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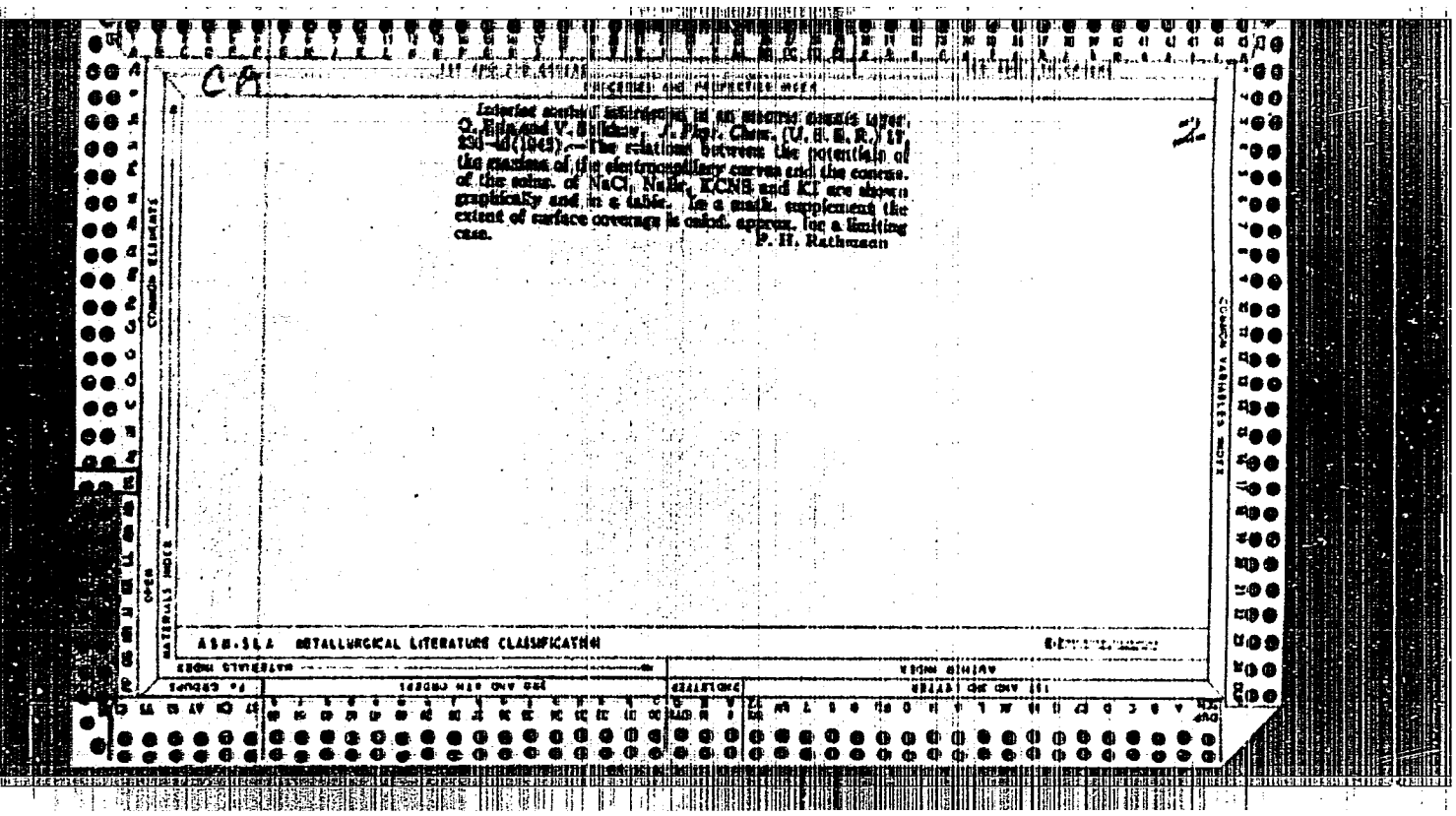

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Interior sorbed substances in an electric double layer. O. Esin and V. Bolkhov. J. Phys. Chem. (U.S.S.R.) 17, 230-40(1943).—The relations between the potentials of the maxima of the electrocapillary curves and the concns. of the solns. of NaCl, NaBr, KCNS and KI are shown graphically and in a table. In a math. supplement the extent of surface coverage is calcd. approx. for a limiting case.

P. H. Rathmann

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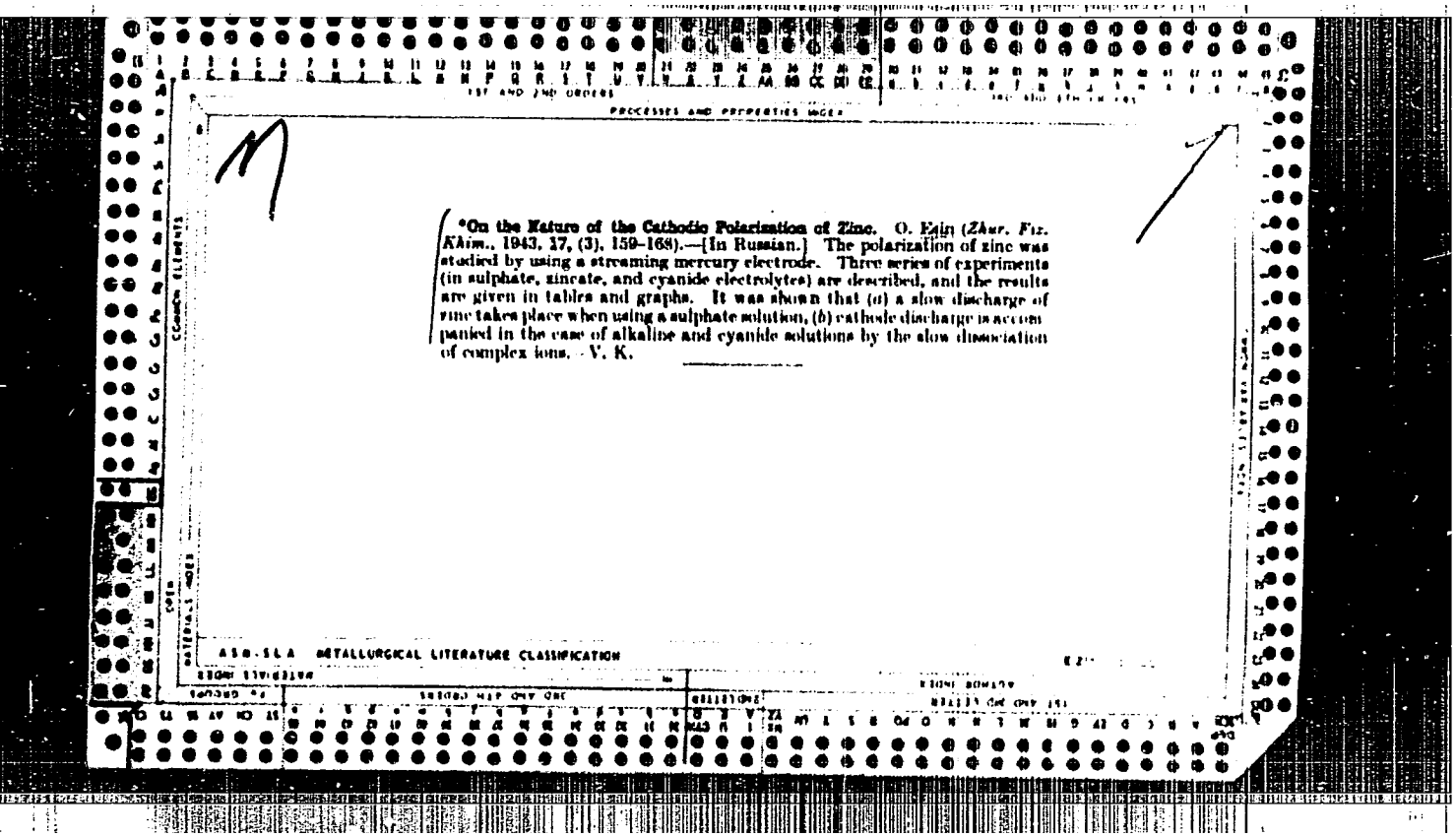

*On the Nature of the Cathodic Polarization of Zinc. O. Eijn (*Zhur. Fiz. Khim.*, 1943, 17, (3), 159–168).—[In Russian.] The polarization of zinc was studied by using a streaming mercury electrode. Three series of experiments (in sulphate, zincate, and cyanide electrolytes) are described, and the results are given in tables and graphs. It was shown that (*a*) a slow discharge of zinc takes place when using a sulphate solution, (*b*) cathodic discharge is accompanied in the case of alkaline and cyanide solutions by the slow dissociation of complex ions. - V. K.

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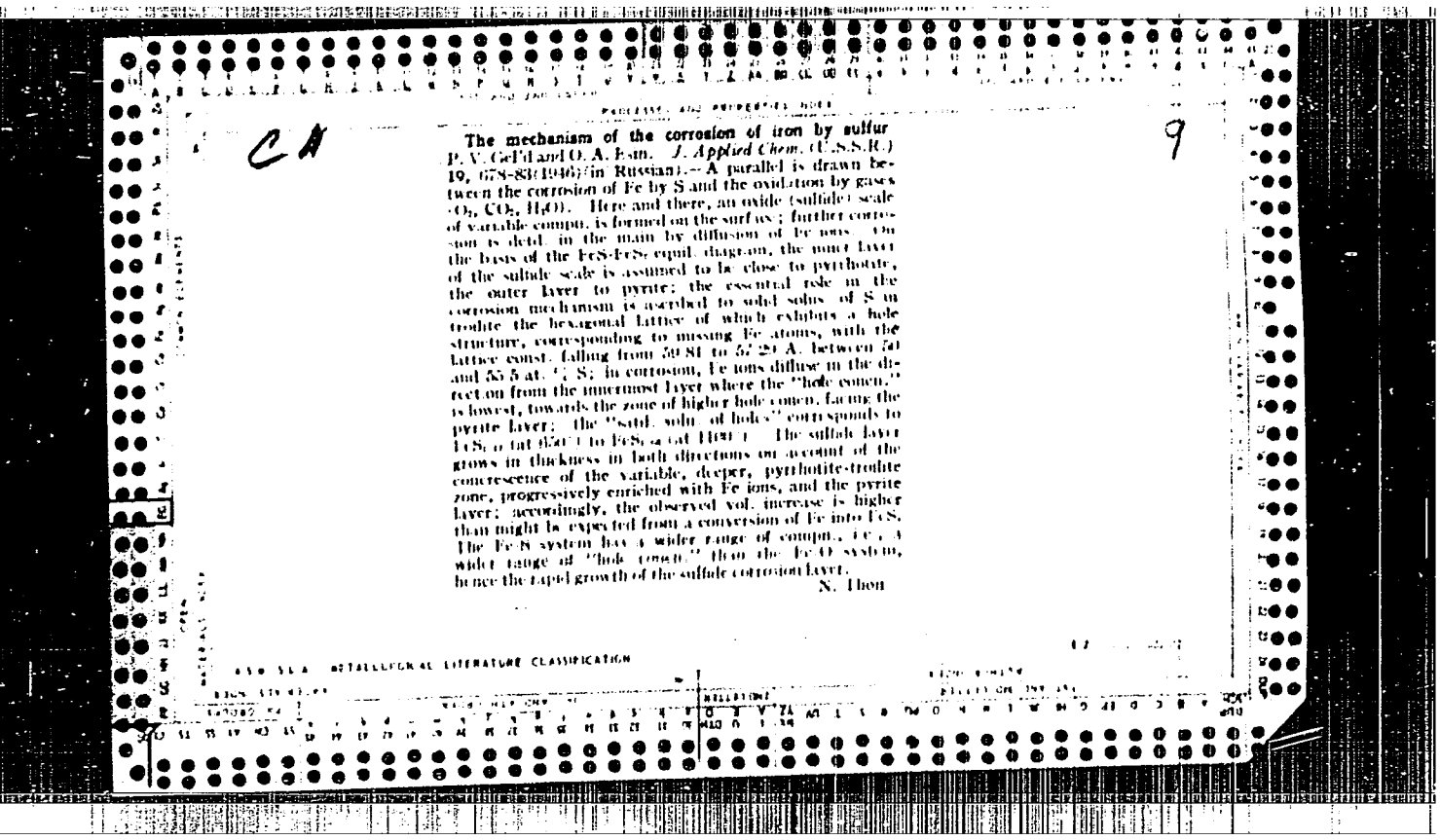

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The mechanism of the corrosion of iron by sulfur P. V. Gel'd and O. A. Esin. *J. Applied Chem.* (U.S.S.R.) 19, 678-83(1946)(in Russian).—A parallel is drawn between the corrosion of Fe by S and the oxidation by gases (O_2, CO_2, H_2O). Here and there, an oxide (sulfide) scale of variable compn. is formed on the surface; further corrosion is detd. in the main by diffusion of Fe ions. On the basis of the FeS-FeS equil. diagram, the inner layer of the sulfide scale is assumed to be close to pyrrhotite, the outer layer to pyrite; the essential role in the corrosion mechanism is ascribed to solid solns. of S in troilite the hexagonal lattice of which exhibits a hole structure, corresponding to missing Fe atoms, with the lattice const. falling from 59.81 to 57.29 A. between 50 and 55.5 at. % S; in corrosion, Fe ions diffuse in the direction from the innermost layer where the "hole concn." is lowest, towards the zone of higher hole concn. facing the pyrite layer; the "satd. soln. of holes" corresponds to $FeS_{1.0}$ (at 650°) to $FeS_{1.4}$ (at 1100°). The sulfide layer grows in thickness in both directions on account of the concrescence of the variable, deeper, pyrrhotite-troilite zone, progressively enriched with Fe ions, and the pyrite layer; accordingly, the observed vol. increase is higher than might be expected from a conversion of Fe into FeS. The Fe-S system has a wider range of compn., i.e., a wider range of "hole concn." than the Fe-O system, hence the rapid growth of the sulfide corrosion layer.

N. Thon

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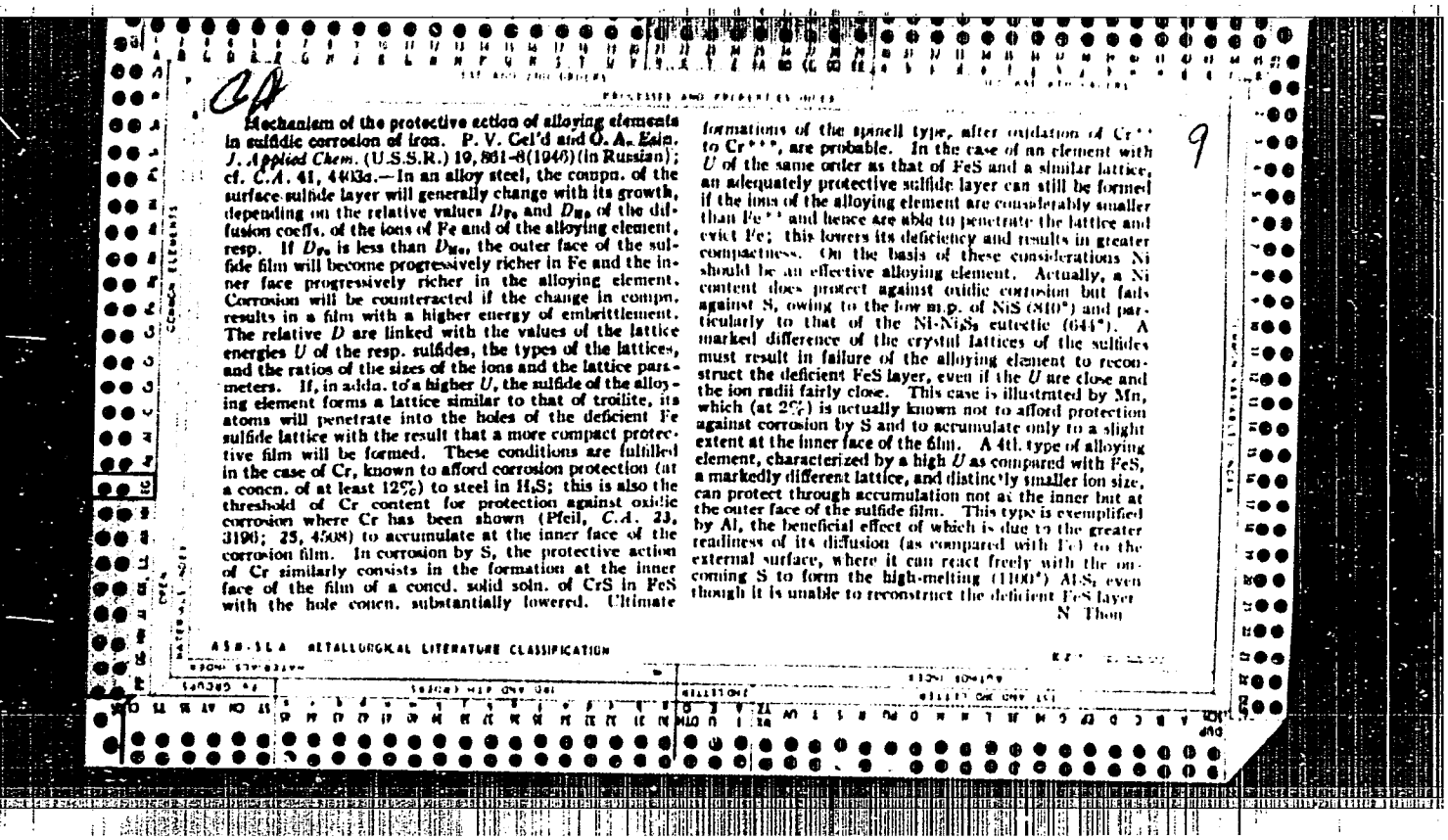

Mechanism of the protective action of alloying elements in sulfidic corrosion of iron. P. V. Gel'd and O. A. Esin. *J. Applied Chem.* (U.S.S.R.) 19, 861-8 (1946) (in Russian); cf. *C.A.* 41, 4403a.—In an alloy steel, the compn. of the surface sulfide layer will generally change with its growth, depending on the relative values D_{Fe} and D_{Me} of the diffusion coeffs. of the ions of Fe and of the alloying element, resp. If D_{Fe} is less than D_{Me}, the outer face of the sulfide film will become progressively richer in Fe and the inner face progressively richer in the alloying element. Corrosion will be counteracted if the change in compn. results in a film with a higher energy of embrittlement. The relative D are linked with the values of the lattice energies U of the resp. sulfides, the types of the lattices, and the ratios of the sizes of the ions and the lattice parameters. If, in addn. to a higher U, the sulfide of the alloying element forms a lattice similar to that of troilite, its atoms will penetrate into the holes of the deficient Fe sulfide lattice with the result that a more compact protective film will be formed. These conditions are fulfilled in the case of Cr, known to afford corrosion protection (at a concn. of at least 12%) to steel in H_2S; this is also the threshold of Cr content for protection against oxidic corrosion where Cr has been shown (Pfeil, *C.A.* 23, 3190; 25, 4508) to accumulate at the inner face of the corrosion film. In corrosion by S, the protective action of Cr similarly consists in the formation at the inner face of the film of a concd. solid soln. of CrS in FeS with the hole concn. substantially lowered. Ultimate formations of the spinell type, after oxidation of Cr^{++} to Cr^{+++}, are probable. In the case of an element with U of the same order as that of FeS and a similar lattice, an adequately protective sulfide layer can still be formed if the ions of the alloying element are considerably smaller than Fe^{++} and hence are able to penetrate the lattice and evict Fe; this lowers its deficiency and results in greater compactness. On the basis of these considerations Ni should be an effective alloying element. Actually, a Ni content does protect against oxidic corrosion but fails against S, owing to the low m.p. of NiS (810°) and particularly to that of the Ni-Ni_3S_2 eutectic (644°). A marked difference of the crystal lattices of the sulfides must result in failure of the alloying element to reconstruct the deficient FeS layer, even if the U are close and the ion radii fairly close. This case is illustrated by Mn, which (at 2%) is actually known not to afford protection against corrosion by S and to accumulate only to a slight extent at the inner face of the film. A 4th. type of alloying element, characterized by a high U as compared with FeS, a markedly different lattice, and distinctly smaller ion size, can protect through accumulation not at the inner but at the outer face of the sulfide film. This type is exemplified by Al, the beneficial effect of which is due to the greater readiness of its diffusion (as compared with Fe) to the external surface, where it can react freely with the oncoming S to form the high-melting (1100°) Al_2S_3 even though it is unable to reconstruct the deficient FeS layer.

N. Thon

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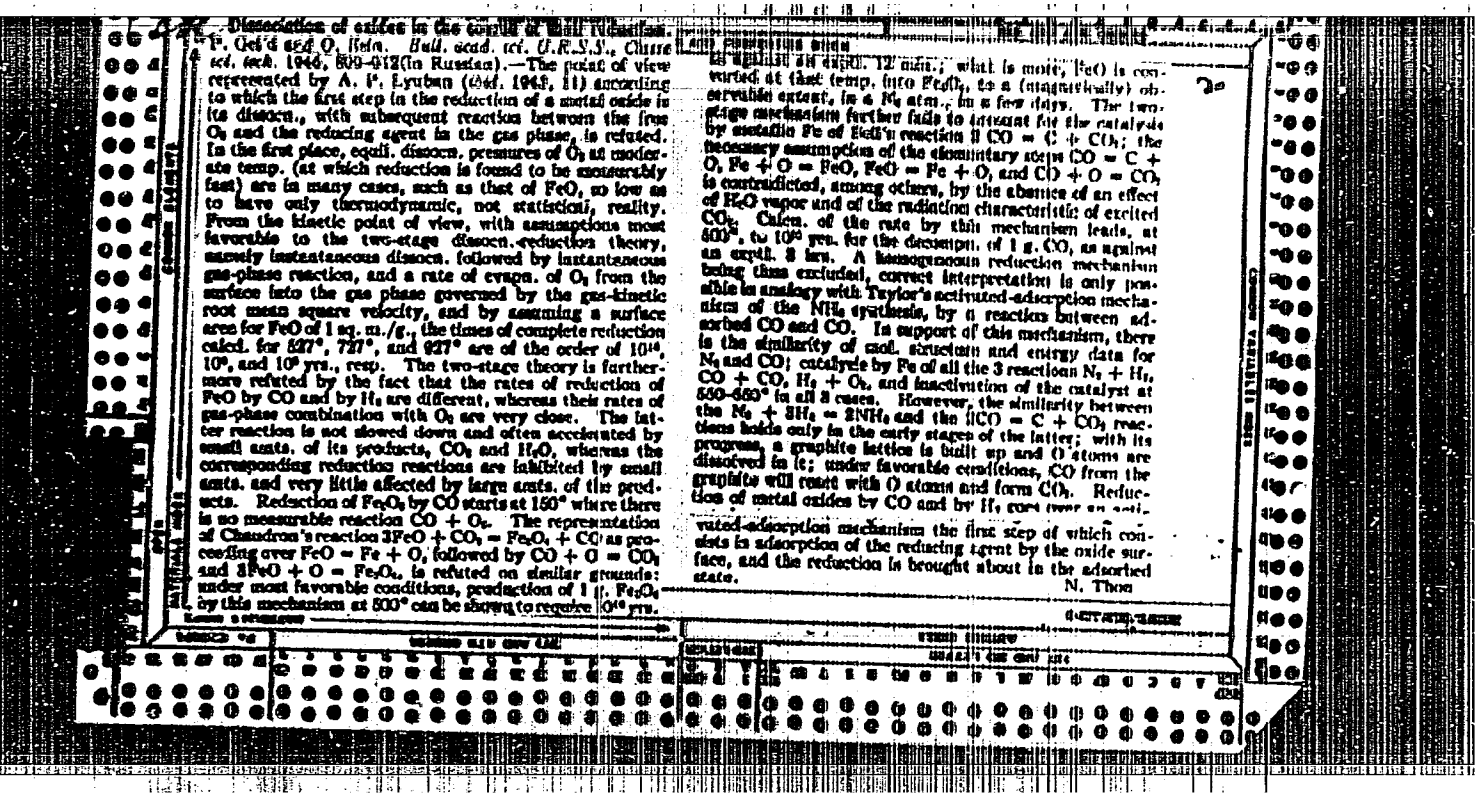

Dissociation of oxides in the course of their reduction. P. Gel'd and O. Bein. *Bull. acad. sci. U.R.S.S., Classe sci. tech.* 1946, 809-912 (in Russian).—The point of view represented by A. P. Lyuban (*ibid.* 1943, 11) according to which the first step in the reduction of a metal oxide is its dissocn., with subsequent reaction between the free O_2 and the reducing agent in the gas phase, is refuted. In the first place, equil. dissocn. pressures of O_2 at moderate temp. (at which reduction is found to be measurably fast) are in many cases, such as that of FeO, so low as to have only thermodynamic, not statistical, reality. From the kinetic point of view, with assumptions most favorable to the two-stage dissocn.-reduction theory, namely instantaneous dissocn. followed by instantaneous gas-phase reaction, and a rate of evapn. of O_2 from the surface into the gas phase governed by the gas-kinetic root mean square velocity, and by assuming a surface area for FeO of 1 sq. m./g., the times of complete reduction calcd. for 527°, 727°, and 927° are of the order of 10^{14}, 10^{9}, and 10^{5} yrs., resp. The two-stage theory is furthermore refuted by the fact that the rates of reduction of FeO by CO and by H_2 are different, whereas their rates of gas-phase combination with O_2 are very close. The latter reaction is not slowed down and often accelerated by small amts. of its products, CO_2 and H_2O, whereas the corresponding reduction reactions are inhibited by small amts. and very little affected by large amts. of the products. Reduction of Fe_2O_3 by CO starts at 150° where there is no measurable reaction $CO + O_2$. The representation of Chaudron's reaction $3FeO + CO_2 = Fe_2O_3 + CO$ as proceeding over $FeO = Fe + O$, followed by $CO + O = CO_2$ and $3FeO + O = Fe_2O_3$, is refuted on similar grounds: under most favorable conditions, production of 1 g. Fe_2O_3 by this mechanism at 500° can be shown to require 10^{10} yrs. as against an exptl. 12 min.; what is more, FeO is converted at that temp. into Fe_3O_4, to a (magnetically) observable extent, in a N_2 atm., in a few days. The two-stage mechanism further fails to account for the catalysis by metallic Fe of Bell's reaction $2CO = C + CO_2$; the necessary assumption of the elementary steps $CO = C + O$, $Fe + O = FeO$, $FeO = Fe + O$, and $CO + O = CO_2$ is contradicted, among others, by the absence of an effect of H_2O vapor and of the radiation characteristic of excited CO_2. Calcn. of the rate by this mechanism leads, at 500°, to 10^{10} yrs. for the decompn. of 1 g. CO, as against an exptl. 3 hrs. A homogeneous reduction mechanism being thus excluded, correct interpretation is only possible in analogy with Taylor's activated-adsorption mechanism of the NH_3 synthesis, by a reaction between adsorbed CO and CO. In support of this mechanism, there is the similarity of mol. structure and energy data for N_2 and CO; catalysis by Fe of all the 3 reactions $N_2 + H_2$, $CO + CO$, $H_2 + O_2$, and inactivation of the catalyst at 550-650° in all 3 cases. However, the similarity between the $N_2 + 3H_2 = 2NH_3$ and the $2CO = C + CO_2$ reactions holds only in the early stages of the latter; with its progress, a graphite lattice is built up and O atoms are dissolved in it; under favorable conditions, CO from the graphite will react with O atoms and form CO_2. Reduction of metal oxides by CO and by H_2 goes over an activated-adsorption mechanism the first step of which consists in adsorption of the reducing agent by the oxide surface, and the reduction is brought about in the adsorbed state.

N. Thon

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YESIN, O.

PA 33/49717

USSR/Chemistry - Electrolytes Nov/Dec 48
Chemistry - Silicates

"Melted Silicates as Microheterogeneous Electrolytes," O. Yesin, Ural Polytech Inst imeni S. M. Kirov and Ural Affiliate, Acad Sci USSR, 7 pp

"Zh Ak Nauk SSSR, Otdel Khim Nauk" No 6

Introduces several regularities illustrating the sharply expressed heterogeneity of a number of solutions of electrolytes. Shows that liquid silicates are clear example of this class of electrolytes. Proposes a model for structure of such a liquid and, proceeding from this, explains

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USSR/Chemistry - Electrolytes (Contd) Nov/Dec 48

peculiarities in behavior. Studies stratification, surface tension, activity of oxides, electroconductivity, and viscosity and its temperature dependence. Submitted 21 Jun 48.

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USSR/Ions - Exchange Apr 1947
Silicates

"The Mechanism of the Transfer of Oxygen Ions in in Fused Silicates," Yesin, 7 pp

"Zhur Fiz Khim" Vol XXI, No 4

Technical discussion with formulae and five tables of experimental data. It is concluded from analysis of the data that liquid ortho-silicates of iron and manganese, as contrasted with Ca_2SiO_4, must have considerable conductivity, out of proportion to their great viscosity.

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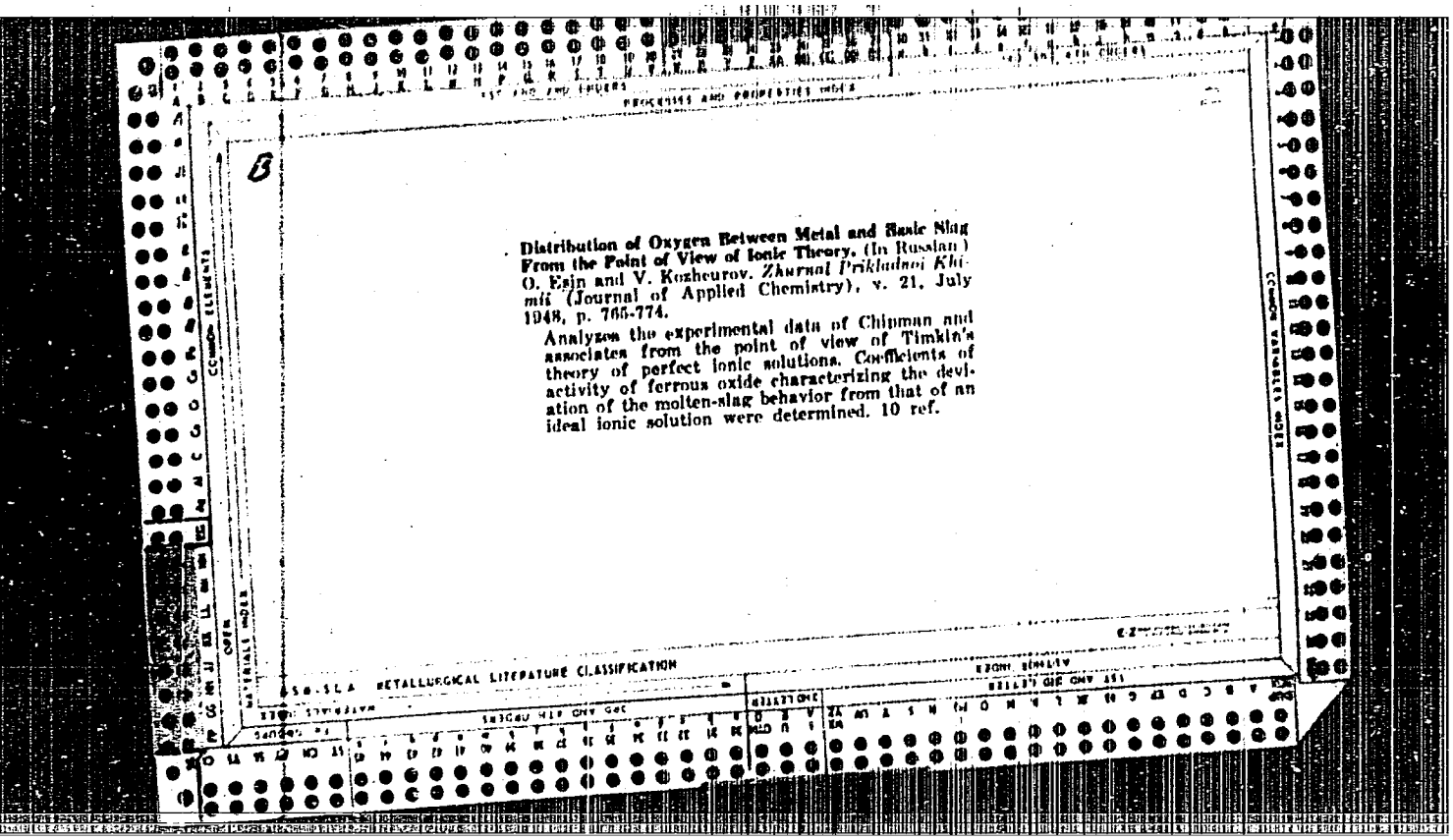

Distribution of Oxygen Between Metal and Basic Slag From the Point of View of Ionic Theory. (In Russian) O. Esin and V. Kozheurov. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 21, July 1948, p. 766-774.

Analyzes the experimental data of Chipman and associates from the point of view of Timkin's theory of perfect ionic solutions. Coefficients of activity of ferrous oxide characterizing the deviation of the molten-slag behavior from that of an ideal ionic solution were determined. 10 ref.

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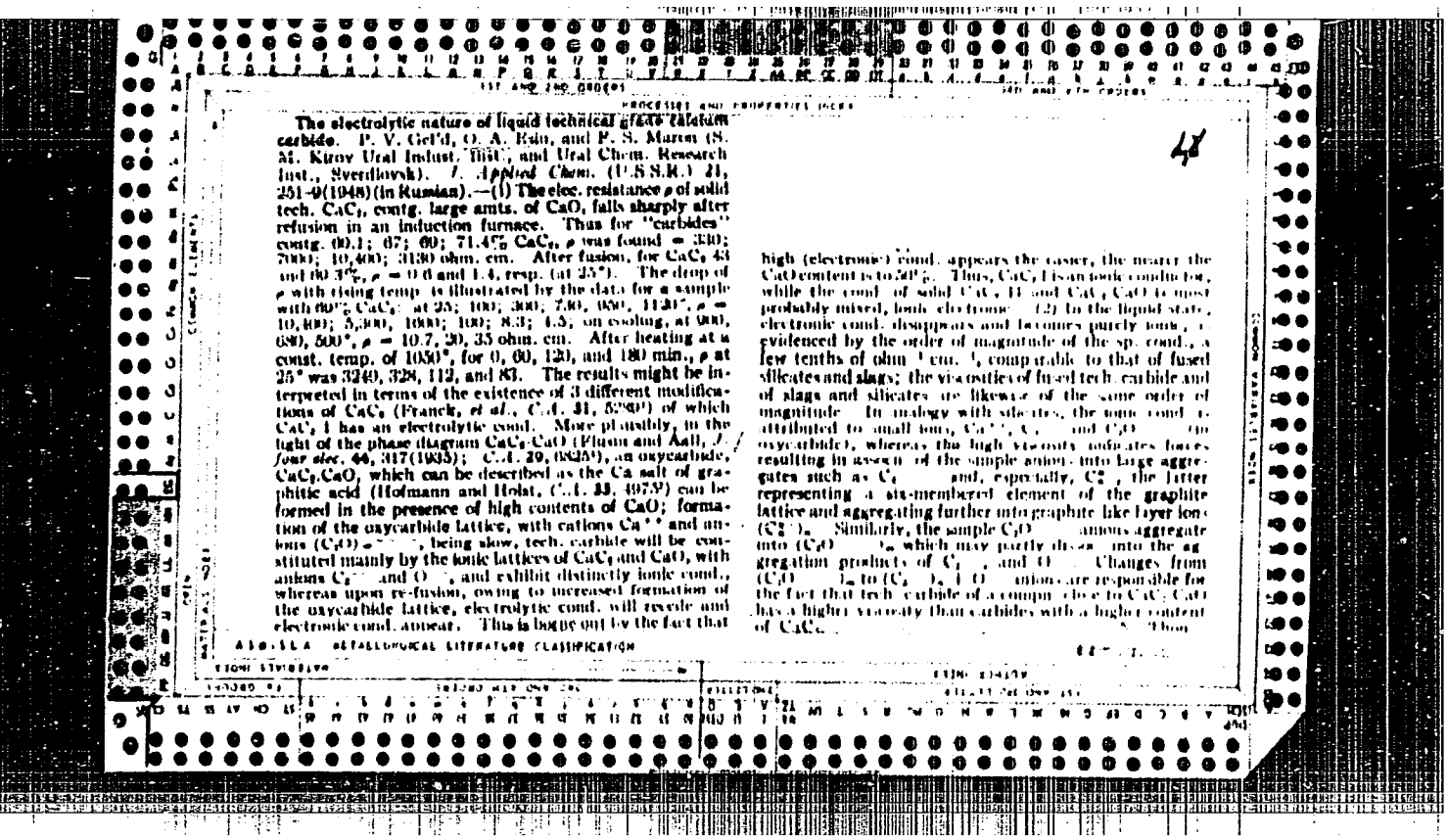

The electrolytic nature of liquid technical grade calcium carbide. P. V. Gel'd, O. A. Esin, and P. S. Marom (S. M. Kirov Ural Indust. Inst., and Ural Chem. Research Inst., Sverdlovsk). *J. Applied Chem.* (U.S.S.R.) 21, 251-9(1948)(in Russian).—(1) The elec. resistance ρ of solid tech. CaC_2, contg. large amts. of CaO, falls sharply after refusion in an induction furnace. Thus for "carbides" contg. 60.1; 67; 69; 71.4% CaC_2, ρ was found = 330; 700; 10,400; 3130 ohm. cm. After fusion, for CaC_2 43 and 80.3%, ρ = 0.6 and 1.4, resp. (at 25°). The drop of ρ with rising temp. is illustrated by the data for a sample with 69% CaC_2: at 25; 100; 300; 760; 850; 1120°, ρ = 10,400; 5,300; 1000; 100; 8.3; 4.5, on cooling, at 980, 680, 500°, ρ = 10.7, 20, 35 ohm. cm. After heating at a const. temp. of 1050°, for 0, 60, 120, and 180 min., ρ at 25° was 3240, 328, 113, and 83. The results might be interpreted in terms of the existence of 3 different modifications of CaC_2 (Franck, *et al.*, C.A. 31, 5780) of which CaC_2 I has an electrolytic cond. More plausibly, in the light of the phase diagram CaC_2-CaO (Plum and Aall, *J. Iron Steel Inst.* 44, 317(1935); C.A. 29, 8825), an oxycarbide, $CaC_2.CaO$, which can be described as the Ca salt of graphitic acid (Hofmann and Holst, C.A. 33, 4079) can be formed in the presence of high contents of CaO; formation of the oxycarbide lattice, with cations Ca^{++} and anions $(C_2O)^{--}$, being slow, tech. carbide will be constituted mainly by the ionic lattices of CaC_2 and CaO, with anions C_2^{--} and O^{--}, and exhibit distinctly ionic cond., whereas upon re-fusion, owing to increased formation of the oxycarbide lattice, electrolytic cond. will recede and electronic cond. appear. This is borne out by the fact that high (electronic) cond. appears the easier, the nearer the CaO content is to 50%. Thus, CaC_2 I can look conductor, while the cond. of solid CaC_2 II and CaC_2.CaO is most probably mixed, both electronic (2) In the liquid state, electronic cond. disappears and becomes purely ionic, as evidenced by the order of magnitude of the sp. cond., a few tenths of ohm^{-1} cm.$^{-1}$, comparable to that of fused silicates and slags; the viscosities of fused tech. carbide and of slags and silicates are likewise of the same order of magnitude. In analogy with silicates, the ionic cond. is attributed to small ions, Ca^{++}, C_2^{--}, and $(C_2O)^{--}$ (in oxycarbide), whereas the high viscosity indicates losses resulting in assocn. of the simple anions into large aggregates such as C_4 and, especially, C_8^{--}, the latter representing a six-membered element of the graphite lattice and aggregating further into graphite like layer ions $(C_8^{--})_n$. Similarly, the sample C_2O anions aggregate into $(C_2O)_n$, which may partly dissociate into the aggregation products of C_4, and O. Changes from $(C_2O)_n$ to $(C_8)_n$ I O anions are responsible for the fact that tech. carbide of a compn. close to CaC_2.CaO has a higher viscosity than carbides with a higher content of CaC_2.

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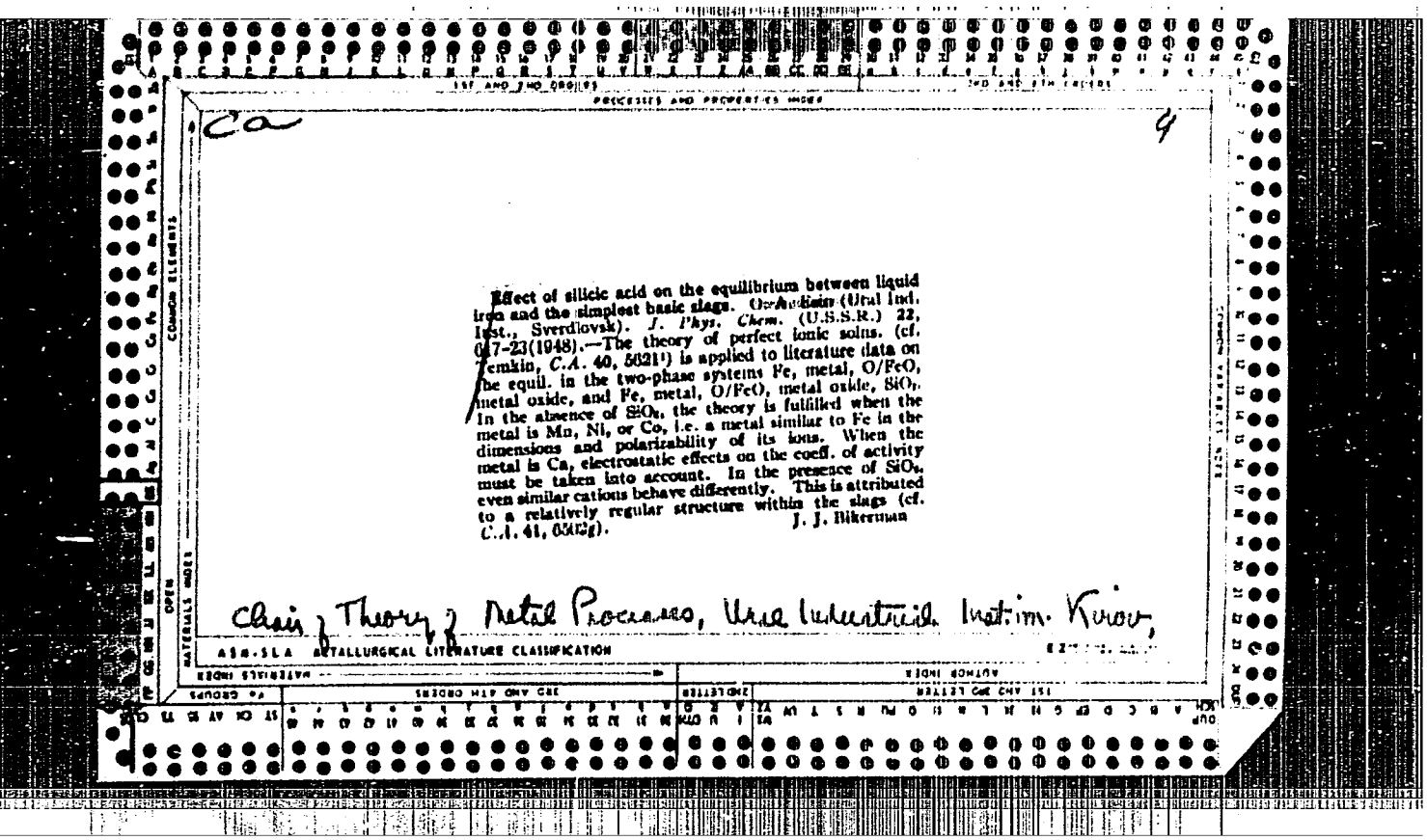

Ca

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Effect of silicic acid on the equilibrium between liquid iron and the simplest basic slags. O. A. Esin (Ural Ind. Inst., Sverdlovsk). *J. Phys. Chem.* (U.S.S.R.) 22, 617-23(1948).—The theory of perfect ionic solns. (cf. Temkin, *C.A.* 40, 5021[1]) is applied to literature data on the equil. in the two-phase systems Fe, metal, O/FeO, metal oxide, and Fe, metal, O/FeO, metal oxide, SiO_2. In the absence of SiO_2, the theory is fulfilled when the metal is Mn, Ni, or Co, i.e. a metal similar to Fe in the dimensions and polarizability of its ions. When the metal is Ca, electrostatic effects on the coeff. of activity must be taken into account. In the presence of SiO_2, even similar cations behave differently. This is attributed to a relatively regular structure within the slags (cf. *C.A.* 41, 6382g). J. J. Bikerman

Chair; Theory; Metal Processes, Ural Industrial Institute, Kirov,

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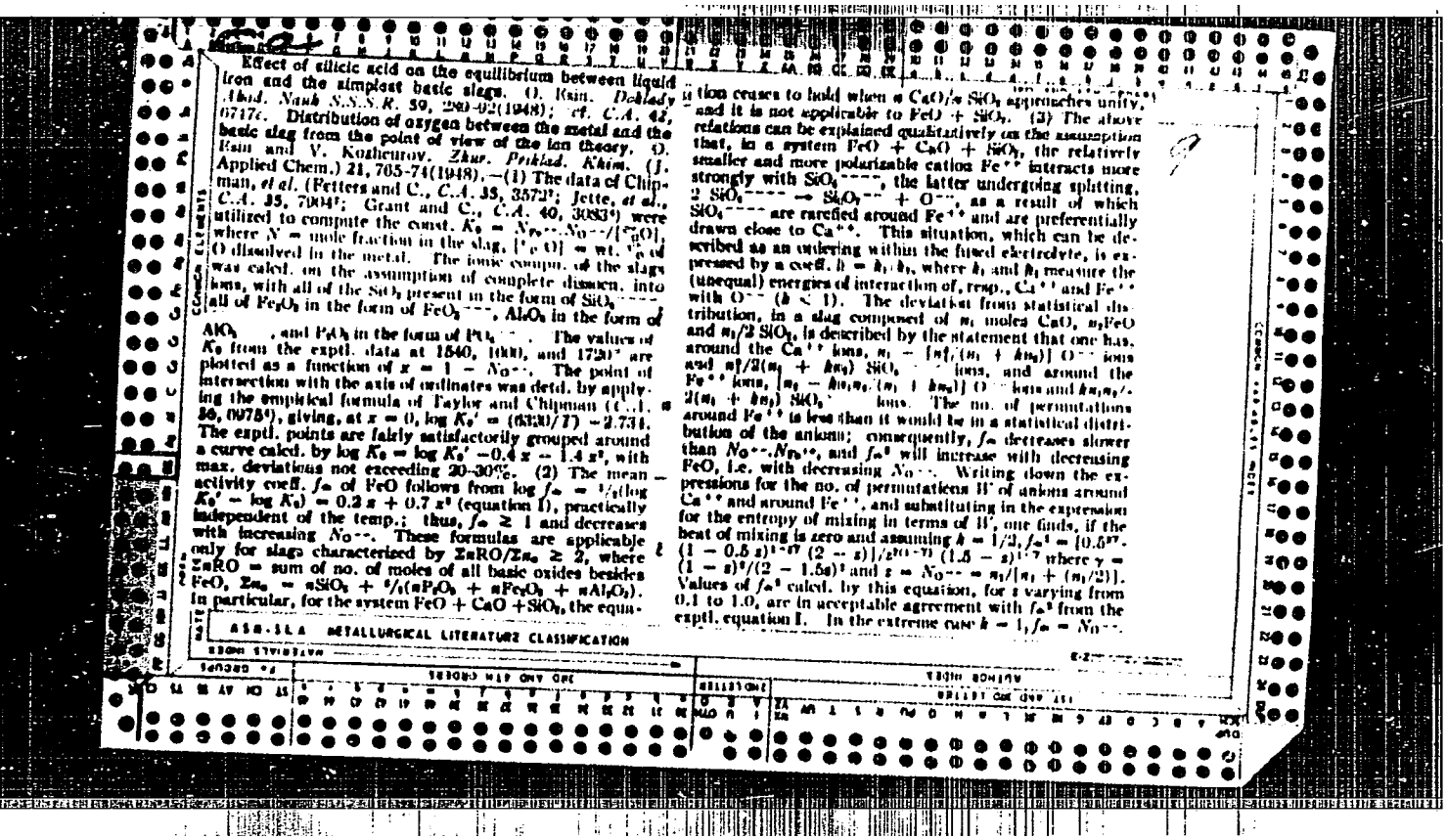

Effect of silicic acid on the equilibrium between liquid iron and the simplest basic slags. O. Esin. *Doklady Akad. Nauk S.S.S.R.* 59, 289-92(1948); *cf. C.A.* 42, 6717*c*. **Distribution of oxygen between the metal and the basic slag from the point of view of the ion theory.** O. Esin and V. Kozhevnov. *Zhur. Priklad. Khim.* (*J. Applied Chem.*) 21, 705-74(1948).—(1) The data of Chipman, *et al.* (Fetters and C., *C.A.* 35, 3572[1]; Jette, *et al.*, *C.A.* 35, 7004[2]; Grant and C., *C.A.* 40, 3083[3]) were utilized to compute the const. $K_0 = N_{Fe^{++}} \cdot N_{O^{--}}/[\%O]$, where N = mole fraction in the slag, [% O] = wt. % of O dissolved in the metal. The ionic compn. of the slags was calcd. on the assumption of complete dissocn. into ions, with all of the SiO_2 present in the form of SiO_4^{----}, all of Fe_2O_3 in the form of FeO_2^{---}, Al_2O_3 in the form of AlO_3^{---}, and P_2O_5 in the form of PO_4^{---}. The values of K_0 from the exptl. data at 1540, 1600, and 1720° are plotted as a function of $x = 1 - N_{O^{--}}$. The point of intersection with the axis of ordinates was detd. by applying the empirical formula of Taylor and Chipman (*C.A.* 38, 6078[4]), giving, at $x = 0$, $\log K_0' = (6320/T) - 2.734$. The exptl. points are fairly satisfactorily grouped around a curve calcd. by $\log K_0 = \log K_0' - 0.4\,x - 1.4\,x^2$, with max. deviations not exceeding 20-30%. (2) The mean activity coeff. f_∞ of FeO follows from $\log f_\infty = \frac{1}{2}(\log K_0' - \log K_0) = 0.2\,x + 0.7\,x^2$ (equation I), practically independent of the temp.; thus, $f_\infty \geq 1$ and decreases with increasing $N_{O^{--}}$. These formulas are applicable only for slags characterized by $\Sigma nRO/\Sigma n_a \geq 2$, where ΣnRO = sum of no. of moles of all basic oxides besides FeO, $\Sigma n_a = nSiO_2 + \frac{2}{3}(nP_2O_5 + nFe_2O_3 + nAl_2O_3)$. In particular, for the system FeO + CaO + SiO_2, the equation ceases to hold when $n\,CaO/n\,SiO_2$ approaches unity, and it is not applicable to FeO + SiO_2. (3) The above relations can be explained qualitatively on the assumption that, in a system FeO + CaO + SiO_2, the relatively smaller and more polarizable cation Fe^{++} interacts more strongly with SiO_4^{----}, the latter undergoing splitting, $2\,SiO_4^{----} \rightarrow Si_2O_7^{--} + O^{--}$, as a result of which SiO_4^{----} are rarefied around Fe^{++} and are preferentially drawn close to Ca^{++}. This situation, which can be described as an ordering within the fused electrolyte, is expressed by a coeff. $h = h_1/h_2$, where h_1 and h_2 measure the (unequal) energies of interaction of, resp., Ca^{++} and Fe^{++} with O^{--} ($h < 1$). The deviation from statistical distribution, in a slag composed of n_1 moles CaO, n_2FeO and $n_3/2$ SiO_2 is described by the statement that one has, around the Ca^{++} ions, $n_1 - [n_1/(n_1 + hn_2)]$ O^{--} ions and $n_1^2/2(n_1 + hn_2)$ SiO_4^{----} ions, and around the Fe^{++} ions, $[n_2 - hn_1n_2/(n_1 + hn_2)]$ O^{--} ions and $hn_1n_2/2(n_1 + hn_2)$ SiO_4^{----} ions. The no. of permutations around Fe^{++} is less than it would be in a statistical distribution of the anions; consequently, f_∞ decreases slower than $N_{O^{--}}$. $N_{Fe^{++}}$, and f_∞^2 will increase with decreasing FeO, i.e. with decreasing $N_{O^{--}}$. Writing down the expressions for the no. of permutations W of anions around Ca^{++} and around Fe^{++}, and substituting in the expression for the entropy of mixing in terms of W, one finds, if the heat of mixing is zero and assuming $h = 1/2$, $f_\infty^2 = [0.5^{2\gamma} \cdot (1 - 0.5\,z)^{1-2\gamma}\,(2 - z)]/z^{2(1-\gamma)}\,(1.5 - z)^{1-\gamma}$ where $\gamma = (1 - z)^2/(2 - 1.5z)^2$ and $z = N_{O^{--}} = n_1/[n_1 + (n_2/2)]$. Values of f_∞^2 calcd. by this equation, for z varying from 0.1 to 1.0, are in acceptable agreement with f_∞^2 from the exptl. equation I. In the extreme case $h = 1$, $f_\infty = N_{O^{--}}$.

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If $h = 0$, i.e. the interaction of the other cation and is negligible, $f_a = 1$ throughout to resolve this contradiction, one must take into account also permutations of the cations. (4) In this picture the preferential crowding of SiO_4^{----} around Ca^{++} and their desertion of the neighborhood of Fe^{++} is detd. by a lesser interaction of Ca^{++} with SiO_4^{----}, as compared with Fe^{++}. This is also the reason underlying the lowering of the elec. cond. of fused Fe_2SiO_4 by addn. of Ca_2SiO_4. (5) These considerations are applicable also to other anions, e.g., aluminates, phosphates, and ferrites.

N. Thon

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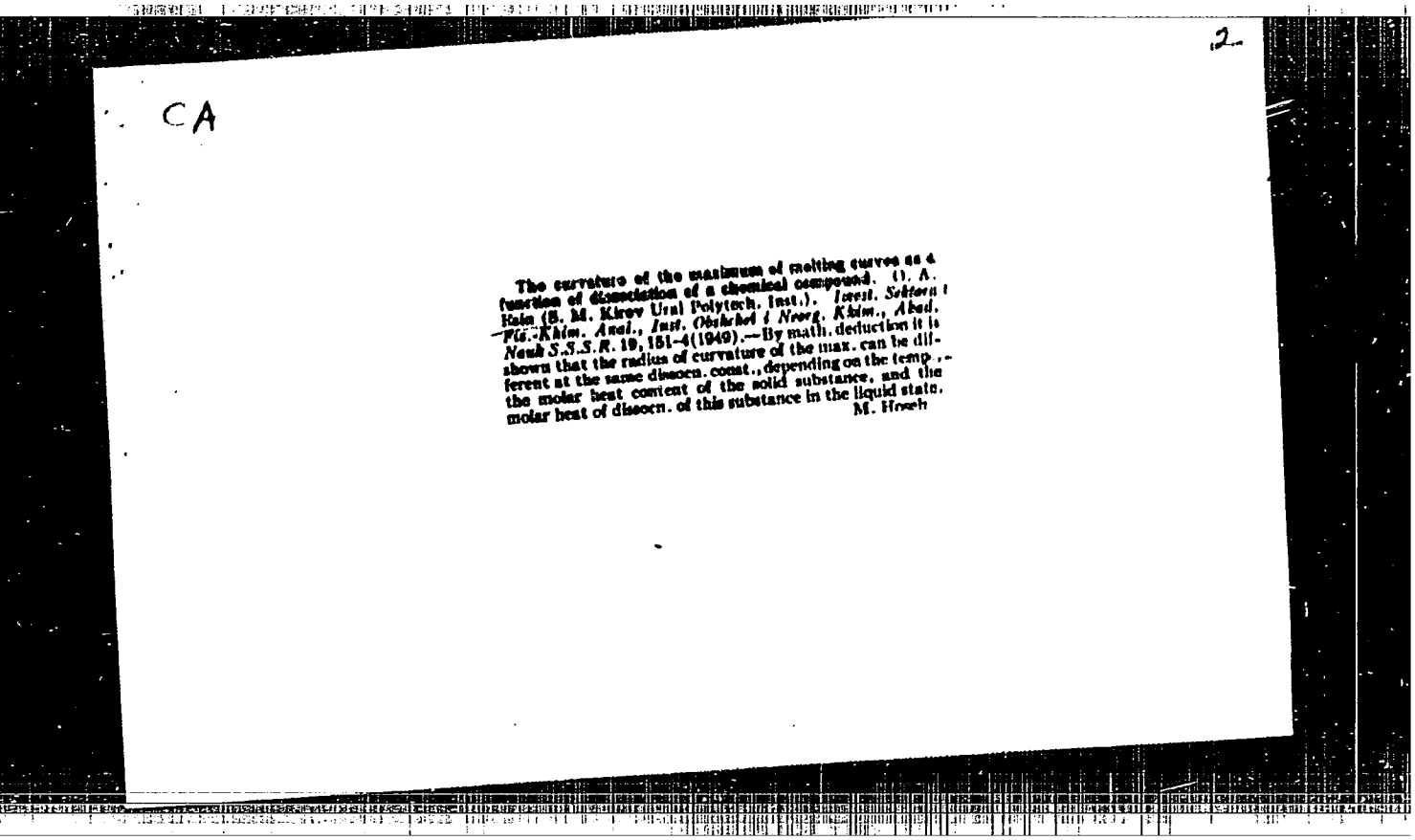

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The curvature of the maximum of melting curves as a function of dissociation of a chemical compound. O. A. Esin (S. M. Kirov Ural Polytech. Inst.). *Izvest. Sektora Fiz.-Khim. Anal., Inst. Obshchei i Neorg. Khim., Akad. Nauk S.S.S.R.* 19, 151–4(1949).—By math. deduction it is shown that the radius of curvature of the max. can be different at the same dissocn. const., depending on the temp., the molar heat content of the solid substance, and the molar heat of dissocn. of this substance in the liquid state.
M. Hosch

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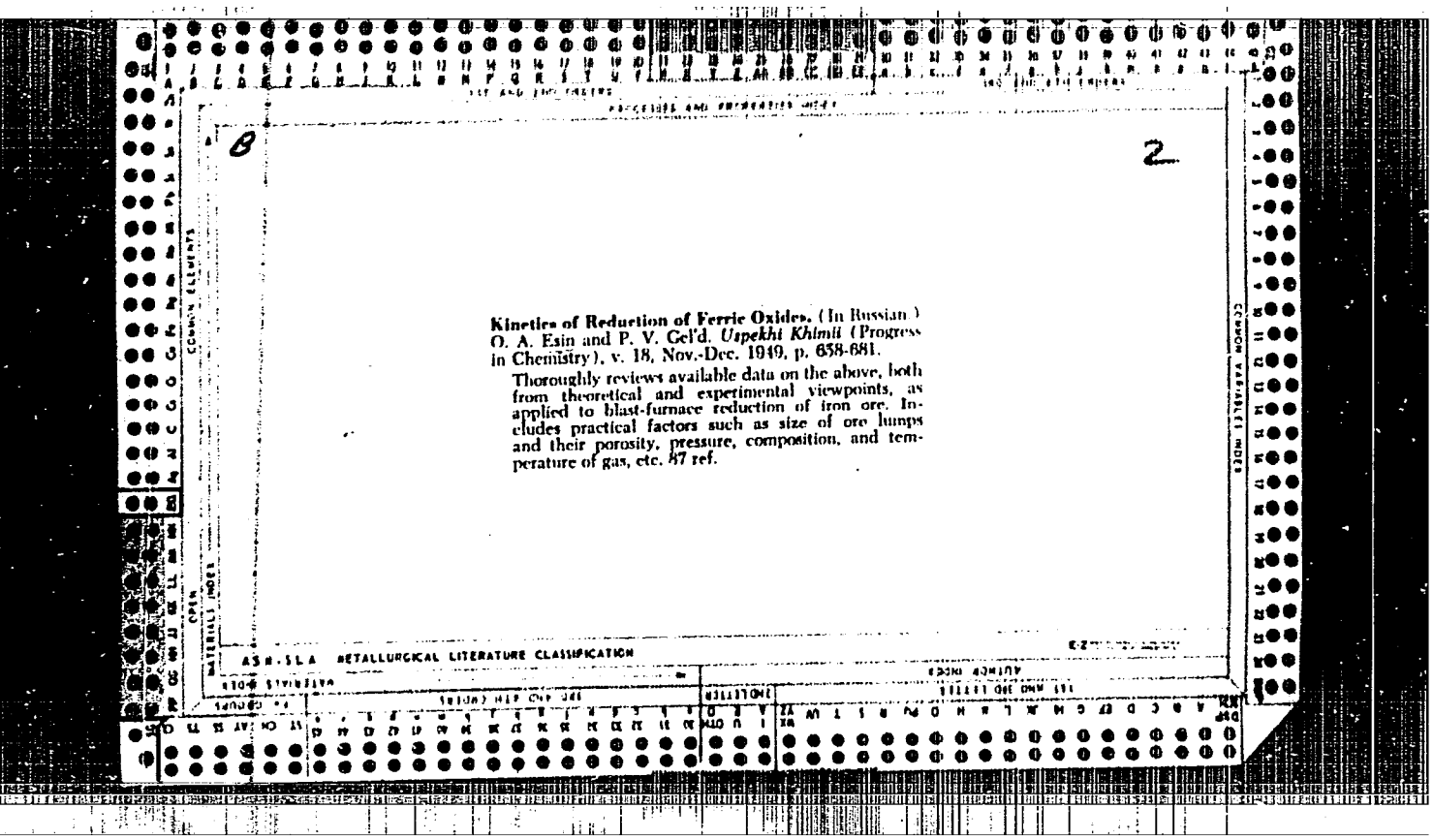

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Kinetics of Reduction of Ferric Oxides. (In Russian.) O. A. Esin and P. V. Gel'd. *Uspekhi Khimii* (Progress in Chemistry), v. 18, Nov.-Dec. 1949, p. 658-681.

Thoroughly reviews available data on the above, both from theoretical and experimental viewpoints, as applied to blast-furnace reduction of iron ore. Includes practical factors such as size of ore lumps and their porosity, pressure, composition, and temperature of gas, etc. 87 ref.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

YESIN, O. A.

USSR/Chemistry - Dolomites Apr 49
Chemistry - Dissociation

"Process of Redistribution of Ions During the Thermal Dissociation of Binary Salts," O. A. Yesin, P. V. Gel'd, S. I. Popel', Chair of Theory of Metallurgical Processes, Ural Ind Inst imeni S. M. Kirov, 6½ pp

"Zhur Prik Khim" Vol XXII, No 4

Investigated thermal dissociation of dolomite $CaMg(CO_3)_2$ with formation of the solid phase $CaCO_3$ and MgO. Submitted 25 May 48.

60/49T27

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

USSR/Chemistry - Dolomites, Dissociation of Carbonates Mar 49

Chemistry - Carbonates

"Possibility of Preliminary Dissociation of Dolomites Into Their Component Carbonates," V. V. Solin, O. A. Yesin, Chair of Theory of Metallurgical Processes, Ural Ind Inst imeni S. M. Kirov, 5 pp

"Zhur Prikład Khim" Vol XXII, No 3

PA 48/49T17

Thermographic and kinetic studies of dissociation of dolomites and magnesium under various temperature and pressure conditions showed: (1) first step of dissociation of dolomites occurs at stages lower than for magnesium, but (2) dissociation for both increases greatly at low pressures. Determined that there was no preliminary dissociation of dolomites in formation of their carbonates. Corrections of thermograms made it possible to determine stages at which various calcium carbonates were formed. Submitted 25 May 48.

48/49T17

YESIN, O. A.

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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

CA

Silicon losses on melting ferrosilicon. P. V. Gel'd, O. A. Esin, N. N. Bulnov, and R. M. Lerinman (Kirov Ural Polytech. Inst.). *Doklady Akad. Nauk S.S.S.R.* 67, 1073-6(1949); cf. *C.A.* 43, 4582h, 5087h.—The nature of the phases involved in losses of Si on melting high-Si alloys was investigated. A solid phase that was almost SiO was collected from a melting furnace. The material richest in SiO was found at the charging level on the electrodes, etc., in the form of kidney-shaped sintered accretions with a glassy fracture; it appeared to have grown from the liquid state; it had a greasy green-yellow sheen, a hardness over 5; it was friable and had a fine grained fracture; its chem. analysis was SiO_2 (on the basis of SiO) 125-8%, $Fe_2O_3 + Al_2O_3$ 1.7 – 2.0%, CaO 0.3%, MgO 0.2%, and volatile matter 1.5%; calcn. gave 85-9% SiO and 10.5% SiO_2 in agreement with vapor pressure and optical-crystallographic data ($n = 2.0$). The gas phase first liquified and then formed the solid. Specimens of fume collected in 1-3 min. on Ni gauze were examd. in a magnetic *electron microscope*. The spherical particles observed varied in size from 1 μ to 40 A. or less and were comparable to synthetic SiO particles. A. G. Guy

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YESIN, O. A.

168T53

USSR/Metals - Electrochemistry Jul 50

"Electomotive Forces in the System: Liquid Metal-Slag," O. A. Yesin, L. K. Gavrilov, Inst of Chem and Metallurgy, Ural Affiliate, Acad Sci USSR

"Iz Ak Nauk SSSR, Otdel Tekh Nauk" No 7, pp 1040-1048

Describes experiments for measuring electromotive forces at 1,600° in system composed of two iron-carbon alloys (electrodes) of various concentrations 0.2-4.7% C and synthetic slag (electrolyte) containing CaO, Al_2O_3 and carbides of these metals. Substantiates electrochemical theory of interaction between liquid pig iron or steel and slags.

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YESIN, O.A.

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Call No.: TN690.E8

BOOK

Author: YESIN, O. A. and GEL'D, P. V.

Full Title: PHYSICAL CHEMISTRY OF PYROMETALLURGICAL PROCESSES. PART I. REACTIONS BETWEEN GASEOUS AND SOLID PHASES

Transliterated Title: Fizicheskaya khimiya pirometallurgicheskikh protsessov. Chast' I. Reaktsii mezhdu gazoobraznymi i tverdymi fazami

Publishing Data

Originating Agency: None

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Date: 1950 No. pp.: 510 No. of copies: 4,000

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Text Data

Coverage: This volume is an exhaustive treatise on reactions between gaseous and solid phases in metallurgical processes. Each particular pyrometallurgical reaction is analysed from two points of view: the thermodynamic analysis is given first, and then the mechanism and kinetics of the process are discussed. Among the large variety of pyrometallurgical reactions the following were selected: (1) combustion of solid and gaseous fuels, (2) dissociation of oxides,

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ESIN O. A.,

USSR/Chemistry - Smelting of iron Nov 50

"Silicon Monoxide in the Slag of Iron Smelting Furnaces," P. V. Gel'd, O. A. Esin, Ural Polytech Inst imeni S. M. Kirov

"Zhur Prik Khim" Vol XXIII, No 11, pp 1200-7

Shows slag obtained under strongly reducing conditions can be formally treated as containing SiO. Sample of slag formed of 2 immiscible liquid phases, of which one is rich in SiO, has been isolated. Presence of SiO in $CaO-Al_2O_3-SiO_2$ considerably changes

170T37

USSR/Chemistry - Smelting of iron (Contd) Nov 50

the concentration limits of separation into layers. Formulates hypothesis in regard to structure of silicon-oxygen complexes containing SiO together with easily and difficultly reducible metal oxides.

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CA

Slags containing SiO. P. V. Gel'd and O. A. Esin (S. M. Kirov Ural Polytech. Inst.). *Doklady Akad. Nauk S.S.S.R.* 70, 473–5(1950).—Chem. analysis of many slags formed in smelting 45–75% ferrosilicon, silicocalcium, silicozirconium, Si, C-free ferrochrome, and other alloys, shows that, if all Si is in form of SiO_2, the total sum is over 100%, in some cases reaching 120–130%. The presence of metal beads in slag cannot account for this large difference. Electron-microscope study of chimney deposits and sublimates showed that they consist of spherical particles formed as a result of the oxidation of SiO fog. Vitreous condition of the deposits, their compn. (up to 85% SiO), and spherical form of particles indicate that condensation of SiO proceeds through the preliminary formation of a liquid phase rich in SiO. This is confirmed by a study of the slag obtained in smelting 75% ferrosilicon. The slag consisted of an outer layer (compn. calcd. on the basis of all Si as SiO_2: SiO_2 126.20, Al_2O_3 1.45, FeO 0.39, CaO 0.63, and MgO 1.39%) and an inner layer (SiO_2 82.50, Al_2O_3 10.79, FeO 1.36, CaO 12.94, and MgO 3.36%); this would give a min. of 80.22% SiO for one and 19.08% SiO for the other. Immersion study indicates that a considerable portion of the inner layer consists of crystals with n of about 2.0 which is close to synthetic SiO. Besides, it contains colorless glass with low n and β-cristobalite. The outer layer was shown by x-rays to consist of spherical particles of Si cemented with a dark material similar to that of the inner layer. The size of Si globules increases regularly from the outer surface to the boundary of the layers. Globules of Si did not exist in the mother liquid phase but appeared during its cooling in accordance with $2SiO = Si + SiO_2$; their distribution along the depth of the layer is governed by the conditions of chilling. Conclusions: Liquid slags exist which contain silicooxygen compds. and Si atoms are partially united to one another directly and partially through O atoms. During their reaction with easily reducible oxides (FeO, MnO), metal is formed and there is an increase in the no. of bonds through O atoms. Thus, the concn. of FeO and MnO in such slags is not great. In the presence of difficultly reducible oxides (MgO, CaO), the complexes attach O ions and are ruptured along the bonds Si—O—Si and the ions Me^{2+} do not change into metal.

B. Z. Kamich

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CA

Thermodynamic analysis of the equilibrium conditions in the reduction of iron chromite by carbon. P. V. Gel'd and O. A. Esin (S. M. Kirov Ural Polytech. Inst., Sverdlovsk). *Zhur. Prikład. Khim.* (J. Applied Chem.) 23, 1360-70(1950).—(1) At any temp. between 500 and 950°, a continuous increase with time of the pressure of CO is observed in the system $FeCr_2O_4$ + C (graphite), i.e. establishment of equil. is very slow, and equil. cannot be reached and detd. experimentally. In this respect, chromite behaves like dolomite, and the reason for the slowness in attainment of equil. is that one of the 2 components, FeO, is reduced by C much more easily, and earlier, than Cr_2O_3. (2) On account of the difficulty of expt. realization of the equil. $FeCr_2O_4 + 4C \rightleftarrows Fe + 2Cr + 4CO$, the thermodynamic data for its 2 consecutive steps, (a) $FeCr_2O_4 + C = Fe + CO + Cr_2O_3$, and (b) $Cr_2O_3 + 3C = 2Cr + 3CO$, were calcd. From the known empirical equations for the heat capacities of the substances involved, one has, for (a) $\Delta H = \Delta H^0 - 0.488\ T - 0.778 \times 10^{-3}\ T^2 - 5.051 \times 10^5\ T^{-1}$. From other thermochem. literature data, $\Delta H^0 = 50,874$ cal., and hence $\Delta F^0 = 50,874 + 0.488\ T \ln T + 0.778 \times 10^{-3}\ T^2 - 2.751 \times 10^5\ T^{-1} + 37.714\ T$, and $\log K_p \sim \log p_{CO} = -(11,112/T) - 0.244 \log T - 0.17 \times 10^{-3}\ T + 0.6 \times 10^5\ T^{-1} + 9.507$, or, simplified, $\log p_{CO} = -(10,405/T) + 8.033$; numerically, at 800, 1000, 1200, 1400, 1600, 1800°K., $\log p_{CO} = -4.287, -2.353, -0.617, +0.023, 1.553, 2.273$. The actually observed pressures of CO, even though equil. was not even remotely attained, were very much higher than the thermodynamic equil. pressures; thus, at 720°C., $\log p_{CO}$ (expt.) = −0.65 (calcd.) = −2.42). The deviations decrease with rising temp. but still remain major. They may be caused by the presence of easily reducible impurities.

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expt. plot shows H/H_0 to be a linear function of $1/\sqrt{\delta}$ up to $\nu = 10^4$ sec.$^{-1}$, i.e. the same law applies to δ as to the depth of penetration of the magnetic field ("normal" skin effect). However, above $\nu = 10^4$, δ decreases at a faster rate ("anomalous" skin effect). evidently as a result of addnl. inhibition effects. Points taken at 3.300° and at 3.026°K. lie on the same curve. On the assumption that at ν corresponding to the beginning of the "anomalous" effect, the transition takes place within a time interval not over $\frac{1}{4}$ of the period T of the a.c., one finds $\nu > 4/(T/2)$, and, with $\delta \sim 3 \times 10^{-5}$ cm. at $T = 10^{-4}$ sec., $\nu > 0 \times 10^4$ cm./sec. These exptls. were done under nearly adiabatic conditions, and so the temp. changes accompanying the transitions cause a variation of H_c which is greater upon disturbance than upon restoration of the supercond. Furthermore, whereas the transition from normal state to supercond. can proceed rapidly through displacement of the boundary, the restoration, through production and growth of nuclei, may proceed considerably slower. This was confirmed by applying, to a sample in the superconductive state, a field $H = H_c +$ $H_\sim$, i.e. a const. field of H_c superposed on an alternating field $H_\sim$. At H only slightly in excess of $H_c(T)$, not all the vol. of the sample goes over into the normal state, as the fall of temp. resulting from partial transition will raise $H_c(T)$ and put a stop to further transformation at the given H. Complete disturbance of the supercond. is attained only with a $H = H_c$ sufficient for the elimination of the supercond. at any temp. T, which may be reached in the adiabatic transition. Evidently, $H_c(T_1) > H_c(T_0)$, and, similarly, for the transition from normal to supercond., $H_c(T_0) < H_c(T_1)$. Plots of H_c as a function of T obtained for the adiabatic transitions in either direction give, for each T, the max. and the min. temp. attained by the sample in the process of the transition, and these limits agree with thermodynamic calcns. The causes of the high velocity of the displacement of the boundary, measured in an alternating magnetic field, as compared with the much smaller velocity of disturbance of the superconducting state in stationary magnetic fields, are seen in the different rates of heat transfer, and in electrodynamic effects linked with Foucault currents. N. T.

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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

Kinetics of the reduction of chromium oxide and of iron chromite. P. V. Gel'd and O. A. Esin (S. M. Kirov Ural Polytech. Inst., Sverdlovsk). *Zhur. Prikład. Khim. (J. Applied Chem.)* **23**, 1271–6(1950).—(1) Data of Baukloh and Henke (*C.A.* **32**, 2044⁶) on the rate of reduction of Cr_2O_3 with H_2 can be represented by $\log A = (30{,}000/4.575\,T) + B$, where A = % of reduction of Cr_2O_3. The activation energy E = 30,000 cal./mole is independent of A. The coeff. B varies with time τ (hrs.) according to $B = \log (177 \times 10^{12}\tau - 4.575 \times 10^{12}\tau^2 + 0.400 \times 10^{12}\tau^3)$, i.e. in the manner characteristic of topochem. processes with simultaneous start of the reaction over the whole surface. (2) Expt'l. kinetic detns. of the reduction of Cr_2O_3 mixed with graphite (100% excess) in pellets pressed under 100 kg./sq. cm., were run, by loss of wt., at 1150, 1175, 1250, and 1300°. No reaction is observed at 1100°, but is perfectly measurable at 1150°. Reduction with C is considerably faster than with H_2. (3) Under the same conditions, chromite ore (Cr_2O_3 33.14, FeO 12.2, MgO 12.37, Al_2O_3 13.44, SiO_2 6.28%) is reduced by graphite more slowly than pure Cr_2O_3, despite the greater thermodynamic ease of reduction of the chromite ore. This contradiction is attributed to binding of Cr_2O_3 particularly by MgO, the Mg chromite being less easily reducible than Cr_2O_3. Communication of the ore facilitates greatly its reduction with C, and so does addn. of 3% K_2CO_3.

N. Thon

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Method of measurement of the interfacial tension at high temperatures. S. I. Popel, O. A. Esin, and P. V. Gel'd (S. M. Kirov Ural Polytech. Inst., Sverdlovsk). *Doklady Akad. Nauk S.S.S.R.* 74, 1097–1100(1950).—The interfacial tension δ is detd. from the height h (measured from the top to the equator of the drop) of a drop, photographed with x-rays, which permits photography of a drop of metal (15–25 mm.) in a fused slag. With ρ_1 and ρ_2 = d. of the metal and of the medium, resp., $\delta = {}^1/_2 (\rho_1 - \rho_2) g h^2$, where g = acceleration of gravity. The method was applied to drops of Hg (against air and against H_2O, at 20°), of Cu (against gas, at 1300°), and of cast iron (against gas, at 1400°). It gives generally too low values of δ as compared with detns. with the aid of other equations, but close thereto. Frozen drops generally show h smaller by about 10% than in the molten state, which may give rise to deviations in δ of ~14–32% with the ds. taken as those of the solids, and of ~6–20% with the use of the ds. of the fused substances. Consequently, δ ought to be detd. in the liquid state. The method is indicated for chemically aggressive or highly viscous substances. N. Thon

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C. A.

Effect of salts on the rates of dissociation and reduction processes. P. V. Gel'd and O. A. Esin (S. M. Kirov Ural Polytech. Inst., Sverdlovsk). *Doklady Akad. Nauk S.S.S.R.* 73, 841-4(1950).—The rate of the reduction of chromite, $FeO.Cr_2O_3$, by H_2 or C (graphite) to Fe + Cr_2O_3 + H_2O (or CO) measured by the amt. reduced in 1 hr. at const. temp., between 300 and 1200°, is strongly accelerated by the addn. of 3% K_2CO_3. Rapts. remained far below the equil., which cannot be reached even in 15 hrs. Reduction by C is faster than by H_2. The dissocn. $CaC_2 \rightarrow 2C + Ca$ (vapor), very slow at 1200°, is markedly accelerated by 5% CaF_2 or $CaCl_2$, and even more by 5% $BaCl_2$. At 1300°, the order of increasing accelerating effectiveness is 5% CaF_2, $CaCl_2$, K_2CO_3, NaCl. Halides of alkali metals should be more effective than alk. earth metals, but they evap. at these temps. The effect is interpreted as an accelerating action of the anions of the salt on the mobility of the cations involved in the reconstruction of the solid lattice. N. T.

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Interphase tension of iron alloys at the slag interface. S. I. Popel, O. A. Esin, and P. V. Gel'd (S. M. Kirov Ural Polytech. Inst., Sverdlovsk). *Doklady Akad. Nauk S.S.S.R.* 75, 227-30(1950); cf. *C.A.* 45, 2743d.—A previously described method was used to det. the interphase tension between molten Fe alloys and slags. A pig iron contg. C 3.45, Si 2.21, Mn 0.64, P 0.263, and S 0.105% had at 1420° a surface tension with gas of 1022 ergs/sq. cm. and interphase tensions of about 630, 700, and 750 ergs/sq. cm. with slags contg. 0, 14, and 50% Al_2O_3 (plus 47% CaO, balance SiO_2). A synthetic Fe alloy contg. 4.0% C and 0.4% Si had at 1460 to 1550° a surface tension with gas of 675 and interphase tensions of about 550, 600, and 610 with slags contg. 16, 27, and 39% CaO (plus 20% Al_2O_3, balance SiO_2). When Na_2O replaced about 50% of the CaO in the 39% CaO slag, the interphase tension at 1400° dropped to about 500, and when Na_2O completely replaced the CaO the value became 410. A synthetic slag contg. SiO_2 48, CaO 26, and Al_2O_3 20% had at 1420 to 1510° interphase tensions of about 600, 510, 480, and 500 with Fe alloys contg. Si 0.4, C 4.8; Si 8.0, C 2.8; Si 20, C 2.6; Si 40, C 0.2%. The results are explained by the ionic theory of slags on the basis that cations and anions of the slag which have a large ratio of charge to radius will strongly adhere to each other and displace ions with weak fields from the surface layer. A. G. Guy

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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

YESIN, O. A.

USSR/Metals - Iron, Alloys Aug 51

"Experimental Verification of the Electrochemical Theory in Respect to a System of Liquid Alloys of Iron With Carbon and Silicon," O. A. Yesin, L. K. Gavrilov

"Iz Ak Nauk SSSR, Otdel Tekh Nauk" No 8, pp 1234-1242

Measured emf at 1470-1480° in system comprising 2 liquid Fe-C-Si alloys of various compn and slag contg CaO, MgO and SiO_2. Content of Si varied from 0.65 to 4% concn of C corresponded to satn. Used values of emf for calcg changes in free energy during transition of Si gram-atom from one Fe-C- Si alloy to another. Also calcd activities of Si in these alloys and compared with activities detd by nonelectrochem methods. Expts revealed existence of considerable concn polarization due to slow diffusion rate of ions in slag. Submitted by Acad I. P. Bardin 14 Feb 51.

205T79

USSR/Metals - Iron, Alloys (Contd) Aug 51

205T79

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

YESIN, O. A.

USSR/Metallurgy - Cast Iron, Ionic Theory Oct 52

"Kinetics of Metal-Slag Interaction From the Viewpoint of the Ionic Theory," O. A. Yesin, A. M. Okunev

"Iz Ak Nauk, Otdel Tekh Nauk" No 10, pp 1472-1482

Demonstrates on example of desulfurization of cast irons, that the kinetic equation developed on basis of the ionic theory of slags, describes process of metal-slag reaction better than that based on the molecular theory. Using equation obtained, clarifies some regularities observed experimentally, such as: retarded decrease of process rate with increase in concentration of S ions in slag; proportionality

243T52

between initial rate and concentration of O ions in slag; sharper decrease of initial rate for slags of lower basicity; dependence of rate constant of direct process on slag basicity. Submitted by Acad I. P. Bardin 25 Dec 51.

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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

PA 197T31

USSR/Chemistry - Electrolysis of Sulfides Dec 51
Metals - Pyrites

"Investigation of the Properties of Molten Sulfides by the Electromotive Force Method. I. The Systems Pb-PbS and Cu-Cu$_2$S," O. A. Yesin, I. I. Stryvalin, Ural Polytech Inst imeni S. M. Kirov, Sverdlovsk

"Zhur Fiz Khim" Vol XXV, No 12, pp 1503-1511

Measurements were taken of emf at temps 1,200-1,300°C in concn cells with electrodes of Pb-PbS or Cu-Cu$_2$S melts and electrolyte of glass with MeS admixt. Emf varied regularly with comp and temp. Results agree with data arrived at by non-electrochem methods (fusibility diagram, equil vapor pressure of S over melt) and provide exptl proof of electrochem nature of interaction between liquid metal sulfide melts and molten silicates.

197T31

YESIN, O. A.

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USSR/Chemistry - Electrolysis of Sulfides Dec 51
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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

YESIN, O. A.

USSR/Chemistry, Metallurgy - Copper, Nickel, Iron Sulfides Mar 52

"Investigation of the Properties of Molten Sulfides By the EMF Method. II. Systems Cu_2S-Ni_3S_2 and Cu_2S-FeS," I. T. Sryvalin, O. A. Yesin, Ural Polytech Inst imeni S. M. Kirov, Sverdlovsk

"Zhur Fiz Khim" Vol XXVI, No 3, pp 371-376

Measured emf values at 1,180° in systems consisting of melts Cu_2S-Ni_3S_2 (I) or Cu_2S-FeS (II) (serving as electrodes) and liquid glass + Na_2S functioning as electrolyte. Demonstrated that emf values change regularly with the compn of the melts and in accordance with their fusibility diagram. The results obtained are in agreement with data based on equil sulfur vapor pressures over melts and confirm the electrochem nature of interaction between the liquid matte and slag. The melts investigated do not behave like ideal solns: the activity of sulfur deviates from that calcd on the basis of the rule of mixing, being higher than the latter with I and lower with II.

PA 213T32

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

USSR/Metals - Iron, Interphase Tension 11 Mar 52

"Effect of Carbon on the Interphase Tension of Iron at the Boundary With Slag," S. I. Popel', O. A. Yesin, Yu. P. Nikitin, Ural Polytech Inst imeni S. M. Kirov, Sverdlovsk

"Dok Ak Nauk SSSR" Vol LXXXIII, No 2, pp 253-255

Describes expts for detg interphase tension of a number of iron-carbon alloys at boundary with slag in range of 1,450-1,500°, using method of resting drop in combination with X-raying. Since existing integral formulas for approximating interphase or surface tension are too complicated and give greatly divergent results, more convenient and sufficiently precise calg method of graphical integration was employed. Submitted by Acad A. N. Frumkin 10 Jan 52.

214T66

YESIN, O. A.

214T66

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

YESIN, O.A.

USSR/Chemistry Metallurgy - Iron-Phosphorus Alloy 1 Jul 52

"The Study of Liquid Iron-Phosphorus Alloys by the Method of Electromotive Forces," O. A. Yesin, L. K. Gavrilov, N. A. Vatolin, Inst of Chem and Metallurgy, Ural Affiliate, Acad Sci SSSR

"Dok Ak Nauk SSSR" Vol LXXXV, No 1, pp 87-89

Studied the relationship between the emf and phosphorus content in molten (1,470°) iron-phosphorus samples. From 1.5 to 22.0%, the relationship is almost const, but from 22 to 24% there is a sharp decrease in emf, indicating a break in the Fe-P bond. Presented by Acad I. P. Bardin 25 Apr 52.

224T10

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

CA

Electrocapillary phenomena at high temperatures. O. A. Esin, Yu. P. Nikitin, and S. I. Popel (Ural Polytech. Inst., Sverdlovsk). *Doklady Akad. Nauk S.S.S.R.* 83, 431–4(1952).—The surface tension of molten Fe-C alloys with 2.5, 3, and 4% C, in a fused-silicate electrolyte of the compn. SiO_2 71.5, NaO 14.6, CaO 8.3, Al_2O_3 5.6% was measured as a function of the polarization by the drop method. The diam. of the drop was 14–16 mm., and the surface area of the other electrode, a graphite tube, large enough to be considered nonpolarizable. The c.d. was not over 50 ma./sq. cm. In the temp. range 1,320–1,480°, the interface tension σ decreases with increasing neg. polarization ε. These exptl. curves represent the cathodic branches of the electrocapillary curves. Anodic polarization has less effect on σ than does cathodic polarization. Consequently, the Na^+ ions are more surface-active than the silicate anions. The curves of σ are steeper at lower C contents of the metal. The charge d. $-E = d\sigma/d\varepsilon$, between 0 and −0.2 v., is 50 and 30 microcoulombs/sq. cm. with 2.5 and 4% C, resp. It follows that the adsorption of C at the surface of the drop falls with increasingly neg. ε; i.e., the pos. charge of the double layer on the electrolyte side repels from the metal surface the C cations more strongly than it repels the Fe cations.

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YESIN, O. A. PA 254T64

USSR/Metallurgy - Metal-Slag System, 11 Dec 52
Electrocapillarity

"Electrocapillary Phenomena at Various Compositions of Metal and Slag," Yu. P. Nikitin, O. A. Yesin, S. I. Popel', Ural Polytech Inst imeni S. M. Kirov, Sverdlovsk

DAN SSSR, Vol 87, No 5, pp 813-815

Authors continue studying electrocapillary phenomena, existence of which in the liquid Fe-C alloy--slag system was experimentally established in a previous work (DAN SSSR, Vol 83, No 3, p 431). They

254T64

investigate effect of Na_2O, added into slag, on interphase tension of Fe alloys. Alloys of commercial iron with 3.1% C and Fe P alloys with 19.8 and 10.6% P were used in expts with slags of 2 comps: 39% CaO, 41% SiO_2, 20% Al_2O_3; 17% Na_2O, 25% CaO, 55% SiO_2, 19% Al_2O_3. Electrocapillary curves are plotted for all combinations. Presented by Acad A. N. Frumkin 8 Oct 52.

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APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

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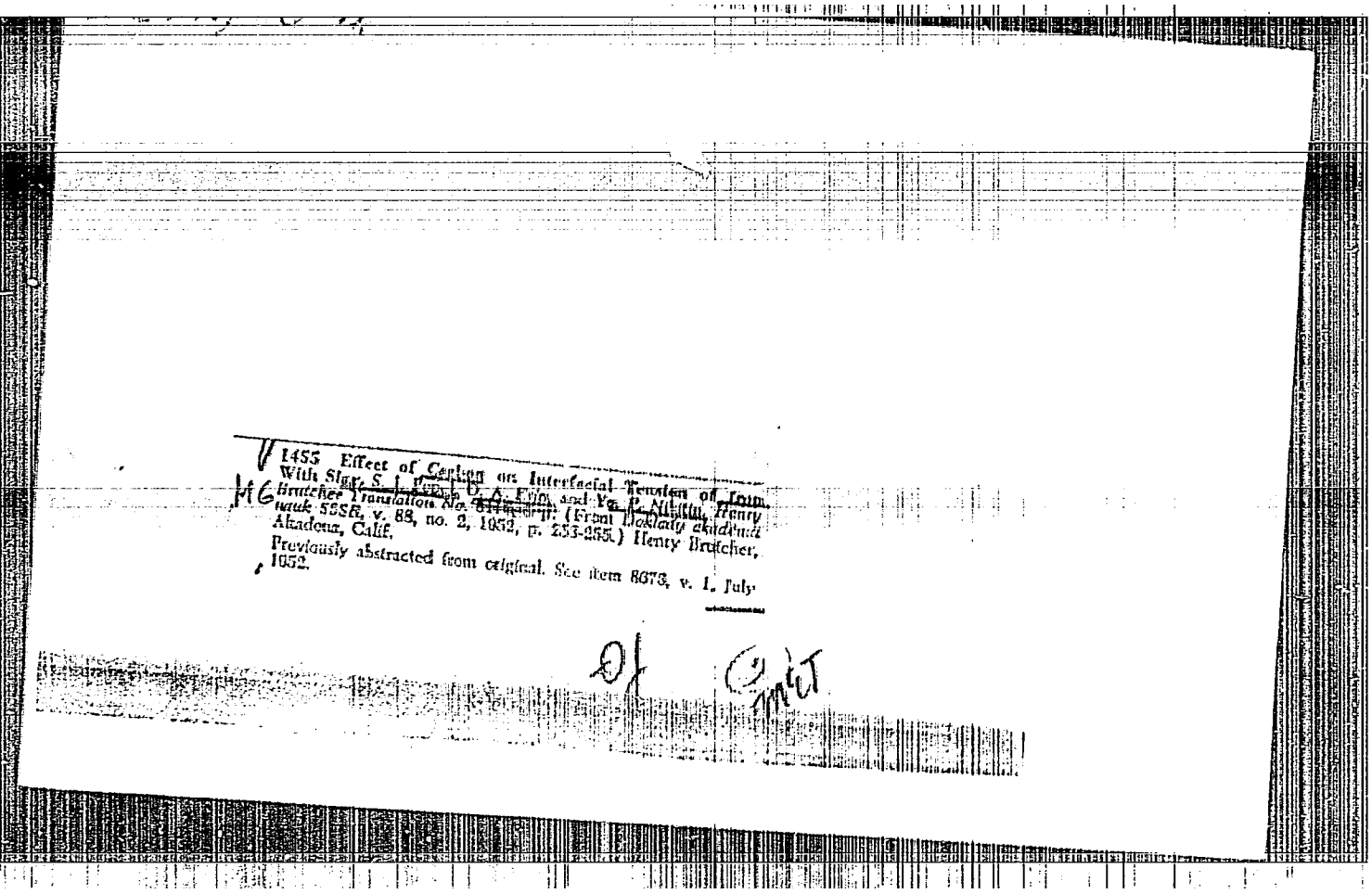

1455 Effect of Ceylon on Interfacial Tension of Iron With Slag, S. I. [illegible], D. A. Frin, and Ye. P. Nikitin, Henry Brutcher Translation No. [illegible] p. (From Doklady akademii nauk SSSR, v. 88, no. 2, 1952, p. 253-255.) Henry Brutcher, Akadena, Calif.

Previously abstracted from original. See item 8673, v. 1, July 1952.

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

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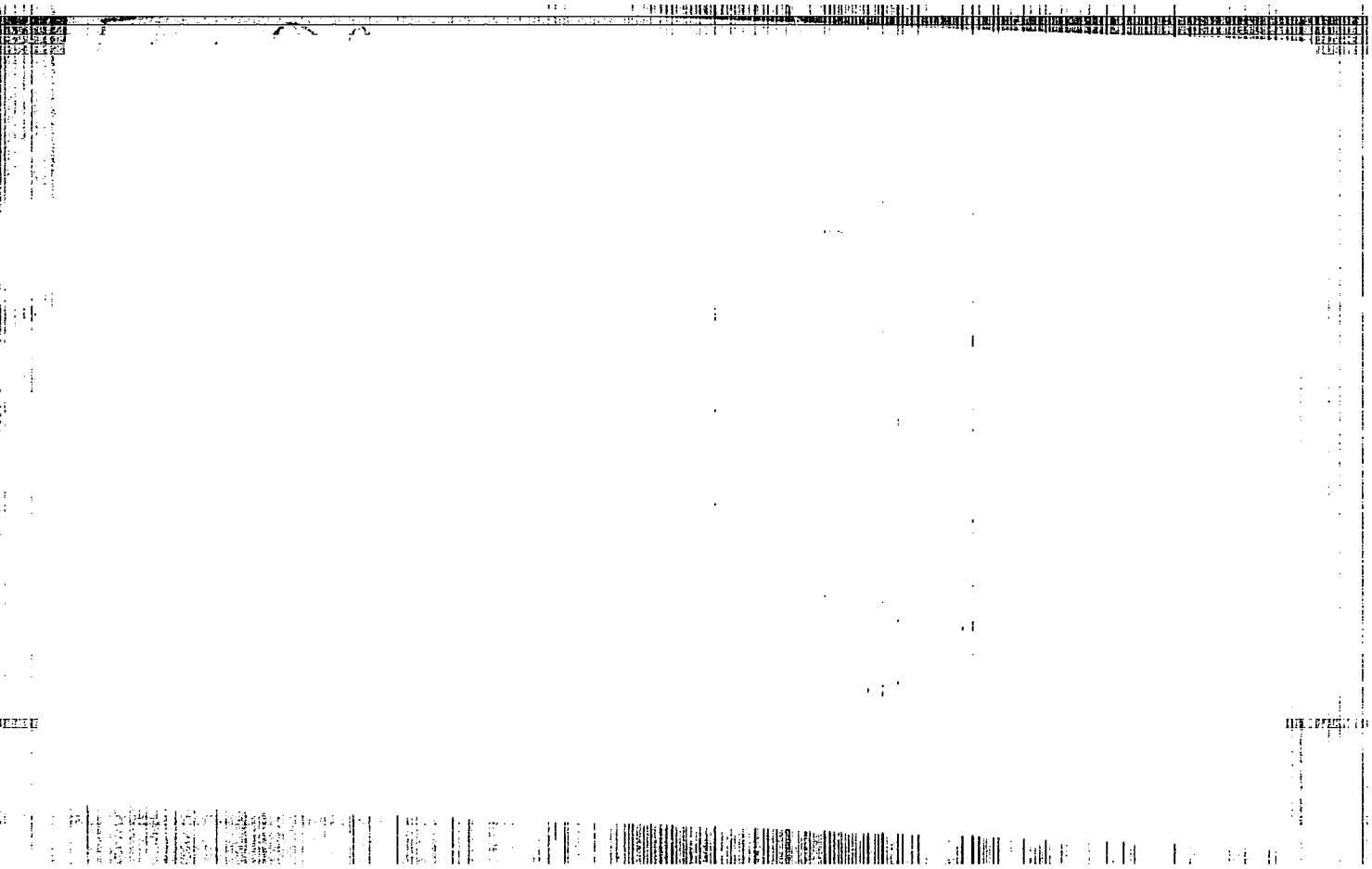

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

YESIN, O. A.

Dissertation: "Electrochemical Investigations in the Field of Pyrometallurgy." Dr Tech Sci, Ural' Polytechnic Institute, Sverdlovsk, 1953. (Referativnyy Zhurnal-Khimiya, No 9, Moscow, May 54)

SO: SUM 318, 23 Dec 1954

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

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ESIN, O.A.

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Chemical Abst.
Vol. 48 No. 4
Feb. 25, 1954
Metallurgy and Metallography

The properties of liquid iron-chromium alloys by the method of electromotive forces. O. A. Esin and N. A. Vatolin. *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* 1953, 1137–42.—The values of e.m.f. at 1460° in a concn. system consisting of 2 alloys of Fe with C and Cr of various compns. and with slag of CaO, MgO, SiO_2, and CrO were detd. The Cr concn. ranged from 1.08% to 27.5%; the C content was that of a satd. alloy. The e.m.f. detns. were used to calc. the free energy in transfer of Cr from the more concd. to the more dil. system, and coeffs. of activity of Cr and Fe were calcd. E.m.f. detns. were made in a system (at 1460°) whose electrodes were alloys of Fe with Cr and Si satd. with C, while CaO, MgO, and SiO_2 slag was used as the electrolyte. The Cr concn. was varied from 3% to 60%, and the Fe-Cr ratio was held near unity. The curves of dependence of e.m.f. on the concn. of Si shows 2 inflections, indicating the existence of at. groupings of silicides (Fe, Cr)Si and (Fe, Cr)Si_2. The result agrees wit[illegible]e existence of 2 breaks in the soly. curve of C in ferros[illegible]ochromium.
G. M. Kdolanoff

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

YESIN, O.A.; GEL'D, P.V.

The forms of existance of metalloids dissolved in metals. Uspekhi Khim. 22, 62-86 '53. (MLRA 6:2)
(CA 48 no.2:420 '54)

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

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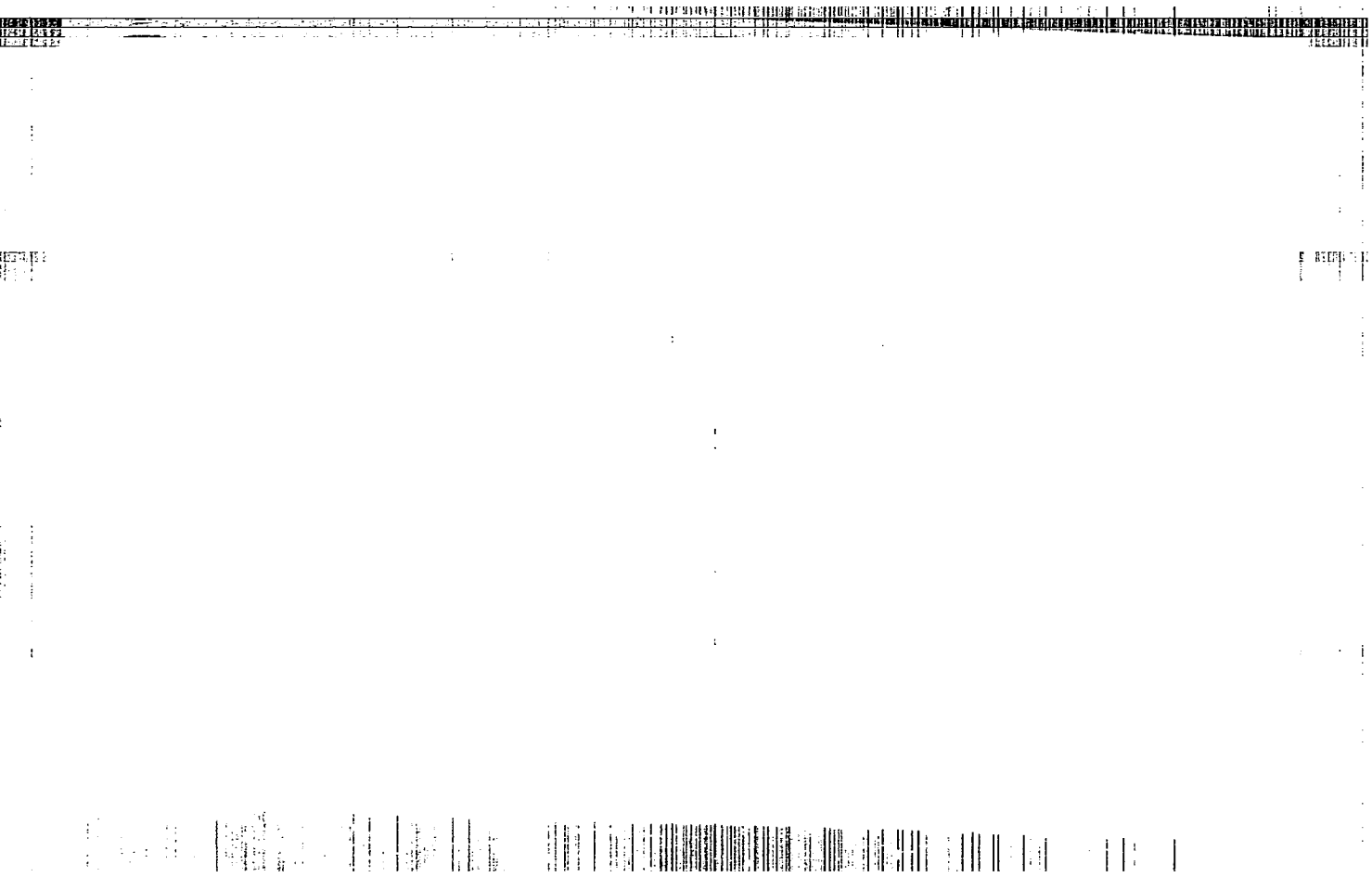

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

Forms of silica existing in molten slags. O. A. Esin, L. K. Gavrilov, and B. M. Lemiskikh (C.R. Acad. Sci., [illegible], 88, 713—716).—The e.m.f. of a concentration cell without transference, consisting of two Fe–Si electrodes each in contact with molten slag of different composition separated by a magnesite or graphite diaphragm, is determined at 1470° as a function of SiO_2 content in one half-cell. There are two breaks on the obtained curve, corresponding to 33 and 53 wt.-% SiO_2 in the slag. In the first part of the curve (up to 33% SiO_2) SiO_2 exists as SiO_4^{4-} anions, in the second mainly as SiO_4^{4-} and $(SiO_3^{2-})_n$, and in the third as $(SiO_3^{2-})_n$ and in the form of little known $Si_xO_y^{2-}$ complexes. S. K. Lachowicz.

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

YESIN, O.A.; GEL'D, P.V.; YUR'YEV, B.N., redaktor; LUCHKO, Yu.V., redaktor; KOVALENKO, N.I., tekhnicheskiy redaktor.

[Physical chemistry of pyrometallurgic processes] Fizicheskaia khimiia pirometallurgicheskikh protsessov. Pt. 2. [Interaction of fluids with gases and solid phases] Vzaimodeistvie zhidkostei s gazami i tverdymi fazami. Sverdlovsk, Gos. nauchno-tekhn. izd-vo lit-ry po chernoi i tsvetnoi metallurgii. 1954. 606 p.
(Metals--Heat treatment) (MLRA 8:1)

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

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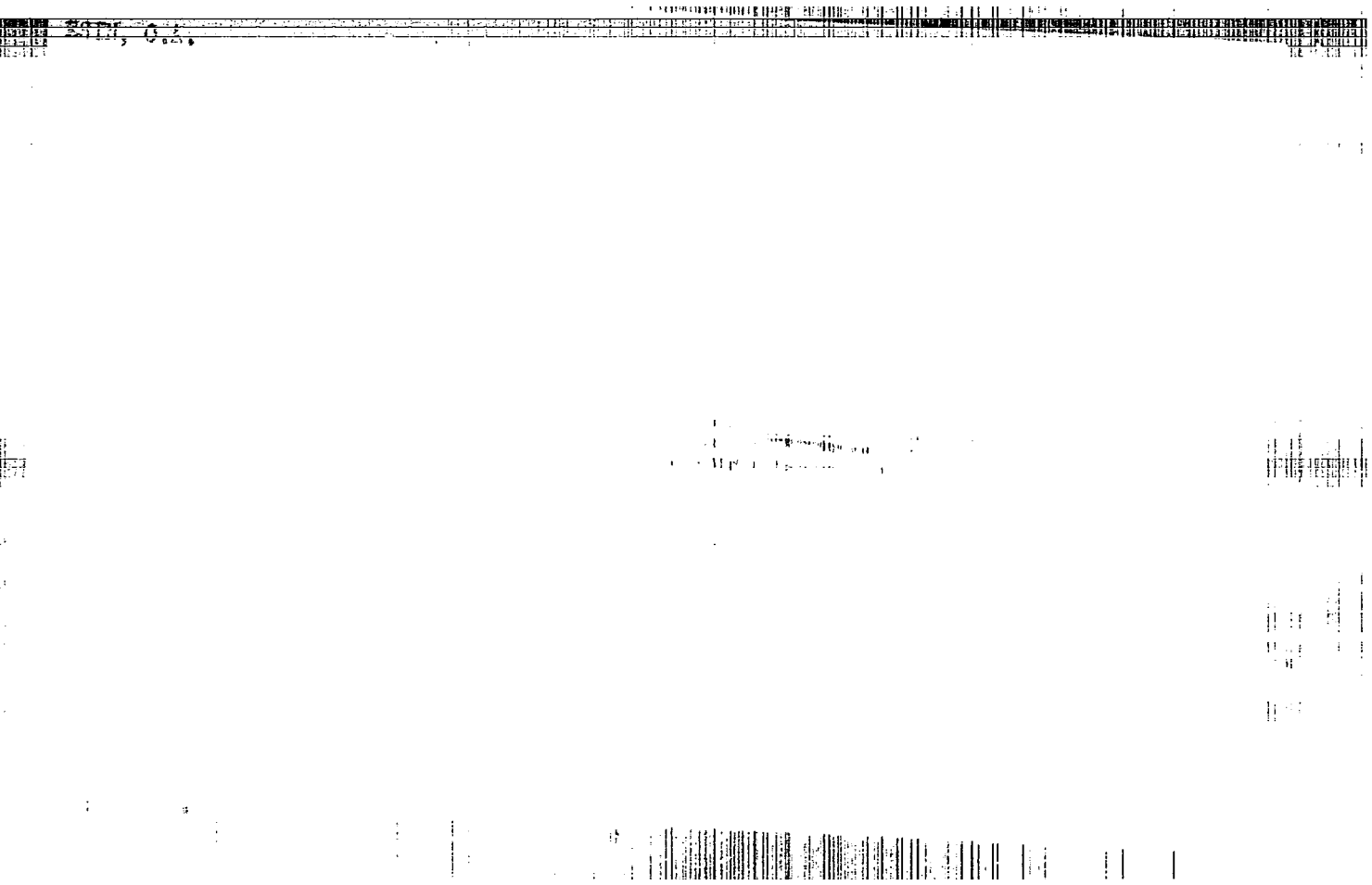

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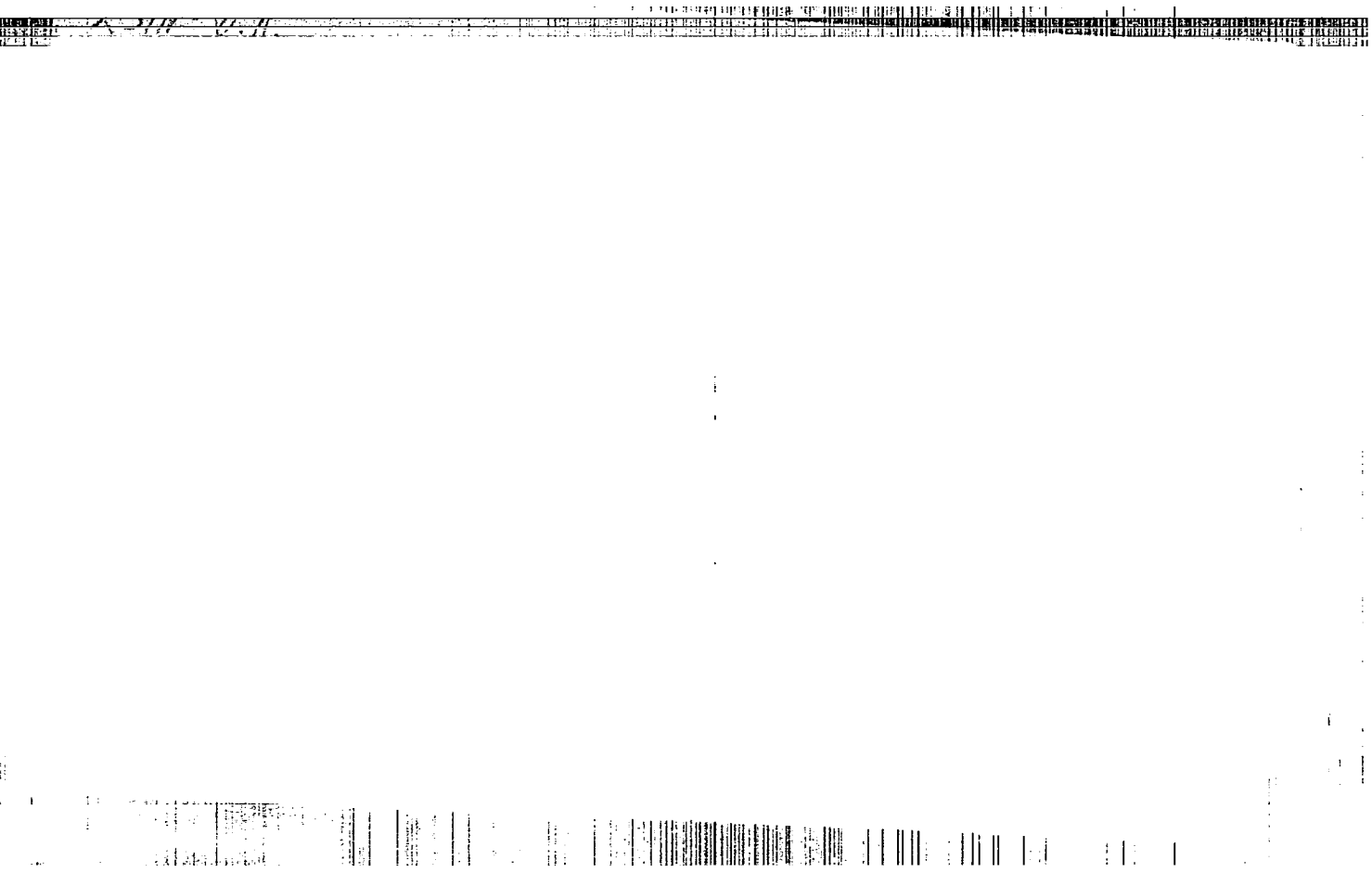

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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

YESIN, O.A.

USSR/ Chemistry - Glass structure

Card 1/1 Pub. 104 - 2/14

Authors : Yesin, O. A., Prof.; and Gel'd, P.V., Prof.

Title : Structure of glasses and the properties of melted silicates

Periodical : Stek. i ker. 11/3, 4-6, Mar 1954

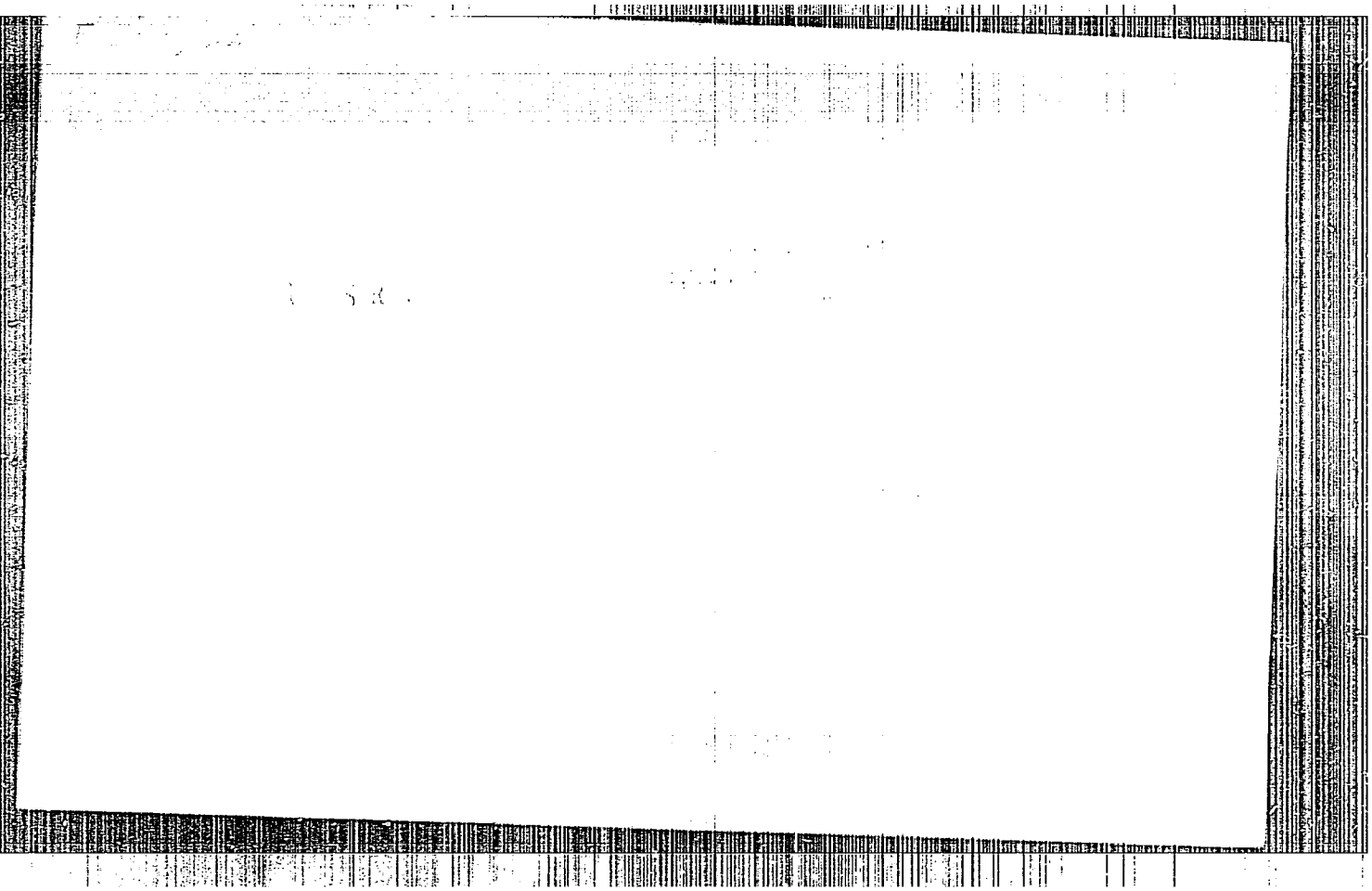
Abstract : An account is given of researches conducted by many scientists to ascertain the crystallic structure of glass and the properties of melted silicates. These involved variations of temperature, chemical composition of various glasses, reaction to electrical currents, examination of crystallic structure by X-rays and refraction effects. The structure of glass was found to be similar to that of a supercooled liquid.

Institution: .....

Submitted: .....

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3



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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

Yesin, O.

AID P - 911

Subject : USSR/Chemistry

Card 1/1 Pub. 152 - 2/22

Author : Yesin, O.

Title : Distribution of sulfur between metal and slag from the point of view of the ionic theory

Periodical : Zhur. prikl. khim., 27, no. 5, 473-479, 1954

Abstract : Effect of individual components of slag and metal on the equilibrium distribution of sulfur. The effect of basic oxides (CaO, Na_2O), of ferrous oxide, silicon oxide, aluminum oxide, calcium fluoride and calcium chloride, and the effect of a metal (Mn) are discussed. Twenty-five references (16 Russian: 1940-1951).

Institution : None

Submitted : Ja 27, 1953

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

ESIN, O. A.
USSR/Chemistry

Card 1/1

Authors : Vatolin, N. A.; and Esin, O. A.

Title : Certain thermodynamic characteristics of sulfur in liquid, carbon saturated ferrisulfide alloys

Periodical : Zhur. Ob. Khim. 24, Ed. 5, 795 - 798, May 1954

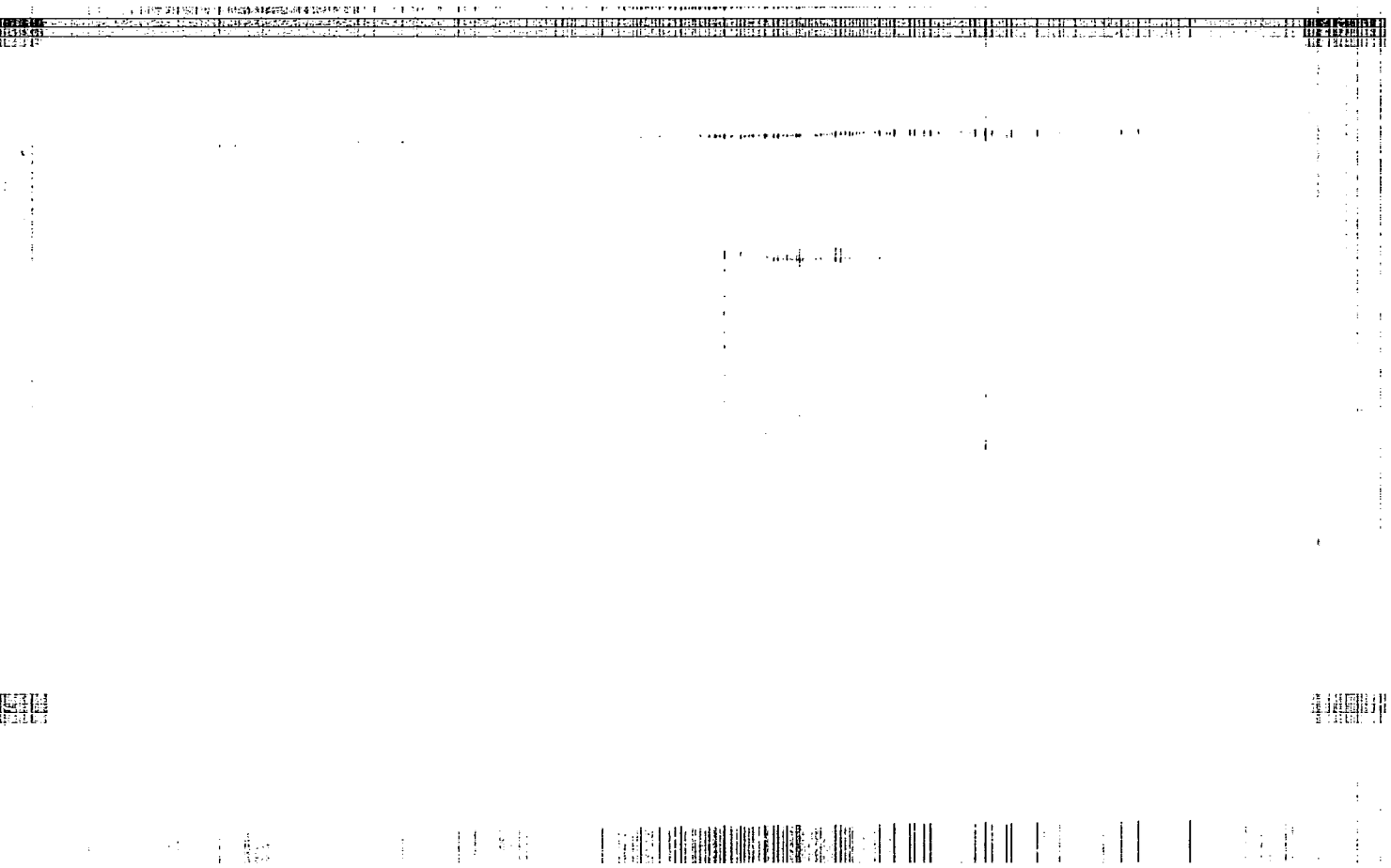
Abstract : The electromotive forces of a concentrated element in which liquid, carbon-saturated iron sulfide alloys served as electrodes were measured. The authors computed the activity and activity coefficients of the sulfur in these fusions and also determined the change in the free conversion energy of one-gram atom of sulfur changing from one solution into another. The results obtained are in perfect conformity with data obtained by means of other methods. Nine references. Tables, graph.

Institution : Academy of Sciences USSR, Ural Branch, Institute of Chemistry and Metallurgy

Submitted : July 6, 1953

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3



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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

USSR/ Physics - Metallurgy

Card 1/1 Pub. 147 - 20/27

Authors : Krasovskiy, N. N.; Nikitin, Yu. P.; Esin, O. A.; and Popel', S. I.

Title : Calculation of surface tension by the form of a recumbent drop

Periodical : Zhur. fiz. khim. 28/9, 1678-1679, Sep 1954

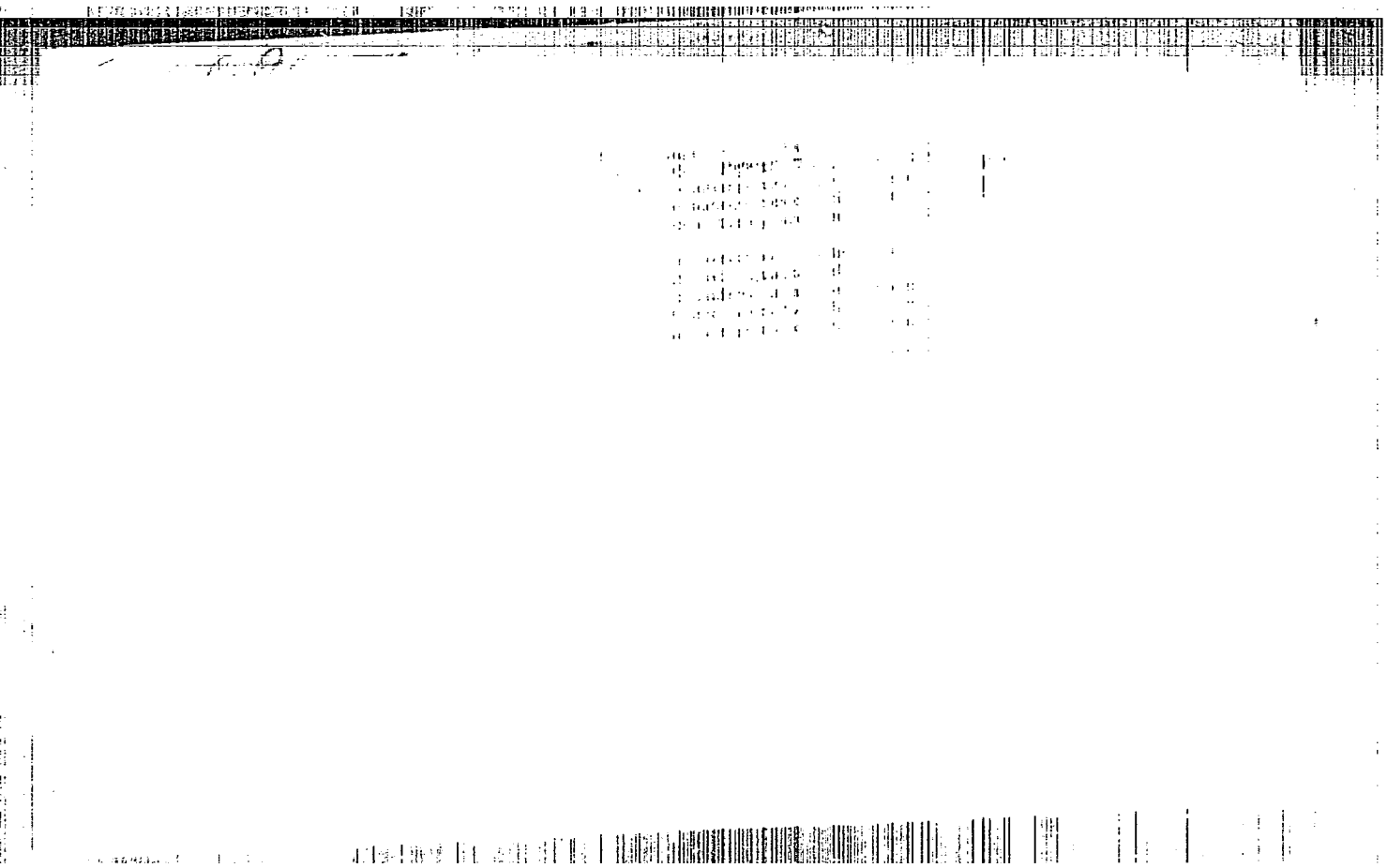
Abstract : A table for the calculation of surface tension according to the form of a recumbent drop and a suitable method for the graphical integration of an equation for such a drop are briefly described. The method, which has numerous advantages, is also applicable to drops of different size and form. Examples of such calculations are shown. Five references: 3-USSR; 1-Indian and 1-English (1883-1953). Table; graph.

Institution : The S.M.Kirov Ural Polytechnicum, Faculty of the Theory of Metallurgical Processes, Sverdlovsk

Submitted : April 20, 1954

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3



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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

YESIN, O. A.: NIKITIN, Yu. P.; Popel', S. I.

"The Surface Activity of Carbon and Phosphorus at the Metal-Slag Interface"
Tr. Ural'skogo Politekhn. In-ta, sb. 49, 1954, 82-86

Interfacial tension of iron-carbon and iron-phosphorus alloys with synthetic slag was determined by photographing drops lying on a corundum block and correlating the results with X-ray data. Established that as the carbon and phosphorus content is increased, the interfacial tension is decreased. The effect of phosphorus is less than that of carbon. Interfacial tension of above alloys is close to that of the surface twnsion Interfacial tension of iron-carbon alloy with carbide slag was estimated using the cooled drop method, and found to be less than the surface tension of the slag. (RZhKhim, No 3, 1955)

SO: Sum No 845, 7 Mar 56

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

YESIN, O. A. and ZAIMSKIKH, N. V.

"Investigation of the Physiocochemical Properties of the System $FeO-SiO_2$". Tr. Ural'skovo Politekhn. In-ta, No. 49, pp 104-124, 1954.

Measured the viscosity, electric conductivity, surface tension, and density of liquid melts of the system $FeO-SiO_2$. Viscosity was measured using two methods, i.e., the method of coaxial cylinders or optic measurement of the angle of rotation of a thread, with the application of the method of damped oscillations. Electric conductivity was measured using an iron crucible and iron rods, both acting as electrodes. Surface tension was determined using the bubble method. (RZhKhim, No 4, 1955)

SO: Sum No 884, 9 Apr 1956

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

Electrolysis of fused iron slags. O. A. Esin and P. M. Shurygin. (S. M. Kirov Ural Polytech. Inst.) Doklady Akad. Nauk S.S.S.R. 94, 1145–7(1954).—The great experimental difficulties of direct electrolysis of Fe-containing slags with electrodes of graphite or Fe are overcome by using liquid Au as the cathode material, which dissolves the Fe metal. The C anode is applied in Fe-free Ca-Mg-Al silicate slag, while a current of pure N_2 washes the electrode to avoid the spontaneous reaction $Fe^{+++} + e \rightarrow Fe^{++}$ in the melt. The expts. are made at 1350° to 1400° in a C resistor furnace, with a cond. of 0.2–3.5 amp./sq. cm. The electrolytic output (in % of the theory) are plotted as a function of the oxidation degree of the slag; given by the ratio % Fe^{+++}/% Fe^{++} × 100. The cond. slag melts have a compn. of the system FeO-Fe_2O_3-SiO_2, with SiO_2 varying between 8 and 34%. The oxidation degree is decreased with increasing SiO_2 content. An increase in the degree of acidity of the slag from 6 to 10% causes about a decrease in the output from 82.6 to 5.0%. Slags of the system FeO-Fe_2O_3-CaO-SiO_2 (CaO = 20% of the system FeO) show much lower outputs than the corresponding CaO-free melts, even for 30 to 35% SiO_2, while slags of the system FeO-Fe_2O_3 never show outputs above 35%. This latter fact is in contradiction to the opinions of Fischer and Bade (*C.A.* 44, 10038i; 45, 3478c) that pure Fe oxide slags would not be able to show any electrolysis. A slag with 40% (FeO + Fe_2O_3), 20% Al_2O_3, and 40% SiO_2 shows a surprisingly good output (22% to 0.6%) in spite of the high acidity. The very different slopes of the electrolysis curves also indicate the high influence of viscosity in the melts on the regeneration of Fe^{+++} ions by convection and diffusion from the furnace atm. The elec. cond. of Fe silicate slags is, however, not exclusively electrolytic; it is in some part electronic. Therefore, a dila. of the Fe oxides by additn. of SiO_2, CaO, and Al_2O_3 to the melts brings about a reduction of the electronic share of the cond. and an increased electrolytic output.

W. Eitel

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

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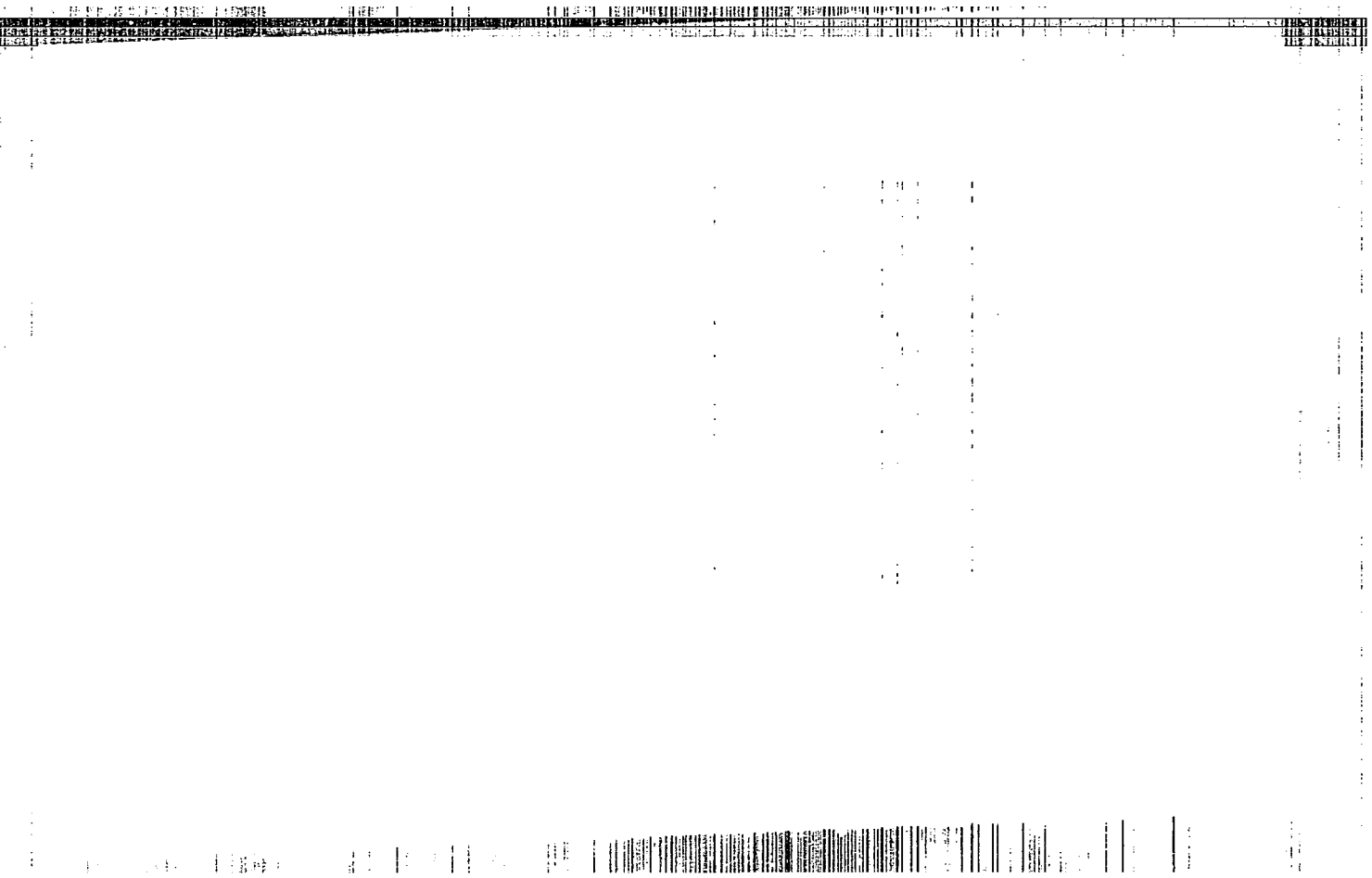

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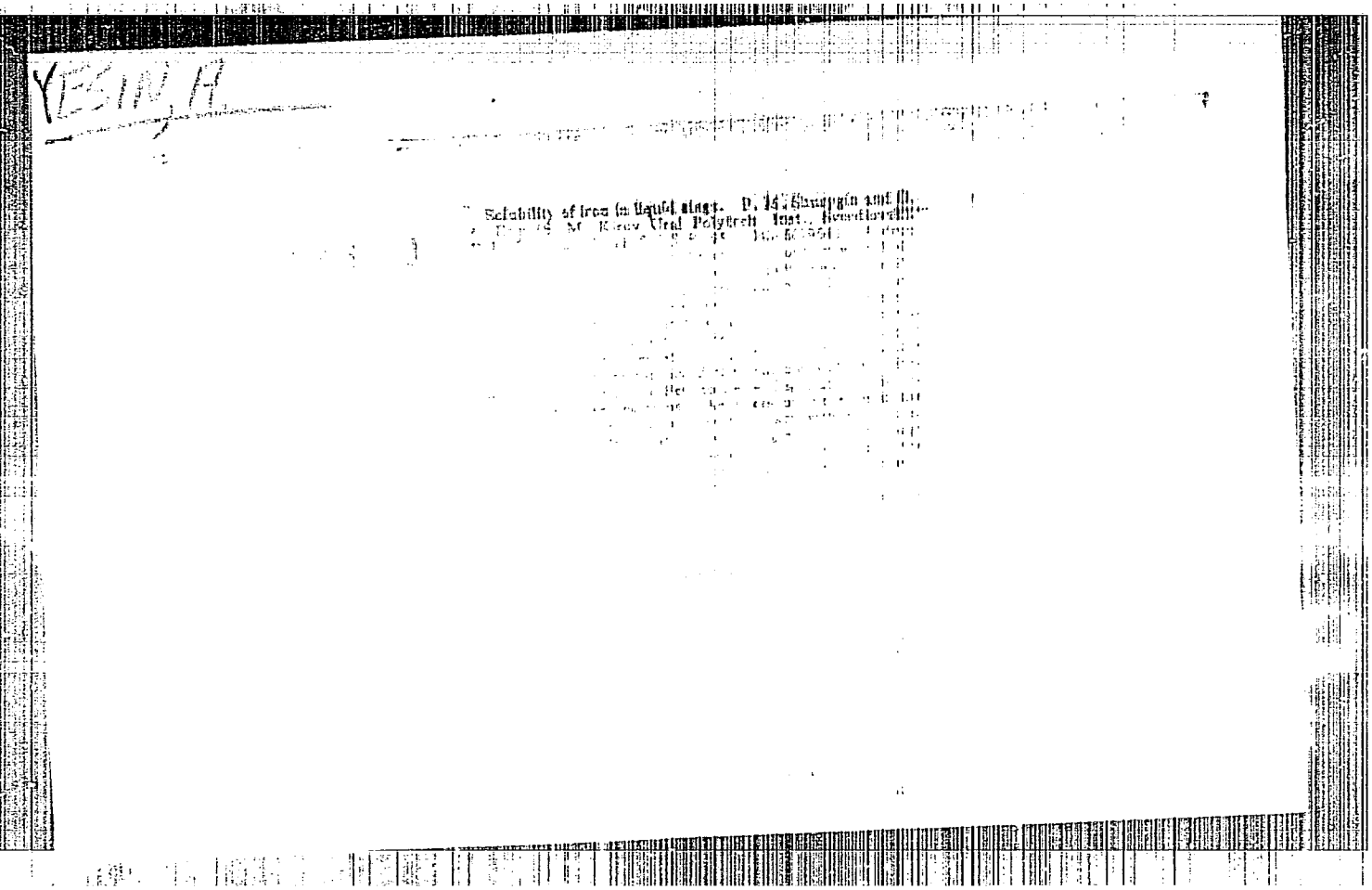

YESIN, A.

Solubility of iron in liquid slags. P. [illegible] Shurpgin and [illegible] M. Kirov Ural Polytech. Inst., Sverdlovskii [illegible]

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

YESIN, O. A.

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

Abst Journal: Referat Zhur - Khimiya, No 2, 1957, 5163

Author: Yesin, O. A., Gel'd, P. V.

Institution: Academy of Sciences USSR

Title: Structural Specific Features of Vitreous and Liquid Silicates

Original Publication: Sb. Stroyeniye stekla, M.-L., AN SSSR, 1955, 44-45

Abstract: Experimental data confirm not only the microheterogeneity and certain orderliness of glasses, but also their ionic nature (on formation from basic and acidic oxides). Glasses are incorrectly designated as microheterogeneous systems since one should not identify crystallites, which are merely micro-regions of heterogeneities with incipient orderliness, with crystals, that have long-range order and interfaces. A crystallite is the embryo of a crystal. Growth of a crystallite, that leads to its gradual conversion to a crystal, is not a simple quantitative change but a complex process of enhancement

Card 1/2

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

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

Abst Journal: Referat Zhur - Khimiya, No 2, 1957, 5163

Abstract: of the heterogeneity of the system, and transformation of short-range order into long-range order, which results in the formation of qualitatively new properties.

Card 2/2

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

YESIN, O.A.

FD-2242

USSR/Engineering - Metallurgy

Card 1/1 Pub 41-10/17

Author : Yesin, O. A. and Shikhov, V. N., Sverdlovsk

Title : Investigation of the limiting stages in the process of the desulfurization of liquid iron by slag

Periodical : Izv. AN SSSR, Otd. Tekh. Nauk 2, 105-112, Feb 1955

Abstract : Attempts to identify the limiting stages in the desulfurization of liquid iron with slag. Develops methodology. Investigates the effect of initial concentration of sulfur in metal on the rate of desulfurization. Studies the effect of temperature on rate of desulfurization. Diagrams, tables. Twelve references, 8 USSR.

Institution: Ural Polytechnic Institute

Submitted : January 5, 1955

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

FD-2391

USSR/Engineering - Metallurgy

Card 1/1 Pub. 41 - 4/12

Author : Yesin, O. A. and Shikhov, V. N., Sverdlovsk

Title : A study on the kinetics of dephosphorization of liquid iron by slag

Periodical : Izv. AN. SSSR, Otd. Tekh. Nauk, 3, 79-89, March 1955

Abstract : Describes the methodology of the experiment conducted and analyzes the findings. The study brought out the fact that the speed with which dephosphorization takes place depends on the chemical reaction of the phosphorous with the slag, rather than on convection and thus physical exposure of the phosphorous to the slag. The area of contact between the slag and the iron and not the height of the slag layer influences dephosphorization. The hypothesis is proposed that the stage which determines the speed of the reaction of phosphorization, is the desorbtion of the anion (PO_4^{3-}) at the slag-to-metal surface. Tables, graphs, formulae. Twelve references, 9 USSR.

Institution : Ural Polytechnic Institute imeni S. M. Kirov

Submitted : January 5, 1955

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

ESIN, C. A

GERM

The form of alumina in fused slags. O. A. Esin and B. M. [illegible] [illegible] 4, 1101[illegible] [illegible] CaO [illegible] Al_2O_3, SiO_2 and CaO-Al_2O_3-SiO_2 [illegible] of complex aluminates [illegible] [illegible] The [illegible] [illegible] studying the galvanic cells of the type Fe, Al, [illegible] CaO, MgO, Al_2O_3, SiO_2 (concn. I)/C/CaO, MgO, Al_2O_3, SiO_2 (concn. II)/Fe, Al, C. The e.m.f. of such cells is detd. by the ratio of the activities (a) of Al_2O_3: e.m.f. = $(RT/6F)\ln(a'_{Al_2O_3}/a''_{Al_2O_3})$. The expts. were made at the const. temp. of 1450° in a graphite crucible. The e.m.f. plotted vs. the concn. of Al_2O_3 shows two discontinuities which correspond to the transitions of complex anions derived from $5CaO$-$3Al_2O_3$ and $2CaO$-Al_2O_3-SiO_2. A peculiar third discontinuity is explained as an indication of the amphoteric character of Al_2O_3. Curves of const. e.m.f. are plotted in the system CaO-Al_2O_3-SiO_2 which shows distinctly a field in which Al forms the cation Al^{+++} (if the melts are high in Al_2O_3 and SiO_2), and another field (for melts high in CaO) in which Al enters the complex anions. Also in *Doklady Akad. Nauk S.S.S.R.* 94, 1187-90(1954). W. Eitel

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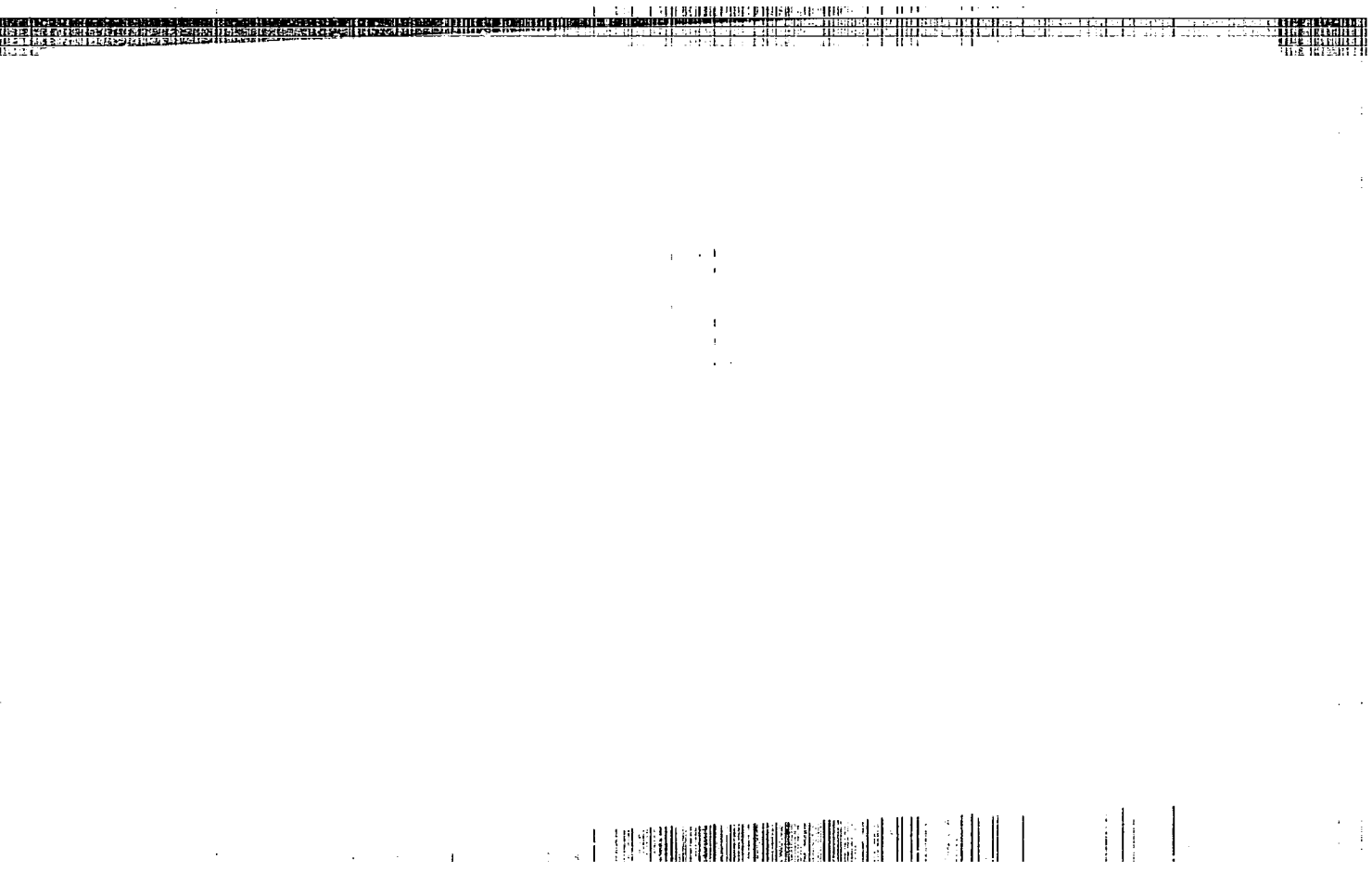

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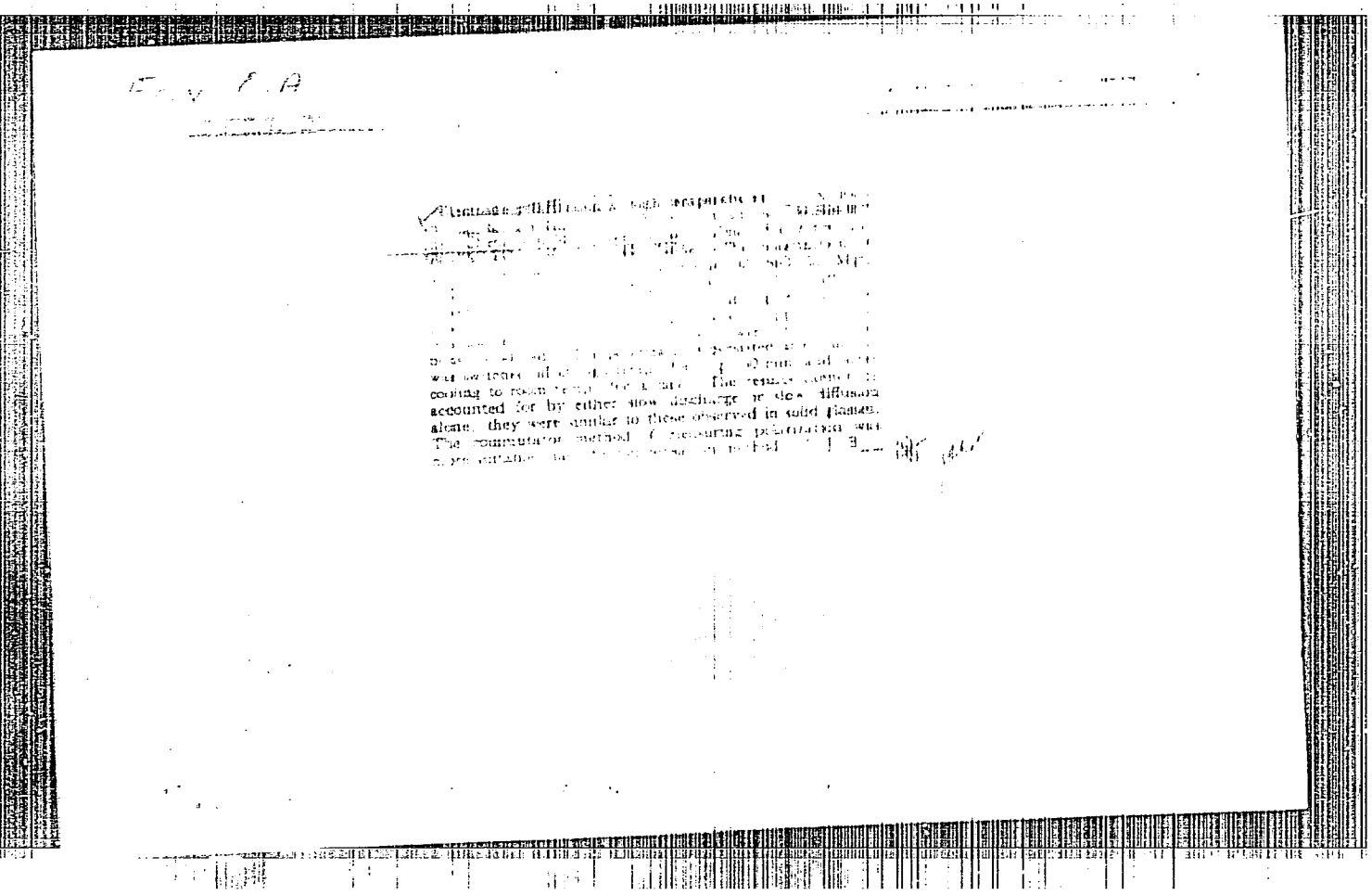

accounted for by either slow discharge or slow diffusion
alone, they were similar to those observed in solid flames.

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GAVRILOV, L.K.; YESIN, O.A.

Variation in time of electrode polarization for oxidic melts. Zhur.fiz. khim. 29 no.4:635-641 Ap '55. (MIRA 8:8)

1. Ural'skiy filial Akademii nauk SSSR, Institut khimii i metallurgii.
(Polarization (Electricity)) (Oxides)

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

YESIN, O.A.

USSR/Chemistry - Metallurgy

Card 1/1 Pub. 22 - 23/47

Authors : Korkiya, I. L.; Yesin, O. A.; and Mikhaylov, V. V.

Title : Mechanism of desulfurization of cast iron

Periodical : Dok. AN SSSR 101/6, 1065 - 1067, Apr. 21, 1955

Abstract : Experiments were conducted with the aid of radioactive Fe^{59} isotope to confirm whether the iron which appears in slag together with sulfur is in the form of small metal beads (ejected by the forming gases) or in the form of FeS molecules. Tests with graphite and magnesia crucibles [illegible] that more sulfur penetrates into the slag than iron but the FeS [illegible] molecule concentrations are equal. The process of [illegible] is explained. It is pointed out that the appearance [illegible] iron is mainly due to the formation of calcium carbide in the [illegible] references: 2 USSR and 2 USA (1948-1952). Table; diagram.

Institution : Acad. Sc., USSR, Ural Branch, Inst. of Chem. and Metallurgy

Presented by: Academician I. P. Bardin, September 14, 1954

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

USSR/ Chemistry - Chemical technology

Card 1/1 Pub. 22 -43/62

Authors : Yesin, O. A., and Shikhov, V. N.

Title : The kinetics of sulfur distribution between liquid iron and slag

Periodical : Dok. AN SSSR 102/3, 583 - 586, May 21, 1955

Abstract : Experiments were conducted with technically pure Fe containing 0.05% C, [illegible] Si, 0.003% P and [illegible] S and three types of slag of [illegible] basicity at temperatures of 1550 - 1700° to determine the [illegible] S-distribution between the melted iron and the slag. The [illegible] of S^{35} and Fe^{59} isotopes into the metal made it possible to [illegible] [illegible] iron with acid slag (at 15[illegible]) [illegible] [illegible] by [illegible] of the [illegible] and [illegible] conversion of large [illegible] quantities into basic or neutral [illegible] companied (at 1560°) by an increase in Fe content in the [illegible] ferences: 4 USSR and 2 USA (1945-1952). Table; graphs.

Institution : The S. M. Kirov Ural Polytechnic Institute, Sverdlovsk

Presented by: Academician I. P. Bardin, December 9, 1954

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

USSR/Metallurgy - Chemical technology

Card 1/1 Pub. 22 - 36/59

Authors : Yesin, O. A., and Shikhov, V. N.

Title : The process of dephosphorization of liquid iron with slag

Periodical : Dok. AN SSSR 102/2, 327-330, May 11, 1955

Abstract : The experiments on the dephosphorization of liquid iron were carried out in an electric furnace with carbon resistance at a temperature of about 1500 and nitrogen atmosphere. The dephosphorization [illegible] The P content in the samples was determined by means of [illegible] beta-counter. Results obtained are given in graphs. [illegible] USSR and 1 Engl. (1946-1954). Graphs; drawing.

Institution : Ural Polytechnic Inst. im. S.M.Kirov, Sverdlovsk

Presented by : Academician I. B. Bardin, December 9, 1954

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

O. A. Yesin

24(8) PHASE I BOOK EXPLOITATION SOV/2117

Soveshchaniye po eksperimental'noy tekhnike i metodam vysokotemperaturnykh issledovaniy, 1956

Eksperimental'naya tekhnika i metody issledovaniy pri vysokikh temperaturakh; trudy soveshchaniya (Experimental Techniques and Methods of Investigation at High Temperatures; Transactions of the Conference on Experimental Techniques and Methods of Investigation at High Temperatures) Moscow, AN SSSR, 1959. 789 p. (Series: Akademiya nauk SSSR. Institut metallurgii. Komissiya po fiziko-khimicheskim osnovam proizvodstva stali) 2,200 copies printed.

Resp. Ed.: A.M. Samarin, Corresponding Member, USSR Academy of Sciences; Ed. of Publishing House: A.L. Bankvitser.

PURPOSE: This book is intended for metallurgists and metallurgical engineers.

COVERAGE: This collection of scientific papers is divided into six parts: 1) thermodynamic activity and kinetics of high-temperature processes 2) constitution diagram studies 3) physical properties of liquid metals and slags 4) new analytical methods and production of pure metals 5) pyrometry, and 6) general questions. For more specific coverage, see Table of Contents.

Yatolin, N.A., and O.A. Yesin. Solubility of Carbon in Iron Alloyed With Various Elements 88

A study was made of the effect of phosphorus, chromium, manganese, sulfur, and vanadium on the solubility of carbon in liquid iron, and also of silicon on the solubility of carbon in molten manganese and ferrochrome. It was shown that regularities observed in the effect of the nature and concentration of the addition, as well as of the temperature, can be qualitatively explained with the aid of the theory of regular solutions.

Ivanov, L.I., I.S. Kulikov, and M.P. Matveyeva. Methods of Measuring the Thermodynamic Constants of Metals and Alloys at High Temperature 96

An apparently reliable method was developed for determining the heat of sublimation of metals, making use of the principle of isotope exchange in the gaseous phase of metals. The use of radioactive isotopes permits the determination of partial values of the following thermodynamic constant: rate of vaporization, vapor pressure, heat of sublimation, and the individual thermodynamic activity of each of the elements of the alloy.

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24(6) PHASE I BOOK EXPLOITATION SOV/2117

Soveshchaniye po eksperimental'noy tekhnike i metodam vysokotemperaturnykh issledovaniy, 1956

Eksperimental'naya tekhnika i metody issledovaniy pri vysokikh temperaturakh; trudy soveshchaniya (Experimental Techniques and Methods of Investigation at High Temperatures; Transactions of the Methods of Investigation Conference on Experimental Techniques and Methods of Investigation at High Temperatures) Moscow, AN SSSR, 1959. 789 p. (Series: Akademiya nauk SSSR. Institut metallurgii. Komissiya po fiziko-khimicheskim osnovam proizvodstva stali) 2,200 copies printed.

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Experimental Techniques and Methods (Cont.) SOV/2117

Filippov, S.I. A Study of the Kinetics of the Decarburization of Steel 108
A description is given of methods and equipment for studying the kinetics of slag-metal reactions, especially desulfurization and dephosphorization. Use is made of the isotopes S35, P32, Fe59, and others.

Chou, Yang-shih. Thermodynamics of Liquid Blast-furnace Slags 113

Shikhov, V.N., and O.A. Yesin. Methods of Using Radioactive Isotopes for Studying the Kinetics of Metal-Slag Reactions 123

Shchedrin, V.M. Stand for Studying High-temperature Reduction Processes Under Pressure 131

Krabov, R.A., and F.F. Galid. Rate of Hydrogen Diffusion in Steels at High Temperatures 147
The rate of diffusion at a given temperature was determined on the basis of the quantity of hydrogen diffusing per unit time through a unit section of fixed thickness, as measured by the drop in pressure. The effect of alloying elements (carbon, chromium, vanadium, silicon, manganese, and nickel), decomposition of austenite, and pressure on the rate of diffusion were studied.

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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

Q. A.

Q. A. Yesin

24(8) PHASE I BOOK EXPLOITATION SOV/2117

Soveshchaniye po eksperimental'noy tekhnike i metodam vysokotemperaturnykh issledovaniy, 1956

Eksperimental'naya tekhnika i metody issledovaniy pri vysokikh temperaturakh; trudy soveshchaniya (Experimental Techniques and Methods of Investigation at High Temperatures; Transactions of the Conference on Experimental Techniques and Methods of Investigation at High Temperatures) Moscow, AN SSSR, 1959. 789 p. (Series: Akademiya nauk SSSR. Institut metallurgii. Komissiya po fiziko-khimicheskim osnovam proizvodstva stali) 2,200 copies printed.

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Experimental Techniques and Methods (Cont.) SOV/2117

Yeremenko, V.N., G.V. Zudilova, and L.A. Gayevskaya. Constitution Diagram of the System Chromium-Niobium 224

Negrescu, T. Quantitative Relationships Existing Between Components Under Conditions of Equilibrium of Slags in the Blast-Furnace Hearth 237

III. PHYSICAL PROPERTIES OF LIQUID METALS AND SLAGS

Popel', S.P., and O.A. Yesin. Methods of Measuring the Surface Tension of Liquid Metals and Slags 257

A comparison was made of the results obtained in measuring the surface tension of slags of the systems $CaO-SiO_2-Al_2O_3$ and $CaO-SiO_2-MgO$ by the maximum-bubble-pressure method and the sessile-drop method. It was shown that the replacement of SiO_2 by CaO (with constant Al_2O_3 content) in the system $CaO-SiO_2-Al_2O_3$ leads to an increase in surface tension. An increase in the content of Al_2O_3 (with a constant ratio of CaO to SiO_2) also results in higher surface tension. This is explained by a breaking-down of silicate anions. It was shown that the replacement of CaO by MgO in the system $CaO-SiO_2-MgO$ has practically no effect on surface tension.

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24(8) PHASE I BOOK EXPLOITATION SOV/2117

Soveshchaniye po eksperimental'noy tekhnike i metodam vysokotempera-turnykh issledovaniy, 1956

Eksperimental'naya tekhnika i metody issledovaniy pri vysokikh temperaturakh; trudy soveshchaniya (Experimental Techniques and Methods of Investigation at High Temperatures; Transactions of the Conference on Experimental Techniques and Methods of Investigation at High Temperatures) Moscow, AN SSSR, 1959. 789 p. (Series: Khimicheskaya nauk SSSR. Institut metallurgii. Komissiya po fiziko-khimicheskim osnovam proizvodstva stali) 2,200 copies printed.

Resp. Ed.: A.M. Samarin, Corresponding Member, USSR Academy of Sciences; Ed. of Publishing House: A.L. Bankvitser.

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Korol'kov, A.M., Surface Tension and Fluidity of Aluminum- and Zinc-Base Alloys 269
No direct relationship between surface tension and fluidity of the alloys investigated was observed.

Yaremenko, V.N., Yu.N. Ivashchenko, and V.I. Mizhenko. Measurement of Surface Tension of Metals and Alloys by the Sessile-Drop Method 285
The surface tension of tin at temperatures of 251-382° C was determined by the sessile-drop method and the maximum-bubble-pressure method. The former method was shown to be accurate to within ± 1.5 percent and capable of further refinement with improved equipment and methods of calculations.

Lepinskikh, B.M., and O.A. Yesin. Measurement of the Electrical Conductivity of Titaniferous Slags 293
Measurements were made of the electrical conductivity of the systems Na_2O-TiO_2, FeO-TiO_2, and MnO-TiO_2 of various

Card 12/32

compositions and at various temperatures using a Wheatstone bridge and a weak alternating current. The conductivity of these systems falls with an increase in TiO_2 content, as in the case of silicate systems. Results indicated that conductivity is higher in the MnO-TiO_2 system than in the FeO-TiO_2 system, that in both of these system it is higher than in the MnO-SiO_2 and FeO-SiO_2 systems, and that in the Na_2O-TiO_2 system it is lower than in the Na_2O-SiO_2 system.

Tikhin, Yu.P., and O.A. Yesin. Measurement of Surface Charge Density of Liquid Metal in Contact With Slag 313

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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

YESIN, O.A.

USSR/ Physical Chemistry - Kinetics. Combustion. Explosives. Topochemistry. Catalysis B-9

Abs Jour : Referat Zhur - Khimiya, No 4, 1957, 11258

Author : Yesin O.A., Shikhov V.N.
Inst : Department of Technical Sciences, Academy of Sciences USSR
Title : On Kinetics of Silicon-Reduction Process

Orig Pub : Izv. AN SSSR, Otd. tekhn. n., 1956, No 6, 113-118

Abstract : Study of kinetics of the reduction of silicon with liquid iron in slag MO - Al_2O_3 - SiO_2, saturated with SiO_2. Rate of the process is determined from the amount of radioisotope Fe^{59}, that passes from Fe into the slag as Fe^{2+}. Depth of slag layer does not affect rate of reaction, i.e., complications due to diffusion are apparently absent. Reduction rate decreases greatly on replacement of MgO, in the slag, by CaO or BaO. Determined were the apparent energies of activation for slags of different composition: with 64.4% SiO_2 + 32.1% MgO (at 1560-1660°) 51 kcal; with 61.2% SiO_2 + 19.4% CaO + 17.4% Al_2O_3 (at 1580-1620°) 66.5 kcal; with 59.1% SiO_2 + 37.3% BaO (at 1580-1680°) 148 kcal. It is assumed that effect of cathions on rate of process is due to different degree of weakening of bonds between Si and O atoms in the slag.

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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

USSR/Physical Chemistry. Electrochemistry. B-12

Abs Jour : Ref Zhur - Khimiya, No 7, 1957, 22487.

acid slag conductivity and of the small mobility of complex silico- and alumo-oxygenous anions.

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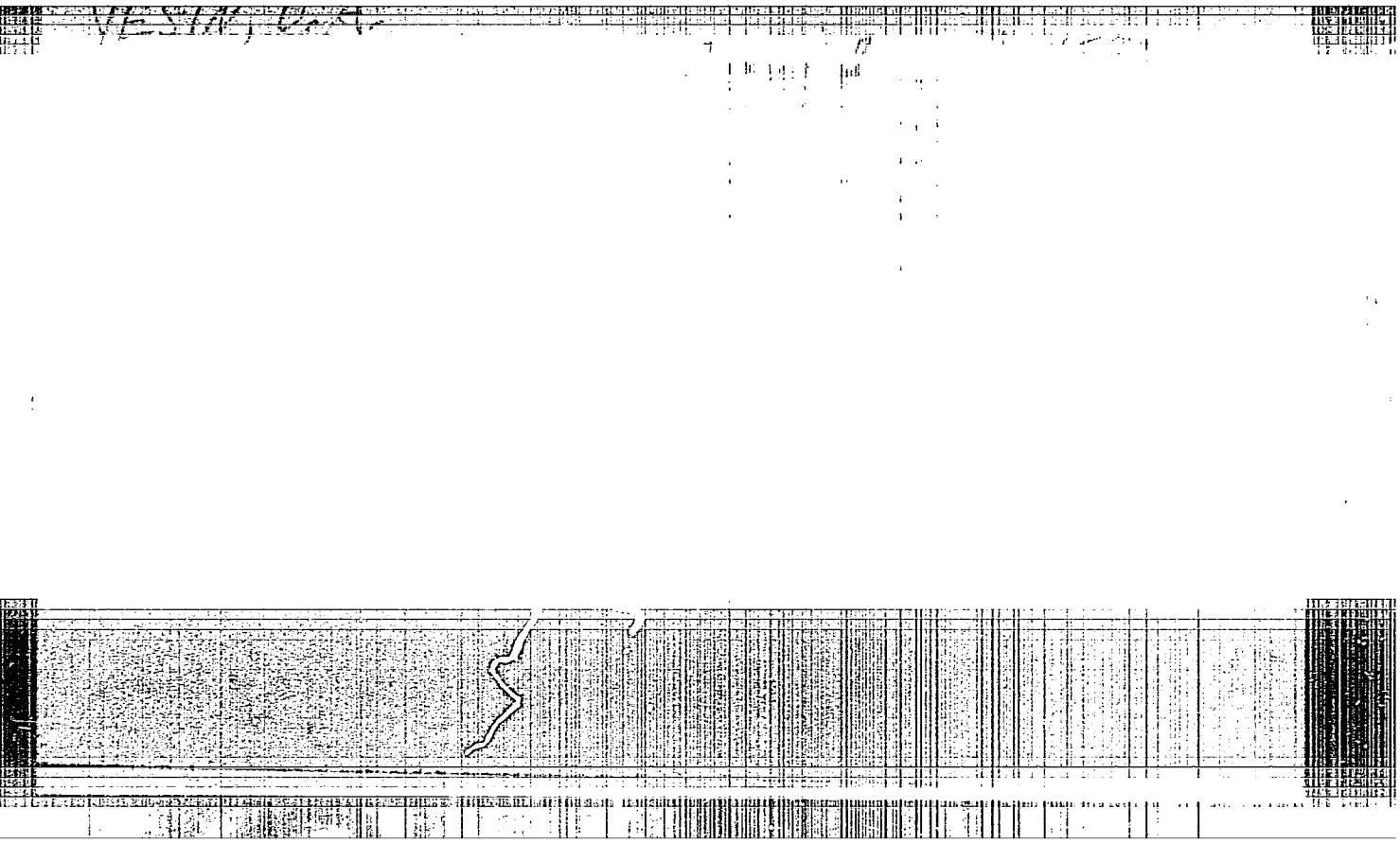

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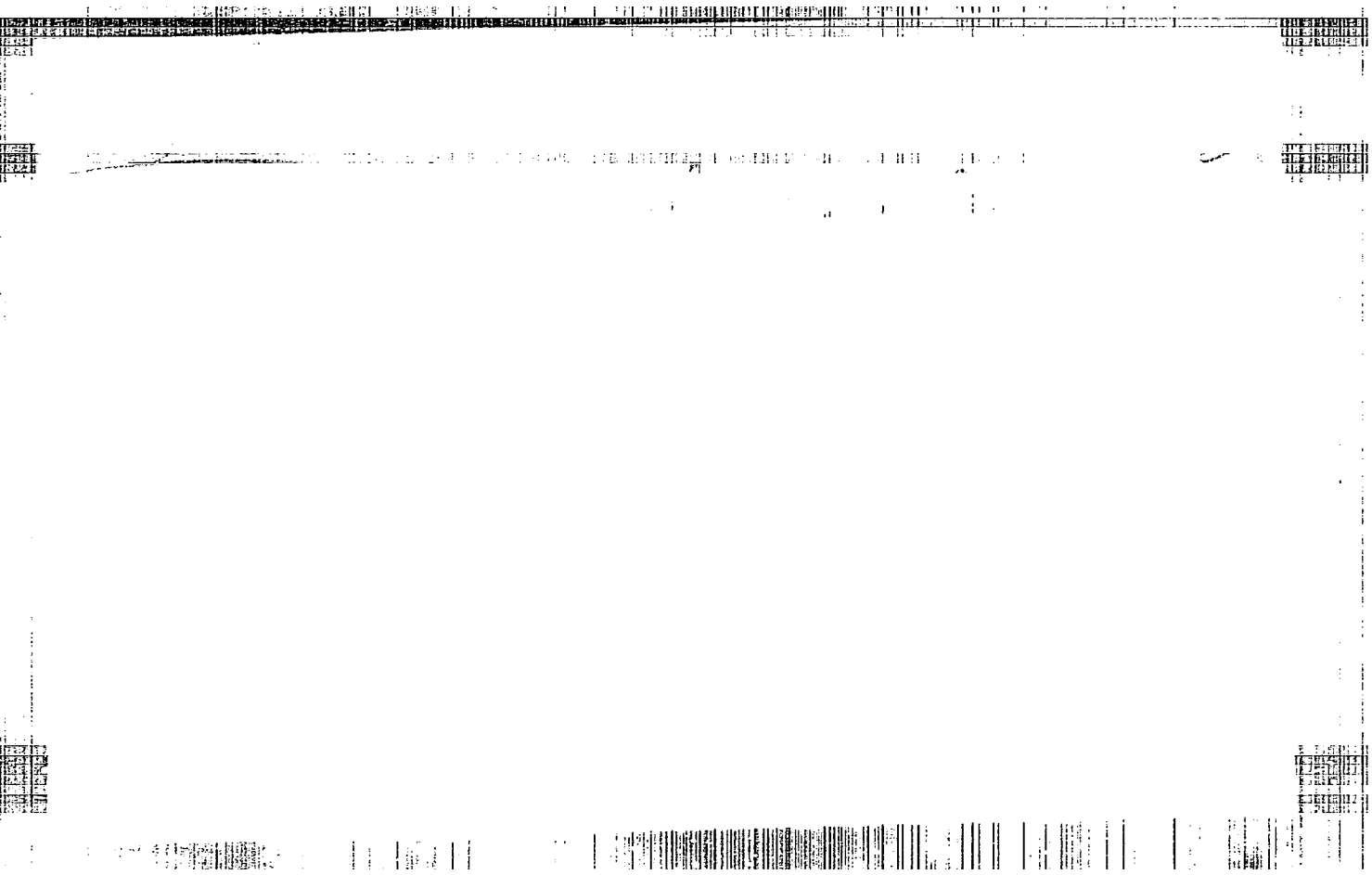

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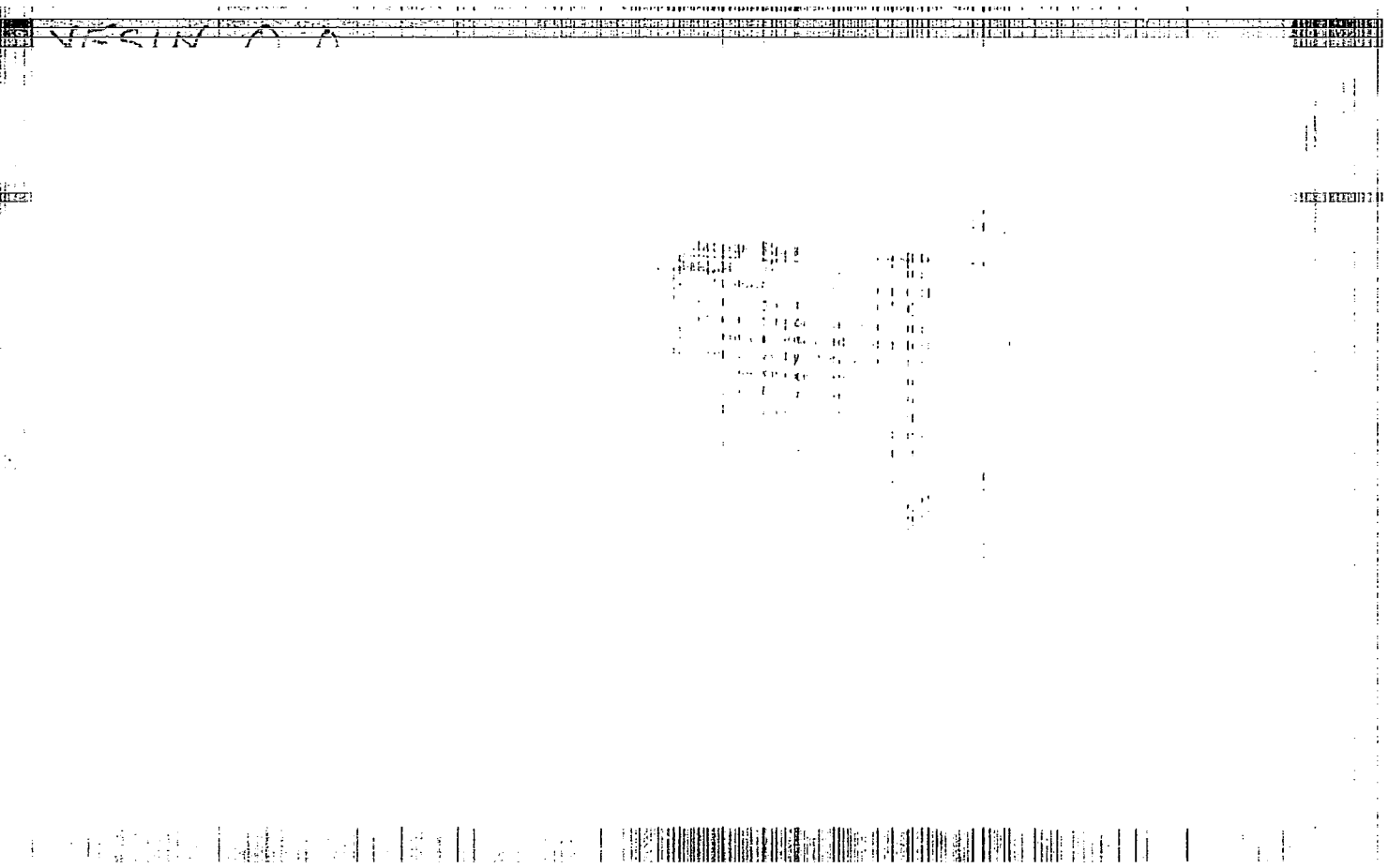

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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

YESIN, O.A.

USSR/ Chemistry - Physical chemistry

Card 1/1 Pub. 147 - 1/35

Authors : Yesin, O. A.

Title : Electrochemistry of molten oxides (Review)

Periodical : Zhur. fiz. khim. 30/1, 3-19, Jan 1956

Abstract : The bases for experimental electrochemistry are reviewed with respect to molten metallurgical slags such as silicates, aluminosilicates, ferrites, titanates, etc. Data are presented regarding the specific electroconductivity of [illegible] and their thermal coefficients. The thermal coefficient of [illegible] melt was found to be [illegible] positive. [illegible] elements of different valence is discussed. Sixty references, 7 Germ., 3 Eng., 2 Japan. and 12 USA (1927-1955). Graphs.

Institution : Ural Polytechnic Inst. im. S. M. Kirov, Sverdlovsk

Submitted : May 3, 1955

APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3"

"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

USSR/Physical Chemistry - Electrochemistry B-12

Abs Jour : Referat Zhur - Khimiya, No 2, 1957, 3961

Author : Yesin O.A., Gavrilov L.K.
Title : Electrode Polarization in Fused Silicates and Formation of Divalent Silicon

Orig Pub : Zh. fiz. khimii, 1956, 30, No 2, 374-378

Abstract : Determination of electrode polarization in silicate slags (43% SiO, 46% CaO, 10% MgO, remainder phosphides) at 1490-1610°, by the commutator method. Liquid ferrophosphorus (23% P) was used as the electrode. On comparing the results obtained with previous determinations (RZhKhim, 1956, 12533, 12534), the authors arrive at the conclusion that polarization in fused silicates exhibites the same regularies as in the case of the use of FeSi electrodes. It is shown that the cause of polarization can be not only slowed down deformation and orientation of complex silicon-oxygen anions but also an accumulation

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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

- YESIN, O. A.

Category: USSR/Physical Chemistry--Surface Phenomena. Adsorption. Chromatography. Ion exchange. B-13

Abs Jour: Referat Zhur--Khimiya, No 3, 1957, 7699

Author : Popel, S. I. and Yesin, O. A.
Inst : Not given
Title : Surface Tension of the Simplest Oxide Systems

Orig Pub: Zh. Fiz. Khimii, 1956, Vol 30, No 6, 1193-1201 (with English summary)

Abstract: The bubble-pressure method was used to investigate the surface tension (σ) of the systems: $FeO-Fe_2O_3$ (I), $FeO-Fe_2O_3-SiO_2$ (II), $FeO-SiO_2-MnO$ (III), $FeO-CaO-Fe_2O_3$ (IV), $FeO-Na_2O-Fe_2O_3$ (V) and $FeO-CaO-SiO_2$ at 1300-1400° in an atmosphere of nitrogen. It is shown that FeO is the surface active component in all the investigated systems (σ at an Fe_2O_3 content of ~ 3 atom percent is equal to σ 590 ergs/cm^2). Fe_2O_3 is surface active in I and reduces σ at a content of 15.1% to 490 ergs/cm^2. Calculation of a Gibbs adsorption isotherm (G) for Fe_2O_3 gives G_{max} = 0.8x 10-9 mole/cm^2. A

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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

The Diffusion of Phosphorus and Calcium in the Melts $CaO-Al_2O_3-SiO_2$ and $CaO-P_2O_5$ 76-10-23/34

field and the data in the references concerning the practically absolute immovability of the latter in the case of a current passage through the melt admit the conclusion that phosphorus diffuses in contrast to calcium in an uncharged form. There are 4 figures, 5 tables, 8 Slavic references.

ASSOCIATION: Ural Polytechnical Institute imeni S. M. Kirov, Sverdlovsk (Ural'skiy politekhnicheskiy institut im. S. M. Kirova, Sverdlovsk).

SUBMITTED: September 24, 1956

AVAILABLE: Library of Congress

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"APPROVED FOR RELEASE: 03/15/2001 CIA-RDP86-00513R001962920009-3

- YESIN, O. A.

Category: USSR B-12

Abs Jour: Zh--Kh, No 3, 1957, 7670

Author : Nikitin, Yu. P. and Yesin, O. A.
Inst : Academy of Sciences USSR
Title : Electro-Osmotic Phenomena in Pyrometallurgical Systems

Orig Pub: Dokl. AN SSSR, 1956, Vol 107, No 6, 847-849

Abstract: A method previously described by the authors (Dokl. AN SSSR, 1952, Vol 83, 341) was used to obtain electroosmotic curves for Ni sulfides (96.1% Ni_3S_2 and 3.9% Ni), Cu sulfides (77.7% Cu, 1.3% Fe, and 20.5% S) at 1,350-1,400° as well as for an Mn-C alloy (7% C, 0.14% Si, 0.37% P, 0.007% S) at 1,480-1,500°. It has been established that in the absence of an external electric field the surface of the melts in contact with the slag is charged negatively. The density of this charge (ε), calculated from the equation $(\partial\sigma/\partial\varphi) = -\varepsilon$, at $\varphi = 0$ is 15 x 10^{-6} coulombs/cm^2 for Ni sulfide; for Cu sulfide and the Mn-C alloy the density is 12 x 10^{-6} and 9 x 10^{-6} coulombs/cm^2, respectively. A method based on the measurement of the flow which arises

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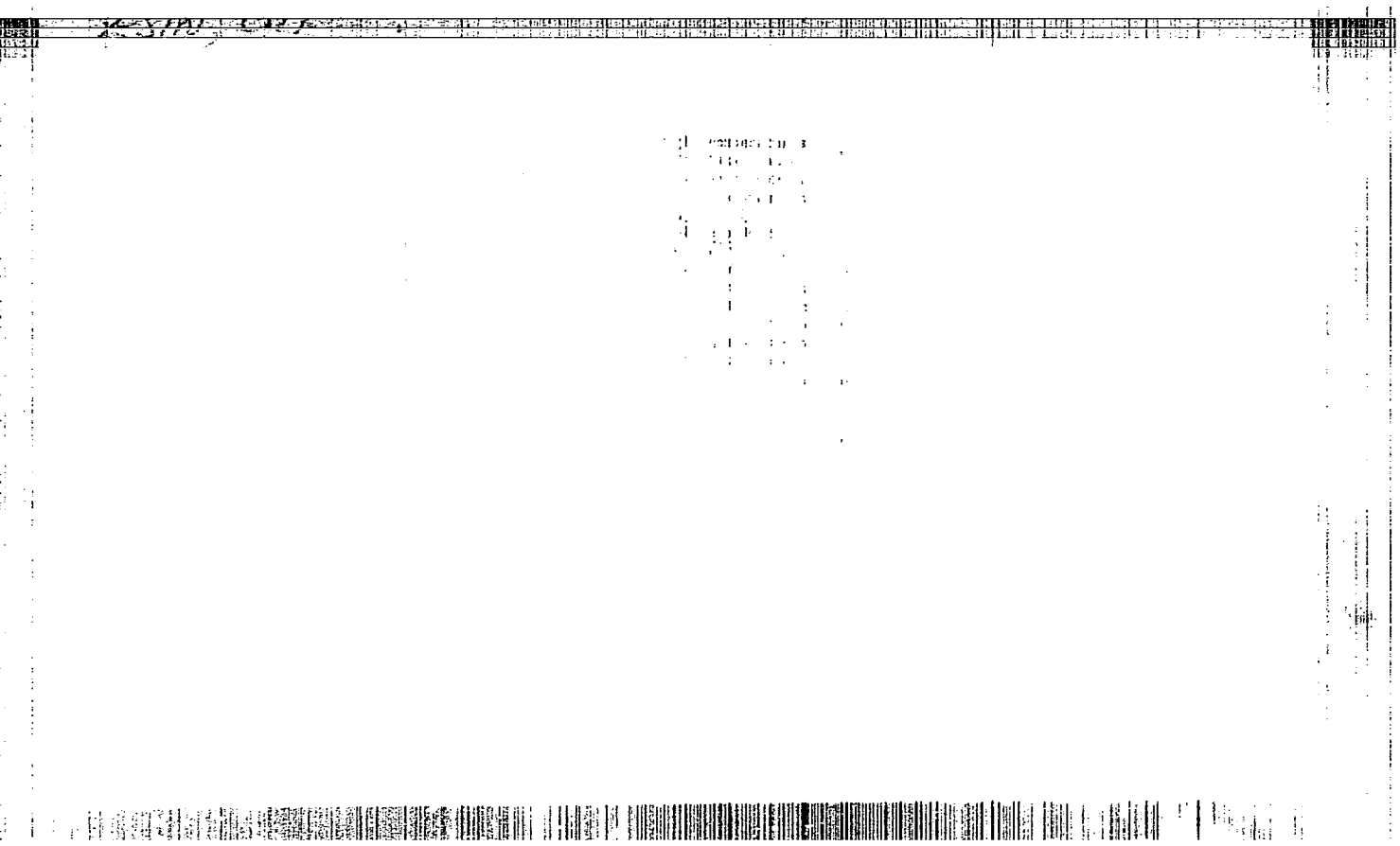

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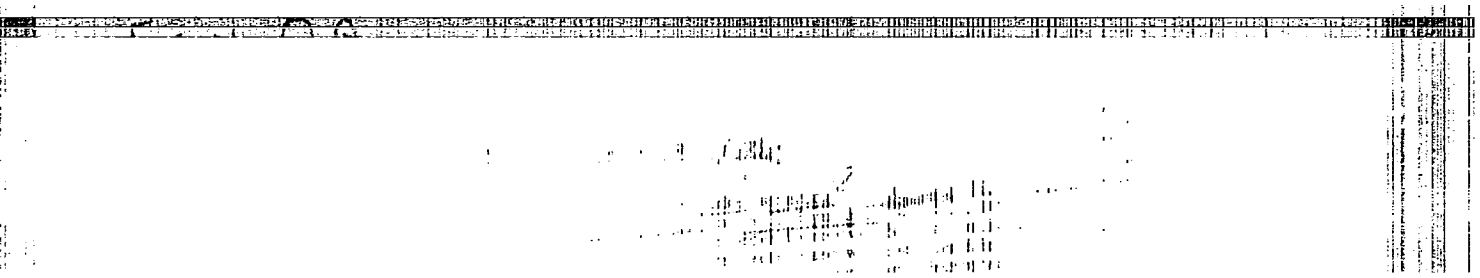

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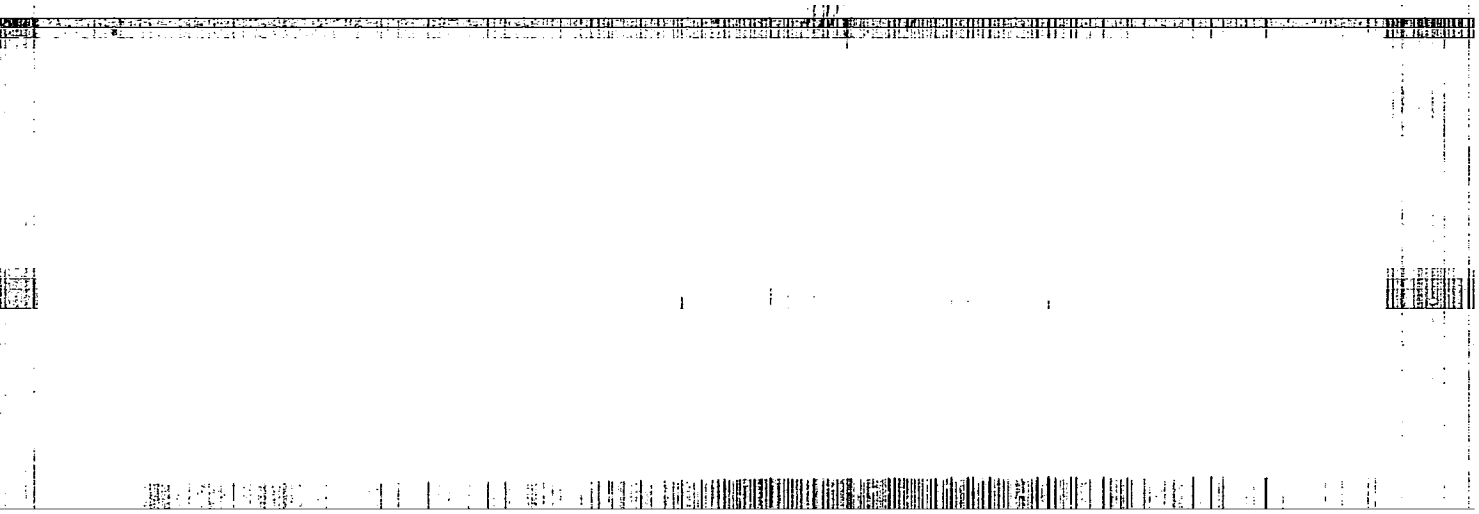

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Gel'd, Pavel Vladimirovich, and Yesin, Oleg Alekseyevich

Protsessy vysokotemperaturnogo vosstanovleniya (Processes of High-temperature Metal Reduction) Sverdlovsk, Metallurgizdat, 1957. 646 p. 4,500 copies printed.

Ed.: Yur'yev, B.N.; Ed. of Publishing House: Kel'nik, V.P.: Tech. Ed.: Zef, Ye.M.

PURPOSE: This book is intended for metallurgists and metallurgical engineers, as well as for vtuz students taking advanced courses in metallurgy.

COVERAGE: The authors state that until recently the attention of physical chemists working in the field of oxide reduction was focused mainly on studying the mechanism and kinetics of the indirect reduction of comparatively unstable oxides of iron, nickel, copper, manganese, etc. Direct reduction has been studied much less extensively, especially the reduction of such oxides as those of

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chromium, calcium, and silicon. Furthermore, such processes are finding more and more application in the ferroalloy and ore-reduction industries. The absence of monographic literature on this question has (until now) hindered the development of these industries. This book deals with the reduction reactions of certain hard-to-reduce oxides, namely those of chromium, manganese, silicon, and phosphorus. The discussion covers equilibrium of the above systems and the molecular kinetics of individual reactions. It is stated that Chufarov, Arkharov, Chizhikov, Vagner, Krupkovskiy, Tumarev and others have contributed to the elucidation of views held by Gryuner, Baykov, Sokolov, and Stark on the mechanism of direct reduction; that Samarin, Khilti, Ol'shanskiy, Khitrik, Richardson, and Tarkdogan have established the nature of intermediate compounds formed in the process of reduction of chromium oxides; that Chufarov, Kapustinskiy, Rode, Simonsen, Vlasov, and Lyuban have contributed much information on the thermodynamic and kinetic aspects of high-temperature reduction of manganese oxides; that much information was obtained from Mikulinskiy, Rapoport,

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