series of expts. were carried out: (1) with a const. length of the outer electrodes, h_2 = 6.2 cm., the length of the inner electrode was varied from 1 to 18 cm. and (2) with a const. length of the inner electrode, h_1 = 6.2 cm., the length of the outer electrode was varied from 1 to 6.2 cm. Results closest to exptl. data for the resistance are obtained from $R = 0.159\rho[(h_2 + h_1)\log(h_2 r_2/h_1 r_1)]/[(h_2 r_1 - h_1 r_2)\log[(h_2 - h_1 + \sqrt{(h_2 - h_1)^2 + (r_2 - r_1)^2})/(r_2 - r_1)]]$ (r_1 and r_2 are the radii of the inner and outer electrodes, h_1 and h_2 the lengths of the inner and outer electrodes and ρ is the resistivity of the electrolyte. A correction replacing h_1 by $h_1 = h_1 - 0.28 r_1$ must be made for the inner electrode. II. V. M. [illegible] and V. P. Mashovets. *Ibid.* 200-6.—A method for calcg. the resistance of the electrolyte confined between 2 flat round electrodes with various diams. and placed in parallel on a common axis with various interpolar distances is described. Three equations for detg. the resistance of the active zone of the electrolyte are given. One of these equations $R_1 = \rho l/\pi r_1 r_2$ (ρ is the resistivity of the electrolyte; l the interpolar distance, r_1 and r_2 are the radii of the electrodes) can be used for approx. tech. calcns. Exptl. measurements of the resistances of 0.1 *N* and *N* $CuSO_4$ solns. with Cu electrodes described indicate considerable deviations of the curves from those obtained from theoretical equations. The exptl. resistance curve becomes a straight line at certain small interpolar distances. The resistance values of the curvilinear part in some regions of the interpolar distance agree satisfactorily with those obtained from the equation $R_c = \rho l_c/[\pi r_1(r_2 l/tg\alpha)]$ and the values of the linear part coincide with those obtained from the equation $R_c = [\rho/\pi r_1 r_2^2][l r_1 + (r_2 - r_1)^2 tg\alpha]$, where α is the angle of the base of the truncated cone of the electrolyte zone which takes part in the transfer of the ions. $tg\alpha$ depends on the relation between the radii of the electrodes and on the properties of the electrolyte. $tg\alpha$ characterizes the degree of dispersion of the current in the electrolyte and is detd. empirically. Through *Khim. Referat. Zhur.* 1960, No. 6, 95. W. R. Henn

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

PROCESSES AND PROPERTIES INDEX

A

L

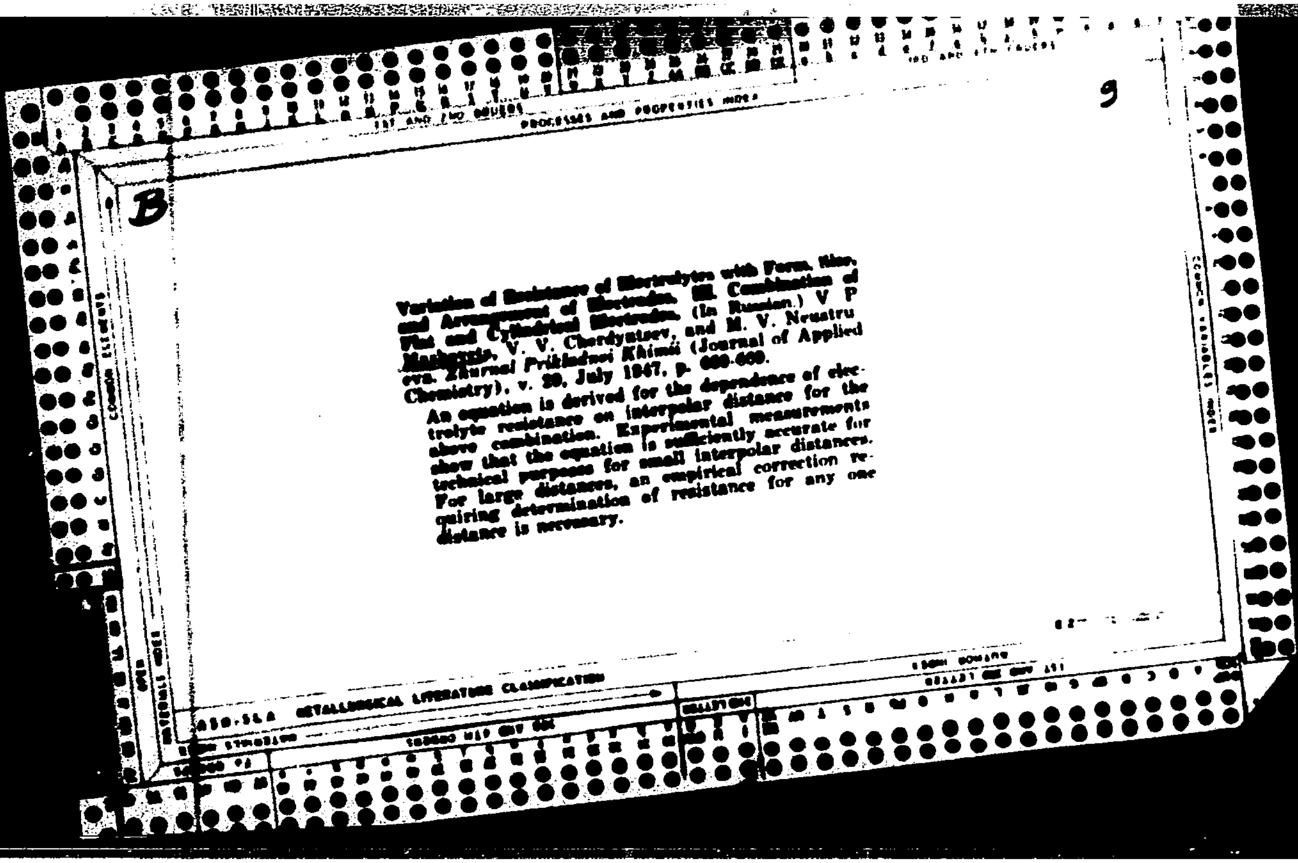
7-[illegible]. **Electrochemical Surface Treatment of Iron Screening for Use in Reinforced Glass.** V. P. [illegible] and A. P. [illegible]. *Journal of Applied Chemistry (U.S.S.R.)*, v. 20, no. 3, 1947, p. 219-224. (In Russian.)

Details of a commercial process which has been worked out for electrochemical degreasing, cleaning, and degasification.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

MASHOVETS, V.P.

-96 (Investigation of certain properties of storage-battery red lead oxide). Issledovanie nekotorykh svoistv akkumuliatornogo surika.
Zhurnal Prikladnoi Khimii, 20(3): 225-238, 1947.



B

9

Variation of Resistance of Electrolytes with Form, Size, and Arrangement of Electrodes. III. Combination of Flat and Cylindrical Electrodes. (In Russian.) V P Mashovets, V. V. Cherdyntsev, and M. V. Neustrueva. Zhurnal Prikladnoi Khimii (Journal of Applied Chemistry), v. 20, July 1947, p. [illegible].

An equation is derived for the dependence of electrolyte resistance on interpolar distance for the above combination. Experimental measurements show that the equation is sufficiently accurate for technical purposes for small interpolar distances. For large distances, an empirical correction requiring determination of resistance for any one distance is necessary.

MASHOVETS, V. P.

PA 75T23

[illegible]

[illegible] , V. P. [illegible] A. S. [illegible]

[illegible] p. 347-361

[illegible]

MASHOVETS, V.P

B

Elt4

③

Influence of Additions to Lead-Antimony Alloys on the Performance of the Plates of Lead Storage Batteries. II. Investigation of the Kinetics of Corrosion. V. P. Mashovets and A. Z. Lyandres. III. Overvoltage of Hydrogen on Alloys and Overvoltage of Oxygen on Oxidized Alloys. V. P. Mashovets and V. N. Faleeva. (In Russian.) *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 21, May 1948, p. 441-455.

In Part II, the characteristics of a series of Pb-Cd alloys containing various small admixtures of Ag, Bi, As, Fe, and Zn with regard to their corrosion when used as storage-battery plates were determined. Lead containing no Cd, but 0.33% Ca, was also evaluated. The protective effect of Ag, the negative influence of Bi, and the harmful effect of Zn are indicated. Pb-Ca appeared to be slightly more stable than Pb-Cd. In Part III, results of overvoltage measurements using specially developed apparatus and a similar series of alloys to that tested in Part II are given. Data are tabulated and graphed. 11 ref.

6/3/54 P

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

9

M

***Effect of Impurities in Lead Antimony Alloys on the Functioning of Lead Accumulator Plates. III.—Hydrogen Overvoltage on the Alloys and Oxygen Overvoltage on the Oxidized Alloys.** V. P. Mashovets and V. N. Fateeva [illegible] **1948, 21,** [illegible]—[illegible] Russian [illegible] The overvoltage of hydrogen on pure [illegible] H_2SO_4, measured over a range of [illegible] than that of pure lead. Addition of [illegible] to the antimonial lead increase the overvoltage [illegible] considerably. The [illegible] the hydrogen overvoltage [illegible] negative [illegible] using the same [illegible] the [illegible] than [illegible] plate in comparison [illegible] antimony [illegible] Therefore as far [illegible] plate [illegible] silver and [illegible] the positive [illegible] not [illegible] in effect. The oxygen overvoltage was measured on plates of lead and lead-5·72% antimony alloy after these had been anodically oxidized at a c.d. of 1 × 10^{-4} amp. cm [illegible] hr. The increase in true surface area during the oxidation was deduced from the overvoltage and also by measurement of the capacity of the oxidized layer; the surface increase for plates of antimonial lead was 1·6–2·1 times greater than for plates of pure lead.—G. V. E. T.

Sept. 19

MASHOVETS, V. P., LHOMYAKOV, V. G. and KUZ'MIN, L. L.

"Technology of Electrochemical Production", Tekhnologiya Elektrokhimicheskikh Proizvodstv, Goskhimizdat, 676 pp, 1949.

MASHOVETS, V. P.

"Technology of the Electro-Chemical Industry," Moscow, 1949.

4

CA

The voltage balance of an electrolyzer. V. P. Mashovets and G. A. Forsblom. *Zhur. Priklad. Khim.* 22 (J. Applied Chem. 22, 1083(1949)). The conventional procedure of averaging the potential of an electrode and assuming an av. ohmic drop across the electrolyzer can be meaningless if the field between the electrodes is nonhomogeneous. Theoretically and experimentally it is possible to have a field distribution in which certain points of layers of the electrolyte lying at the anode are at a lower potential than some points close to the cathode. N. Thon

MASHOVETS, V. P.

FDD PA 169T46

USSR/Metals - Metallography, Lead Aug 50

"Method for Preparing Microsections of Lead and Its Alloys," V. P. Mashovets, A. X. Lyandres, State Sci Res Bat Inst

"Zavod Lab" Vol XVI, No 8, pp 1014-1016

Reviews existing methods and recommends method consisting of cutting specimens with microtome and of subsequent coarse etching and polishing fine etching. Mixture of equal volumes of strong acetic acid and concentrated H peroxide has to be used for coarse etching. Reagent for fine

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USSR/Metals - Metallography, Lead Aug 50
(Ccntd)

etching consists of nitric acid, glacial acetic acid and glycerin in ratio of 1:1:2. Method permits discernment of separate structural components of alloys, and to expose orientation of crystals.

169T46

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CA

A method of investigation of the electric field in solutions. V. P. Mashovets. *J. Applied Chem. U.S.S.R.* 23, 63-78 (1950)(Engl. translation).—See *C.A.* 44, 4803d.
R. M. S.

CA

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Method of investigation of the electric field in solutions. [illegible] P. Mashovets. *Zhur. Priklad. Khim.* (J. Applied Chem.) 23, 66-80(1950).—The potential distribution is detd. in a $CuSO_4$ electrolyte soln. in a flat L-shaped cell made of a horizontal glass bottom, 2 vertical parallel L-shaped Cu strips serving as cathode and anode, and two end strips of glass. The distance between one pair of branches of the L-strip is 2 cm., between the other pair, 18 cm. Viewed vertically, the cell is a model of half a cell for Al electrolysis. The measurements, after passage of a polarizing current, give the potential distribution curves along consecutive sections of the cell, and hence permit construction of maps of isopotential and elec. field lines. These maps give the current distribution over the electrodes, the sp. elec. cond. of the soln., the spatial distribution of the ohmic and polarization energy, the elec. resistance of the cell, and the polarization curve. The method is applicable to models of electrolyzers of any prescribed shape.

N. Thon

MASHOVETS, V.P.; FORSBLOM, G.V. Prinimal uchastiye POPOV, R.B.; GULYANITSKIY, B.S., inzh., retsenzent; FIRSANOVA, L.A., red.; ATTOPOVICH, M.K., tekhn. red.

[Electrolytic production of aluminum] Elektroliticheskoe proizvodstvo aliuminiia; prakticheskoe rukovodstvo dlia rabochikh, brigadirov i masterov tsekhov elektroliza aliuminevykh zavodov. Moskva, Metallurgizdat, 1951. 220 p. (MIRA 16:7)

1. Vsesoyuznyy alyuminiyevo-magniyevyy institut (for Mashovets, Forsblom).

(Aluminum--Electrometallurgy)

MASHOVETS, V.P.; YUDIN, B.F.

Thermodynamics of the interaction between AlF_3, Na_3AlF_6 and $NaAlF_4$ with water vapor. Izv. vys. ucheb. zav.; tsvet. met. 5 no.4: 95-105 '62. (MIRA 16:5)

1. Leningradskiy tekhnologicheskiy institut, kafedra fizicheskoy khimii.

(Aluminum fluoride—Thermodynamic properties)
(Cryolite—Thermodynamic properties)
(Vapor pressure)

CA

Electrochemistry-4

Effect of the geometrical parameters of the electrolyser on the distribution of electrical energy within it. V. P. Mashovets, N. V. Pototskaya, N. L. Komarov, and U. F. Turomshina. *Zhur. Priklad. Khim.* 24, 154-66; *J. Applied Chem. U.S.S.R.* 24, 169-80(1951)(Engl. translation); cf. *C.A.* 44, [illegible].—In a model of a single-anode Al bath the effects of varying the distance from the anode to the side wall, the depth of the electrolyte, and the interelectrode distance (L) were studied by using an aq. soln. of $CuSO_4$, H_2SO_4, and alc. at 25°. The fields were plotted (*loc. cit.*). The formula $S_c = (A + 3L)(B + 3L)$, where S_c = the derived cross section of the electrolyte and A and B = the length and width of the electrode, resp., is recommended for the design of Al baths. Earl S. McColley

A-U Inst. Aluminum Magnesium

MASHOVETS, V. P.

3 ① Elec
θ KD/K

The effect of nonconducting inclusions on the conductance of an electrolyte. V. P. Mashovets. *Zhur. Priklad. Khim.* 24, 353-60. ~~*J. Applied Chem. U.*~~*S.S.R.* 24, 391-8 (1951)(Engl. translation).—Exptl. and graphic data are reported from a study of the effect of cylindrical and spherical nonconducting inclusions on the cond. of an electrolyte. An empirical formula $K = (K_s/K_0) = 1 - p$ is offered for calcg. relative cond., and $K_s = 1 - 1.78p + p^2$ when K_0 is the sp. cond. of the pure electrolyte, K_s is the sp. cond. of the electrolyte contg. inclusions, and p is the relative packing factor. The formula is claimed to hold good for all spherical inclusions and for packing factors that do not exceed 0.4 of the total vol. for cylindrical inclusions.

D. F. Brown

8-30-54

MASHOVETS, V. P.

3 (4)

"The Role of Geometrical Factors in the So-Called "Dispersibility" of Galvanic Baths. V. P. Mashovets and O. V. Forsblom (Zhur. Priklad. Khim., 1952, 25, (6), [illegible] (in Russian); J. Appl. Chem. U.S.S.R., 1952, 25, (5), 597-609 (in English)).—According to Lainer and Kudryavtsev ("Fundamentals of Electroplating", Moscow: 1949), the dispersibility of the bath is the divergence of the distribution of the metal from the fundamental distribution of current, thus indicating the possibility of obtaining a uniform deposit on a profiled cathode without the use of contoured anodes, screens, &c. M. and F. propose analytical expressions enabling the effect on the dispersibility of variations in the polarising powers of the electrodes, the sp. elect. conductivity of the electrolyte, the current strength, and the distance between the electrodes to be determined. By graphical construction of the elect. fields in various baths, it has been shown that a given variation in any one factor may lead to either more or less uniform distribution of the current on the cathode, depending on the geometrical parameters of the bath.—G. V. E. T.

Metallurgical Abst.
June 1954
Electrodeposition

ASHOVETS, V. P.

The role of geometrical factors in the so-called "dispersibility" of galvanic baths. V. P. Mashovets and G. V. [illegible]. *J. Appl. Chem. U.S.S.R.* 25, [illegible]-606(1952) (Engl. translation); *Zhur. Priklad. Khim.* 25, 532-42 (1952).—Analytical expressions are proposed for detg. the effect of variations in the polarizing powers of the electrodes, sp. cond. of the electrolyte, current strength, and distance between the electrodes on the distribution of current on the cathode in relation to the geometrical parameters of the cell. By a series of graphs of the elec. fields in various cells, it was shown that one and the same variation of any one factor lead both to more uniform and less uniform distribution of current on the cathode, depending on the geometrical parameters of the cell. A systematic connection between the effect of the various factors and the geometrical parameters of the field was shown. B. R.

MASHOVETS, V. P.

232T40

USSR/Chemistry - Aluminum Sep 52

"Investigation of the Composition of Anode Gases During the Electrolysis of Molten Cryolite-Alumina," V. P. Mashovets, M. F. Dogramadzhi, Ye. M. Florinskaya

"Zhur Prik Khim" Vol 25, No 9, pp 955-965

Authors state that before this work, the formation of pure CO_2 as a primary anode product had never been established experimentally in the electrolytic production of Al. A specially constructed large laboratory bath set up for the electrolysis of molten cryolite-alumina permitted the generation of the primary anode gas, avoiding protracted contact of the gas with the carbon anode. An increase in temp and a decrease in the anodic cd enriched the primary gas with carbon monoxide. The content of CO was also increased by using a carbon anode with high oxidizability. By using carbon with low chem activity and applying low temp and high current densities, a primary gas consisting of almost pure carbon dioxide was generated. In industrial single-anode baths, the av content of CO_2 in bath gases approached 55%-60%. The relation of the compn of anode gases to the above factors was confirmed, as well as to the width of the anode and to the time of taking the sample. At the time of the anode effect, a significant amt of gas of unknown compn with a high mol wt was found.

(3)

232T40

MASHOVETS, V. M.

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An investigation of the composition of anode gases during electrolysis of cryolite-alumina melt. [redacted] M. F. Dozmanadzhi, and E. M. [redacted] J. Appl. Chem. U.S.S.R. 25, 1023-30(1952); Zhur. Priklad. Khim. 25, 956-65(1952).—A large-scale lab. cell was constructed of such design to allow the immediate sampling of primary anode gas. Increase in temp. and decrease in c.d. enriched the anode gas with CO. CO increased with readily oxidizable C anodes. Low temp. and high c.d. with low-activity C anodes gave 97% CO_2 in the anode gases. CO_2 (55-60%) was found in anode gas from industrial uni-anode cells.

Charles M. Mason

MASHOVETS, V.P.

Evaluation of voltage drop in aluminum cells. G. V. Forsblom and V. P. Mashovets (All-Union Aluminum-Magnesium Inst., Leningrad). *Zhur. Priklad. Khim.* 25, 1165-76(1952); cf. *C.A.* 44, 4802e.—The ohmic voltage drop ΔV in a cryolite-Al_2O_3 bath with Al and graphite electrodes was detd. analytically as a function of parameters obtained either from a plot of the elec. field or from the dimensions of the electrodes, length A and width B ($P = 2(A + B)$) and the interelectrode distance L. At first it was assumed that the entire polarization effect was due to that of the graphite electrode. Then 3 fields of this electrode were plotted: no assumed polarization; polarization assumed according to the c.d. *vs.* η data of Karpacheva, *et al.* (*C.A.* 43, 6519e) and according to similar data of de-Kay Thompson, *et al.* (*C.A.* 27, 4483). The analysis of these fields led to the conclusion that the effect of polarization on ΔV was negligible and the equation was reduced to $\Delta V = (I\rho/N^2)\sum_{i=1}^{i=N} m_i = 1.56$ which was considered in satisfactory agreement with exptl. data ($I = iN$, i the elec. power of each "tube" of force, N the no. of tubes in the entire vol., m the no. of elements of vol. in each tube, and ρ the specific resistance of the electrolyte). A simpler equation which could be solved without plotting the electrode field was obtained: From previously published data (*C.A.* 46, 10962g) it was shown that the effect of the distance C between the walls and the edges of the electrodes was negligible for $C \geqq 5L$. It was also shown that for L between 3 and 10 cm. the no. of tubes as a function of L was practically linear. Within these limits of C and L the equation was $\Delta V = I\rho L/[AB + P(L + 2.5)]$. Over a wide range of the parameters the calcd. values agreed satisfactorily with exptl. data. I. Bencowitz

1. MASHOVETS, V. P.: FORSBLOM, G. V.

2. USSR (600)

4. Electric Currents

7. Distribution of a direct current electric field in electrolysers. Zhur. fiz. khim. 26 no. 10, 1952.

9. Monthly List of Russian Accessions, Library of Congress, March 1953. Unclassified.

MASHOVETS, V. P.

*Influence of the Geometric Parameters of the Electrolytic Cell on the Distribution of Potential and Current on the Electrode Surface. G. V. Forsblom and V. P. Mashovets (*Trudy Soveshchaniya po Elektrokhimii 1950*, 1953, 431-441). —[In Russian]. Various experiments were made, using acid $CuSO_4$ baths. The effective electrode potential, calculated for the mean c.d., depends on the geometry of the cell. The ohmic resistance of the electrolyte depends not only on the geometry and the resistivity of the electrolyte, but also on the polarizability of the electrode and the current strength, so that the conception of a "cell const." is meaningless. The same is true of the idea of "throwing power".—G. V. E. T.

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MASHOVETS, V. P.

NG

The Effect of Temperature on Mould Filling in the Casting of Lead-Antimony Alloys. V. P. Mashovets and E. I. Daragan-Sushchova (*Liteinoe Proizvodstvo*, [illegible], 14-21).—[In Russian]. A special test was used to study the effect of mould and metal temp. on the fluidity of 4 alloys contg., resp., Sb 3·5, 6·25, 9, and 13%, remainder Pb. The test mould was made in cast Fe and contained 8 vertical pyramidal cavities (from 1 to 5 mm. sq. at the base and 40–100 mm. long) all joined to a common gating system. The degree of filling of the moulds was used as an index of the fluidity of the alloy. The results show that the poorest fluidity is obtained with the alloy contg. Sb 6·25% and that the mould temp. can be better utilized to control the fluidity than can the metal temp.—V. K.

MASHOVETS, V. P.

MASHOVETS, V.P., prof., doktor tekhn. nauk.

Investigating copper oxide cells at low temperatures. Sbor. nauch. trud. LETIIZHT no.5:214-221 '53. (MIRA 11:3)
(Electric batteries)

MASHOVETS, V.P.

USSR

Checking the discharge of copper oxide cells by the specific gravity of the electrolyte. V. P. Mashovets. *Sbornik Nauch. Trudov Leningrad. Elektrotekh. Inst. Inzhenerov Zhelezno-Dorozh. Transporta* 1953, No. 6, 222-7; *Referat. Zhur., Khim.* 1954, No. 34787.—The condition of CuO cells could be checked from the sp. gr. of the electrolyte (KOH soln.) which changed because of the accumulation of zincate according to $CuO + Zn + 2KOH \rightarrow Cu + K_2ZnO_2 + H_2O$. There was no appreciable layer sepn. in the electrolyte and the change of its d. could be expressed by $d_k = d_0 + ak + bk^2$, where k was the capacity in fractions of the nominal taken as 1, d_0 was the initial d., d_k was the final d., and a and b were coeffs. 0.144 and 0.03, resp. When the cell was discharged, zincate crystd. out and the d. of the electrolyte became const. The check could be carried out with an ordinary storage-cell pipet hydrometer.

M. Hosch

✓**Concerning the Criterion for the Uniformity of Distribution of a Metal on the Cathode.** V. P. Mashovets (*Zhur. Priklad. Khim.*, 1953, 26, (7), 775–77~~9 (in Russian)~~; *J. Appl. Chem. U.S.S.R.*, 1953, 26, (7), 731–735 (in English)).—Although emphasizing the desirability of obtaining such a criterion, M. criticizes the papers and books of Kadaner (preceding abstract) on this subject. The criterion $M_i/(M_s + M_i)$ would be more suitable than M_i/M_s. The phys. meanings of M_i/M_s and $m\Big/\frac{dm}{dl}$ are different. The former criterion characterizes the uniformity of distribution of the metal. The meaning of the latter quantity is best given by considering its reciprocal (with a negative sign prefixed); this signifies the relative change in the increase in weight of the deposit (or thickness or rate of deposition) with change of distance, and has no phys. meaning for a bath of arbitrary configuration. Throwing power is not an objective property of the electrolyte independent of the geometrical configuration of the bath. Apart from his other mistakes, K.'s derivations are all useless in that they are based on the fundamentally erroneous concept of rectilinear distribution of current.—*G. V. E. T.*

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USSR.

The dependence of the electrochemical and ohmic fall of potential upon the geometry in an electrolytic cell G. A. Forsblom and V. F. Mashovets. *J. Appl. Chem. U.S.S.R.* 26, 913-8(1953)([redacted]).—See C.A. 48, 5688c.
H. L. H.

MASHOVETS V.P.

The dependence of the electrochemical and ohmic fall of potential upon the geometry in an electrolytic cell. G. Y. Forsblom and V. P. Mashovets. *Zhur. Priklad. Khim.* 26, 1020-5(1953).—The effective potential of an electrode was dependent upon local c. ds. which were detd. by cell geometry. In regions of low c.d., the electrode potential usually diminished faster than linearly with a decrease of c.d. Therefore the effective potential was lowered as current distribution became nonhomogeneous. The change in potential was illustrated for 2 electrolytic cells differing only in the shape of the anode. A graphical method of field construction was used (*C.A.* 47, 9835*c*). Potential and current distribution patterns were shown for a cell with two parallel plate electrodes (presumably Cu) 300 mm. long, sepd. by a distance, *l*, where $l = 50$ or 100 mm. One electrode was displaced 100 mm. relative to the other. The technique permitted calcn. of cell consts. as used in cond. measurements (*C.A.* 44, 4802*e*). Cell consts., *C*, were measured for a soln. contg. 50 g./l. of $CuSO_4.5H_2O$ and 3 solns. of the same concn. of $CuSO_4$ contg. H_2SO_4. At $l = C = 2.05$ for the $CuSO_4$ soln.; 2.32 for a soln. contg. 20 g./l.; 2.33 for a soln. contg. 50 g./l.; and 2.09 for a soln. contg. 350 g./l. At $l = 50$ mm., with a.c., $C = 1.33$ for all 4 solns.; with d.c. (45 ma.). $C = 1.33$ for the $CuSO_4$ soln.; 1.40 for the soln. contg. 20 g./l.; 1.60 for the soln. contg. 50 g./l.; and 1.80 for a soln. contg. 350 g./l. With the soln. contg. 50 g./l. and $l = 50$ m.m. the values of *C* at 15 and 90 ma. d.c. were 1.68 and 1.40, resp. The increase of *C* in the d.-c. measurements with higher H_2SO_4 concns. resulted from longer current lines and must be ascribed to greater polarization since the cond. increased. Current distribution must be uniform to obtain reproducible electrolytic cell data, especially in good conductors such as fused salts. For this reason, "cell consts." derived from a.-c. data were inadmissible for use in d.-c. electrolysis.

R. D. Misch

A-11 Aluminum-Magnesium Inst.

FRUMKIN, A.N., akademik; FORSBLOM, G.V.; MASHOVETS, V.P.

Conditions for the modeling of the electric field of electrolysers. Dokl. AN SSSR 91 no.3:593-595 Jl '53. (MLRA 6:7)

1. Vsesoyuznyy alyuminiyevo-magniyevyy institut (for Forsblom and Mashovets).
2. Akademiya nauk SSSR (for Frumkin).
(Electrolysis--Electromechanical analogies)

MASHOVETS, V. P.

The Committee on Stalin Prizes (of the Council of Ministers USSR) in the fields of science and inventions announces that the following scientific works, popular scientific books, and textbooks have been submitted for competition for Stalin Prizes for the years 1952 and 1953. (Sovetskaya Kultura, Moscow, No. 22-40, 20 Feb - 3 Apr 1954)

Name	Title of Work	Nominated by
Mashovets, V. P. Foreblom, G. V.	"Investigation of DC Electrical Fields in Electrolyzers"	State Scientific Research Institute of Aluminum and Magnesium (13)

SO: W-30604, 7 July 1954

MASHOVETS V.P.

②

Distribution of the electric field of direct-current cells. V. P. Mashovets and G. V. Forsblom. *Zhur. Priklad. Khim.* 27, 280-[illegible](1954); cf. *C.A.* 47, 7919*h*.—To confirm experimentally the differential equations and conclusions derived analytically and previously reported, the equipotential lines of a rectangular electrolyzer were detd. over a wide range of c.d., polarizing power of the electrodes (Cu, Pb), and the sp. cond. χ of the electrolyte. Electrodes of identical dimensions and parallel to each other were offset so that only a part of each was opposite the other, thus distorting the field. The electrolytic contact was so mounted that it could be moved normal and parallel to the electrodes. The potentiometer was set at predetd. p. ds. ΔU and the contact moved over the cell until the zero point was reached and recorded. At the end of the expt. the entire cell was plotted with equipotential lines. The current lines, normal to the equipotential lines and forming angle θ with the electrode, were drawn with a divider so that the distance between them was equal to that between the equipotential lines. The no. of spaces, "tubes of force," between the current lines, n, in the field and their current force, i, entered in all subsequent calcns.: $\chi = I/1.5n\Delta U$, where $I = in$, (1.5 cm. = the electrolytic depth in the cell). The calcd. and exptl. values of χ agreed within ±5%. Curves of c.d. *vs.* φ yielded the values of $d\varphi/dj$, the polarizing power of the electrodes, and those of c.d. *vs.* λ gave $dj/d\lambda$; j = the c.d. over the electrode and λ the distance in cm. of a given point from the edge (left) of the electrode. The calcd. value of $\tan \theta = -j/\chi(d\varphi/dj)(dj/d\lambda)$ agreed satisfactorily with the exptl. values, considering the difficulties of obtaining the several values from plots. Addnl. conclusions made previously (loc. cit. and *C.A.* 48, 6885*i*) were corroborated.

I. Bencowitz

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Mashovets, V.P.

BELETSKIY, M.S.; MASHOVETS, V.P.

Determining the amount of aluminum in an electrolytic cell by means of radioactive tracers. TSvet.met. 28 no.5:51-54 S-O '55. (MIRA 10:10)

(Aluminum--Analysis) (Radioactive tracers)

Mashovets, V. P.

Category: USSR/Analytical Chemistry - Analysis of inorganic substances. G-2

Abs Jour: Referat Zhur-Khimiya, No 9, 1957, 31040

Author : Mashovets V. P., Zakharov Ye. L.
Inst : not given
Title : Analytic Determination of Carbon Fluorides in Anodic Gases of an Aluminum Cell

Orig Pub: Zh. prikl. khimii, 1956, 29, No 10, 1512-1521

Abstract: The method of determination of carbon fluorides in the gases is based on decomposition of the fluorides with water vapor in the presence of activated Al_2O_3 and SiO_2 (at 700-800°) followed by absorption of CO_2; CO is burned over CuO at 300-350° and the resulting CO_2 is absorbed in alkaline solution of pyrogallol. The method is applicable in the separation of CF from higher fluorides. The method described is more sensitive and yield better reproducible results than the fluoride method. It was found that anodic gases of an Al-cell having fired anodes, do

Card : 1/2

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Analysis of carbon fluorides [illegible] gases of an aluminum bath [illegible]

MASHOVETS, V.P., doktor tekhnicheskikh nauk, professor; RAMLAU, A.I., assistent, inzhener; SUPRUN, L.M., assistent, inzhener.

Electrode potentials of copper oxide electrode elements and testing the discharge duration pattern. Sbor.LIIZHT no.151:222-237 '56.
(Electrodes) (MLRA 10:1)

MASHOVETS, V.P., doktor tekhnicheskikh nauk, professor.

Stabilizing battery galvanic cell voltage. Sbor.LIIZHT no.151:238-246 '56. (MLRA 10:1)

(Electric batteries)

AUTHOR: Mashovets, V.P., Professor. 136-5-10/14

TITLE: The heat balance and calculation of inter-electrode distance for aluminium electrolyzers. (O teplovom balanse i raschete mezhduelektrodnogo rasstoyaniya alyuminievykh elektrolizerov.)

PERIODICAL: "Tsvetnye Metally" (Non-ferrous Metals) 1957, No.5, pp. 63 - 69 (U.S.S.R.)

ABSTRACT: The author deplores the complications which have been introduced into heat-balance and electrode-separation calculations for aluminium electrolyzers. For example, P.P.Fedotev (1) started the unnecessary practice of referring heat-balances to the electrolyzer temperature. This has led to numerous errors and some confusion (refs. 2,3,4), which have been criticised by I.M. Kaganskii and A.A. Edingaryan (5). The main cause of this unfortunate development is attributable to the unjustified use of the second law of thermo-dynamics for problems completely covered by the first law. The author favours 0 °C as the reference in temperature, in agreement with G.A. Abramov and his co-workers (7) and Kaganskii and Edingaryan, and cites the balance published by V.D.Ponomarev and I.Z. Slutskii (8) as an example of confusion and error partly due to the use of another temperature. In discussing

Card 1/2

The heat balance and calculation of inter-electrode distance for aluminium electrolyzers. (Cont.) 136-5-10/14

the thermo-dynamics of electrolyzer operation, the author mentions his own experimental work with A.A. Revazyan (11) and his criticism together with G.V. Forsblom (13) of the views of G.A. Abramov et al. (7). G.V. Forsblom's (17) relatively high value (0.63-0.83 Ωcm) is attributed to gas saturation and foaming, K.P. Batashov (16) having obtained lower values. For calculating inter-electrode distance it is only necessary to know the reversible decomposition voltage and the over-voltage in the given concrete conditions of the electrolyzer, and the requirements enumerated by B.S. Gulyanitskiy and V.V. Krivoruchenko (18) are considered to be incorrect.

Card 2/2

There are 18 references, 14 of which are Slavic.

ASSOCIATION: All-Union Aluminium-magnesium Institute (VAMI)

AVAILABLE:

MASHOVETS, V.P.

15

4

Electromotive force of galvanic cells of fused cryolite-alumina. V. P. Mashovets and A. A. Revazyan. *Zhur. Priklad. Khim.* 30, 1006-12(1957).—The e.m.f. of cells Al\|Na_3AlF_6 + Al_2O_3\|gas electrode were detd. at 1000-13°; the gas electrodes were: Pt(O) and Pt(O...) (I), Pt(CO_2) (II), C(CO_2) (III), and C(O) (IV). The electrolytic cells consisted of 2 concentric porous sintered corundum cylinders inside a graphite crucible. The inside cylinder protected the gas electrode from possible "metallic fog." The Mo wire connecting the Al electrode and the C gas electrodes (hollow C tubes) were protected by corundum sleeves and so was the Pt electrode with the gas flowing through the tube. Synthetic cryolite (NaF:AlF_3 = 3) was satd. with Al_2O_3. The theoretical e.m.f. of I (2.12 v.), calcd. from the free energy of the reaction $Al_2O_3 \rightarrow 2Al + 1.5\ O_2$, indicated that the reaction was reversible. The exptl. e.m.f. of a gas contg. 12.9% O and 87.1% N was 2.00-2.01, and that of a gas contg. 3.5% O and 96.5% N was 1.84-1.83 v. The O electrode approached reversibility at O_2 = 1 atm. so that the process was more accurately represented by $Al \rightarrow Al^{+++} + 3e$ on the anode and $O_2 + 4e \rightarrow 2O^{--}$ or $O_2 + 2Al_2O_3 + 4e \rightarrow 4AlO_2^-$ (depending on the character of the O-contg. anion) on the cathode and $2Al^{+++} + 3O^{--} \rightleftarrows Al_2O_3$ or $Al^{+++} + 3AlO_2^- \rightleftarrows 2Al_2O_3$ in the liquid phase. The e.m.f. of II was equal to the theoretical value, 1.10-1.12 v., and the process was represented by $CO_2 + 4e \rightarrow C + 2O^{--}$ or $CO_2 + 2Al_2O_3 + 4e \rightarrow C + 4AlO_2^-$. The e.m.f. of III decreased with time from 1.346-1.40 v. during the first 5 min. to 1.11 v. after 30 min. and remained const. at this value till the end of the expt. (120 min.). The C electrode had not been treated in any way except that it was held over the

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MASHOVETS, V.P.; REVAZYAN, A.A.

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melt for 15-20 min. before submerging. In 1 expt. the CO_2 was stopped after the const. e.m.f. (1.11 v.) was reached, and the e.m.f. decreased to 0.74 v. In another expt. the C electrode was removed and kept in the air a few min. and then submerged; the initial e.m.f. was 1.35-1.45 v. A similar decrease of the e.m.f. with time was exhibited by electrode IV. These results indicated that CO_2 was the controlling factor and that an intermediate gas C_xO was formed.

I. Rencowitz

2/2

[illegible] Composition [illegible]

ASHOVETS, V. P.

137-58-5-9276

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 5, p 71 (USSR)

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TITLE: On the Cathodic Process in the Electrolytic Manufacture of Aluminum (O katodnom protsesse pri elektroliticheskom poluchenii alyuminiya)

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ABSTRACT: A majority of the authors who have investigated the relationship existing between the current efficiency and various factors in the course of electrolysis of melts have arrived at the following empirical formula: $\eta = 1 - k/j^n$, where η is the current efficiency, k is the losses of substance (or of electrical energy), j is the current density, and n is an exponent. The value of the constant k in the aboveindicated formula is determined empirically and is a function of temperature, interelectrode spacing, design of the electrolyzer, composition of electrolyte, etc. It represents the relative losses in metal (the fraction of metal lost) at $j = 1$ amp/cm^2 and is always less than unity. The values of the exponent n vary among different authors from 0.5 to 1.0. A somewhat more complicated version of this formula makes it

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possible to determine correctly in principle metal losses that are independent of the electric current. However, a comparative analysis of the equations presented has shown that a universal equation should cover not only the chemical losses, which are independent of the electric current, but also electrochemical losses which are a function of the electrode potential; these factors are not taken into account in the formulas presented above.

I. G.

1. Aluminum--Production 2. Aluminum--Electrolysis 3. Electrolysis --Applications

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