cM

2

The question of the existence of a calcium cuprotide
P. V. Gel'd, F. S. Morev, and N. N. Sheviakova.
Doklady Akad. Nauk S.S.S.R. 68, 123-5(1949).—
Dilatometric and thermographic detns. on CaC_2 + CaO
alloys, with tech. carbides contg. 62.4-81.3% CaC_2,
as with synthetic products contg. 83.6-91.0% CaC_2,
showed consistently transition in the temp. range 420-
440°, i.e. practically in the temp. range of the known
transitions CaC_2 I → IV and CaC_2 III ⇄ IV, the 1st
irreversible, the 2nd reversible. The vol. expansion of
CaC_2 at the polymorphic transition is in agreement with
data of Bredig (*C.A.* 37, 1917⁹) and of Marchetterg
(*C.A.* 29, 11). The dilatometric curves show for CaC_2
a greater expansion coeff. than for CaO, in agreement with
data of lattice energies. The fact that the transition
characteristic of pure CaC_2 is observed, in the proper
temp. range, both in alloys rich and poor in CaC_2, indi-
cates absence of an cuprotide CaC_2.CaO, and invalidates
the corresponding finding of Plaskin and Aall (*C.A.* 39,
[illegible]). N. Thon

Ural Polytech. Inst. im. Kirov

GEL'D, P.V.
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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
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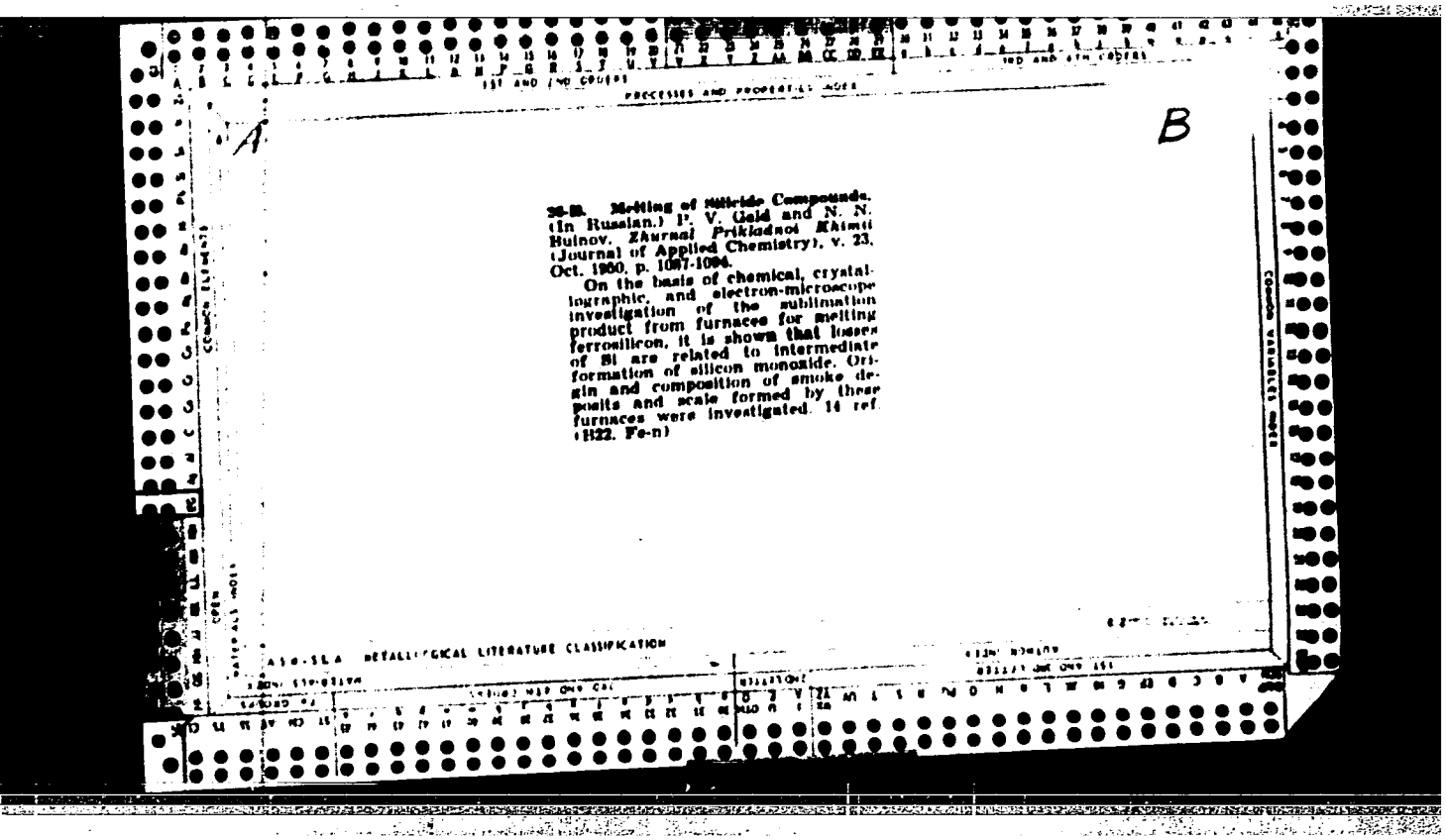


A

B

Melting of Nitride Compounds. (In Russian.) P. V. Geld and N. N. Buinov. *ZAurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 23, Oct. 1950. p. 1087-1094.

On the basis of chemical, crystallographic, and electron-microscope investigation of the sublimation product from furnaces for melting ferrosilicon, it is shown that losses of Si are related to intermediate formation of silicon monoxide. Origin and composition of smoke deposits and scale formed by these furnaces were investigated. 14 ref. (H22. Fe-n)

METALLURGICAL LITERATURE CLASSIFICATION

GEL'D I. V.,

USSR/Chemistry - Alloys and abrasives Nov 50

"Certain Thermometallurgical and Other Processes," P. V. Gel'd, R. N. Lerinman, Ural Polytech Inst, Inst of Metal Phys, Ural Affiliate, Acad Sci USSR,

"Zhur Prik Khim" Vol XXIII, No 11, pp 1191-99

Microscopic examination of brickets of chromium ore partly reduced with Si shows there is intermediate formation of SiO. Electron-microscopic examination of smoke deposits obtained in production of carbon-free ferrochromium and ferromolybdenum by reduction with Si disclosed presence

170T36

USSR/Chemistry - Alloys and abrasives Nov 50
(Comtd)

of spherical particles, formation of which is due to action of SiO. Structural characteristics of smoke deposits obtained in production of titanium by reduction with aluminum, smelting of corundum in electrical furnaces, and production of fused magnesite are described, and their formation is tentatively explained.

170T36

GEL'D, O. A. V.

PA 170T37

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

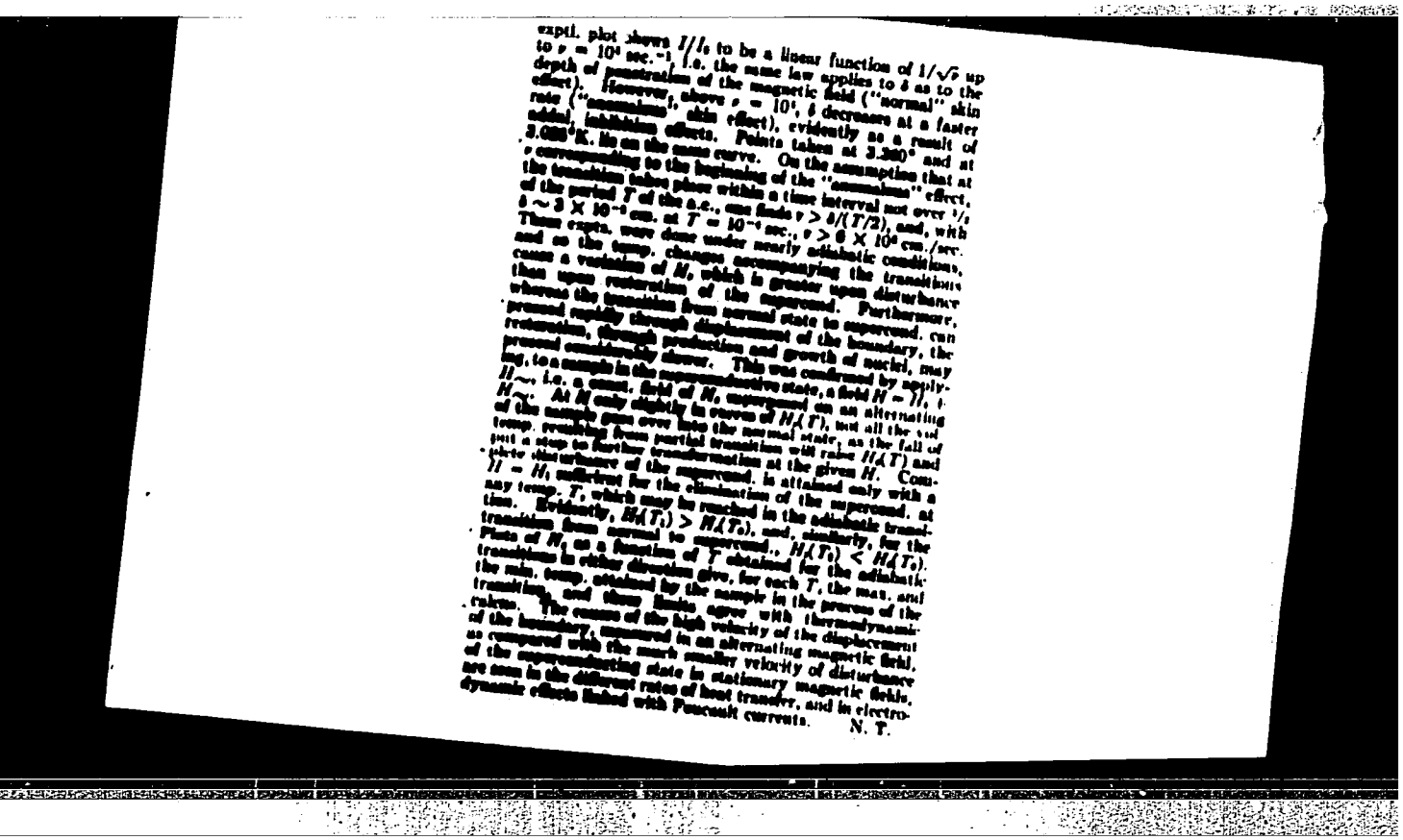
USSR/Chemistry - Smelting of iron Nov 50
(Contd)

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.

170T37

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.) 33, 1200–70(1960).—(1) At any temp. between 800 and 960°, 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 exptl. realization of the equil. $FeCr_2O_4$ + 4C ⇌ 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*) ΔH = ΔH° − 0.498 T − 0.778 × 10⁻³ T^2 − 5.053 × 10⁵ T^{-1}. From other thermochem. literature data, ΔH° = 50,874 cal., and hence ΔF° = 50,874 + 0.493 T ln T + 0.778 × 10⁻³ T^2 − 2.751 × 10⁵ T^{-1} + 37.714 T, and log K_p ~ log p_{CO} = −(11,112/T) −0.244 log T − 0.17 × 10⁻³ T + 0.6 × 10⁵ T^{-2} + 9.807, or, simplified, log p_{CO} = −(10,405/T) + 8.053; numerically, at 800, 1000, 1200, 1400, 1600, 1800°K., log p_{CO} = −4.087, −2.352, −0.617, +0.623, 1.853, 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} (exptl.) = −0.65 (calcd.) = −2.43). The deviations decrease with rising temp. but still remain major. They may be caused by the presence of easily reducible impurities.



expti. plot shows I/I_0 to be a linear function of $1/\sqrt{\nu}$ 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 added inhibition effects. Points taken at 3.380° and at 3.088°K. lie on the same curve. On the assumption that at a corresponding to the beginning of the "anomalous" effect, the transition takes place within a time interval not over 1/4 of the period T of the a.c., one finds $\nu > \delta/(T/2)$, and, with $\delta \sim 3 \times 10^{-3}$ cm. at $T = 10^{-4}$ sec., $\nu > 6 \times 10^4$ cm./sec. These expts. were done under nearly adiabatic conditions, and as 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 reverse transition, through production and growth of nuclei, may lag, to a marked degree. This was confirmed by applying $H \sim$, i.e. a const. field of H_c, superposed on an alternating $H \sim$. At H only slightly in excess of $H_c(T)$, but all the coil 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., $H_c(T_0) < H_c(T_0)$. 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, encountered 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.

CA

2

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. Prikhid. Khim.* (J. Applied Chem.) **23**, 1271-6 (1950).—(1) Data of Bonhoeffer and Henke (*C.A.* **32**, 2044[9]) on the rate of reduction of Cr_2O_3 with H_2 can be represented by $\log A = (20{,}000/4.575\ T) + B$, where A = [illegible] of reduction of Cr_2O_3. The activation energy E = 20,000 cal./mole is independent of A. The coeff. B varies with time τ (hrs.) according to $B = \log (177 \times 10^9\ \tau - 4.575 \times 10^9\ \tau^2 + 0.406 \times 10^9\ \tau^3)$, i.e. in the manner characteristic of topochem. processes with simultaneous start of the reaction over the whole surface. (2) Expt. 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 63.14, 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. Comminution of the ore facilitates greatly its reduction with C, and so does addn. of 3% K_2CO_3.

N. Thon

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_2 126.21, Al_2O_3 1.45, FeO 0.39, CaO 0.63, and MgO 1.69%) 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 silicon, oxygen 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^{++} do not change into metal. B. Z. Kamish

1951

1

CA

Silicon monoxide in the melting of acid steel. P. V. Gel'd, A. I. Khatunlev, and N. N. Sulnov (S. M. Kirov Ural Polytech. Inst., Ural Branch, Acad. Sci., U.S.S.R.). *Doklady Akad. Nauk S.S.S.R.* 70, 679-82(1950).—Expts. were made on 4-ton heats of C steel in an acid elec. arc furnace to det. whether SiO is produced during the reducing period. In the course of this period the lining was attacked and the SiO_2 content of the slag increased from 63 to 82%. Dark blue sublimate flakes flew from the furnace. They had a sp. gr. of 0.02 to 0.06, were elastic in compression, and contained: SiO_2 70.16, CaO 2.09, MgO 0.77, Fe_2O_3 41.07, MnO 3.34, S 0.18%; Al_2O_3 was not detected. The presence of SiO accounts for a total analysis of more than 100% for this material and for the slag. Glowing of sublimate particles on the floor was attributed to the oxidation of SiO. By light and electron-microscope exams. it was detd. that the sublimate was composed of brownish spheres less than 1 μ in diam. with n 1.485. The material was identified as crystobalite. The sphere size decreased as deoxidation continued and the reducing agent was used up. In view of the similarity to melting of high-Si alloys, it was concluded that SiO is an intermediate product and probably is present in the slag and metal as well as in the gas phase. A. G. C.

Inst. Physics of Metals Ural Br. AS

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, 341-4(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 800 and 1300°, is strongly accelerated by the addn. of 5% KCl. Rapid. 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 1300°, is markedly accelerated by 5% CaF_2 or $CaCl_2$, and even more by 5% $NaCl_2$. 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.

1956

METHOD OF MEASURING INTERPHASE TENSION AT HIGH TEMPERATURES. S. I. Popel, O. A. Esin, and P. V. Gel'd. Translated from Doklady Akad. Nauk S.S.S.R. 71, 1097-1100(1950). 9p. Available from Henry Brutcher (Trans. No. 2769), Altadena, Calif. (AEC-tr-1321)

GEL'D, P. V.

4148 Interphase Tension of Iron Alloys at Boundary With Slag. S. I. Popel, O. A. Esin and P. V. Gel'd, Henry Brutcher, Translation 2734, 8 pages. (From Doklady Akademii Nauk SSSR. v. 75, Nov.11, 1950, p. 227-230.)
Previously abstracted from original.

See also:

4008 (electrical properties of oxide film on Al)
4021 (physical properties of sputtered Ag films)
4027 (anodized Al alloys)
4037 (work functions of thin Ag films
4038 (work functions of vacuum-deposited Au films)
4091 (thermodynamics of aging of alloys)
4170 (resistivity vs. stress-strain properties of wires)
4173 (conductivity and density of Mg-Th alloys
4185 (electrical effects of Hg on Se)
4188 (physical properties of Mg alloys)
4198 (electrical properties of Cu wire)
4311 (magnetic properties of stainless steels)
4400 (physical properties of Ge)
4402 (properties of nuclear reactor materials)
4408 (physical properties of special alloys)
4410 (permanent-magnet alloys)
4562 (bonding of MoS_2 lubricants to metals)
4487 (electrical conductivity of molten iron oxide)
4962 (properties of Cu-Ni capacitor)
4971 (Ni and Ni alloys--composition effects on oxide-coating emission)

GEL'D, P. V.

USSR/Chemistry - Oxides, Reduction 1 Jun 51

"Reduction of Metal Oxides With Solid Carbon," P. V. Gel'd, V. G. Vlasov, N. N. Serebrennikov, Ural Polytech Inst imeni S. M. Kirov, Sverdlovsk

"Dok Ak Nauk SSSR" Vol LXXVIII, No 4, pp 693-696

Expts for reducing chromium oxide and manganous oxide with graphite in vacuum installation corroborate existing viewpoint that reducing process consists of 2 stages, and rate of process is detd by 2d, slow stage, i.e., gasification of carbon with carbon dioxide. Disproves assumption that process is direct reaction between oxide and

184T8

USSR/Chemistry - Oxides, Reduction (Contd) 1 Jun 51

carbon without intermediate formation of carbon monoxide. Submitted by Acad S. I. Vol'fkovich, 2 Apr 51.

184T8

GEL'D, P. V.

USSR/Engineering - Refractories, Processes 11 Oct 51

"Sublimates on Heating Silicates in Reducing Atmosphere," P. S. Mamykin, P. V. Gel'd and N. N. Buynov

"Dok Ak Nauk SSSR" Vol LXXX, No 5, pp 801-804

Investigates phenomenon of pneumatological transfer of silica during high-temp firing of silicates. Reviews several cases of silica sublimation and discusses expts of firing crucibles made of carborundum fire clay mixt at 1,500° C. Presents several micrographs obtained with electron microscope. Submitted by Acad D. S. Belyankin 15 Aug 51.

221T43

YAVOYSKIY, V.I., professor, doktor tekhnicheskikh nauk; GEL'D, P.V., doktor tekhnicheskikh nauk, otvetstvennyy redaktor; KOVALENKO, N.I., tekhnicheskiy redaktor

[Gases in steel smelting furnace hearths] Gazy v vannakh stalеplavil'nykh pechei. Sverdlovsk, Gos. nauchno-tekhn.izd-vo lit-ry po chernoi i tsvetnoi metallurgii, 1952. 243 p. [Microfilm] (MLRA 7:10)

(Smelting furnaces)
(Gases in metals)

GEL'D, P. V.

Chemical Abst.
Vol. 48 No. 9
May 10, 1954
General and Physical Chemistry

5

B. Chem.

Reactions of oxides and their compounds with solid carbon. P. V. Gel'd, V. G. Vlasov, and N. N. Serebrennikov. *J. Appl. Chem. U.S.S.R.* 25, 129-41(1952)(Engl. translation).—See *C.A.* 47, 4701h. H. L. H.

GEL'D, P.V.

Structural peculiarities of solid silicon monoxide. P. V. Gel'd and S. I. Porel. *J. Appl. Chem. U.S.S.R.* 25, 65[illegible] (Engl. translation). *Zhur. Prikład. Khim.* 25, 405-73(1952).—Mineralogical investigation of isotropic SiO gave $n = 1.075$ for light-colored particles and $n = 1.075$ to 2.020 for brown particles, increasing with the depth of color. Grinding of specimens was accompanied by darkening. By reflected light, sections have a creamy-watery color and the dull milky appearance characteristic of devitrified glass. Electron-microscope studies show that the fundamental mass of the specimens consists of uniform particles of elongated form. Their dimensions vary in breadth from 70 to 1000 A. and in length from 0.05 to 4.5 μ; the majority of the particles are 150-200 A. wide and 0.5–1.0 μ long. The SiO is single-phase. Films of sublimed SiO showed no structure by this technique. Debye x-ray photographs of SiO obtained from Si + SiO_2 at 1250° *in vacuo* showed lines corresponding with d values and intensities of Si and three extremely weak lines not due to Si or SiO_2. Studies on annealed specimens failed to detect submicroscopic SiO_2 in the SiO. A. J. C.

GEL'D, P. V.

USSR/Chemistry - Silicon Jun 52

"Liquid Silicon Oxide," P. V. Gel'd, S. I. Popel', Yu. P. Nikitin, Chair of Theory of Metallurgical Processes, Ural Polytech Inst imeni Kirov

"Zhur Prik Khim" Vol XXV, No 6, pp 592-601

In cooling of gases from furnaces for smelting of Si alloys, silicon oxides are condensed with the formation of a liquid phase contg up to 85% of SiO. Oxidation of Si and its alloy proceeds gradually with intermediate formation of SiO. The interphase tension at the boundary of Fe-Si alloys with slag fusions was measured. Si substantially lowers the

218T30

USSR/Chemistry - Silicon (Contd) Jun 52

surface energy of the alloy. Substitution of Fe by Cr, i.e., conversion of ferrosilicon to ferrosilicon chromium, is accompanied by a very slight rise of the interphase tension. The very low interphase tension at the boundary of the silicon-silicate melt is explained by the formation of SiO, which lowers the energy differential between the phases in contact and favors of unification their structurally similar elements.

218T30

P.V. G.L'B, M.V. ZAIMSKIKH, N.N. SEREBRENNIKOV, YU. P. NIKI IN June 52

USSR/Chemistry - Alloys

"Surface Tension of Iron-Silicon Alloys," Chair of Theory of Metallurgical Processes, Ural Polytech Inst. im S.M. Kirov

Zhur Prik Khim, Vol 25, No.7, pp.687-695

The Isotherm has abreak in the region of compns corresponding to stable FeSi. The rule of additivity can be applied to the system of ferrosilicon-acid slag. It is assumed that it applies semi-quantitatively to the systems of metal-sulfide, slag-sulfide, and iron-acid slag.

263 T 42

GELD, P. V.

(4)

Surface tensions of iron-silicon alloys. P. V. Geld, N. V. Zahnskikh, N. N. Serebrennikov, and Yu. P. Nikitin. *J. Appl. Chem. U.S.S.R.* 25, 767–74(1952); *Zhur. Prikład. Khim.* 25, 687–93(1952).—The surface tension of Fe-Si melts was measured at 1480 ± 30° by the max.-bubble-pressure method. Porcelain capillaries calibrated against H_2O were used. The isotherm suffers a break in the region of compn. corresponding to the compd. FeSi. For < 50 at. % Si the isotherm is given by $\sigma = 1200 - 138.5 \ln(0.3C_i + 1) - 2.41C_i$; for > 50 at. % Si, $\sigma = 650 - 70.9 \ln(0.4C_i + 1) - 1.49C_i$. σ = surface tension in ergs/cm.^{2}, C_i = concn. of FeSi in moles/l. and C_i = concn. of free Si in g. atoms/l. Antonov's rule of additivity applies to the interfacial tension of systems of ferrosilicon-acidic slag. Considerations are given for the semiquant. application of this rule to metal-sulfide, slag-sulfide, and iron-acid slag systems.

Don T. Cromer

GELD, P. V.

J. of the Inst. of Metals
Feb. 1954
Properties of Metals

Interfacial Tension at the Boundary of Liquid Immiscible Metals. P. V. Geld and S. K. Chuchmarev (*Doklady Akad. Nauk S.S.S.R.*, 1952, 83, (6), 877-880). [In Russian].

Danilov and Pomogailo (*ibid.*, 1949, 68, 843; *M.A.*, 18, 107) and D. and Kamenetskaya (*Problemy metallovedeniya i fiziki metallov*, 1951, 2, 3) estimated the surface energy ($\sigma_{1,2}$) at the interface solid metal/molten metal indirectly from the kinetics of crystn. and showed that for similar systems $\sigma_{1,2}$ is very small (e.g. ~1-2 erg/cm.^{2} for alkali metals), i.e. $\sigma_{s-s} \simeq \sigma_{s-l}$. G. and Ch. have determined $\sigma_{1,2}$ at the interface molten Pb/molten Zn (more precisely their mutually saturated soln.), this system being chosen because of its technological importance, the low m.p. of the components, and their comparatively small mutual solubility at low temp. The sessile-drop method was used, but because of the comparatively small difference in d of the two metals, attempts to photograph the drop under molten Zn by use of X-rays were unsuccessful, so measurements were made on the solid system, by the method used by Leont'eva (*ibid.*, 1945, 50, 323; *Zhur. Fiz. Khim.*, 1945, 19, 388; *Kolloid. Zhur.*, 1949, 11, 176) for metal/silicate systems. The abs. accuracy was ~10%. Zn (previously saturated with Pb) was melted in a crucible with a flat bottom having a central depression. A small piece of Pb was rapidly introduced, so that it melted, and collected at the centre of the crucible bottom. On slow cooling, first the Zn and then the Pb solidified. The specimen was sectioned through the axis of the drop and photographed; the profile of the Pb drop was magnified 9-10 times and its parameters determined. Frequently, the Pb was melted out at ~350° C. and the hole photographed. The data obtained related to the m.p. of the Zn eutectic (~418° C.). $\sigma_{1,2}$ was calculated by the formula: $\sigma_{1,2} = 0{\cdot}5(\rho_{Pb} - \rho_{Zn})gh^2$ erg/cm.^{2}, where h is the height of the drop, and ρ_{Pb}, ρ_{Zn} the d of Pb and Zn. The contact angle (θ) was also determined by photography. Values of 0° obtained using a magnesite crucible and drops of Pb, Pb + 0·15% Na, Pb + 0·30% Na, and Pb + 0·7% Na, resp., with the following upper layers were: Zn, saturated with Pb, 40°, 55°, 75°, 180°; Zn, 65°, 65°, —, 180°; Zn + 0·05% Na, 70°, 130°, 165°, 180°; Zn, saturated with Pb, +0·05% Na, 130°

135°, , 180°; Zn saturated with Pb, + 0·1% Na, 150°, 135°, 180°, 180°; Zn saturated with Pb, + 0·2% Na, 150°, 180°, 180°, 180°. Values of σ (ergs/cm.^{2}) with this crucible were: Pb/Zn saturated with Pb, 128; Pb 0·15% Na/Zn saturated with Pb, 95; Pb-0·30% Na/Zn saturated with Pb, 82; Pb/Zn, 109; Pb-0·15% Na/Zn, 53; Pb/Zn-0·05% Na, 67. Corresponding values for θ and σ obtained with a graphite crucible are also given; and in general are similar. Thus values for Pb/Zn saturated with Pb are the same as in magnesite, but for Pb/Zn on graphite σ = 112 (cf. 100) and θ = 45° (cf. 65°). The reason for the reduction in $\sigma_{Zn/Pb}$ is not clear, but the difference is within the limit of accuracy. Comparison of the results with the data for the pure metals (σ_{Zn} = 743; σ_{Pb} = 452) shows that the additive law is not obeyed, i.e., $\sigma_{Zn} - \sigma_{Pb} > \sigma_{Zn,Pb}$. Evidently the observed data do not refer to the pure metals, and the solubility of Pb in Zn sharply reduces its surface tension; the generalized moment of Pb, m_{Pb} (cf. Semenchenko, *Zhur. Fiz. Khim.*, 1932, 3, 285), $< m_{Zn}$. This is evident from the latent heats of vaporization of the pure metals ($L_{Zn} > L_{Pb}$), their surface tensions ($\sigma_{Zn} > \sigma_{Pb}$), &c. Since values of m for the alkali metals (judging by L and σ) $< m_{Zn}$ and m_{Pb}, they should be capillary-active at the Zn/Pb boundary, as they are with Hg (cf. D. and K., *loc. cit.*; Pugachevich, *ibid.*, 1951, 25, 1363) and Sn (Pokrovsky and Galanina, *ibid.*, 1948, 23, 324). Also the alkali metals form intermetallic compounds of low m with Pb, but are immiscible with Zn. They and their compounds with Pb should therefore accumulate at the interface. The sharp fall in σ and increase in θ on adding 0·05% Na to the Pb or Zn confirms this. The method used permitted dotn. of $\sigma_{L,g}$ only for $\theta < 90°$, i.e. only for small addn. of Na. Addn. of K were rather less effective than those of Na (possible owing to smaller solubility in the metals), but were also surface-active. In a system contg. Na, enrichment of the Zn with Pb leads to a reduction in θ and probably also in $\sigma_{Zn,Pb}$: thus, in melting Pb 0·2% Na under Zn by stages, in 4 successive meltings θ was 142° (pure Zn), 120°, 90°, and 72°.—G. V. E. T.

GEL'D, P. V.

USSR/Metallurgy - Ferrochromium May 52

"Solubility of Nitrogen in Iron-Chromium Alloys," K. T. Kurochkin, P. V. Gel'd, V. I. Yavoyskiy, Ural Polytech Inst imeni S. M. Kirov, Sverdlovsk

"Dok Ak Nauk SSSR" Vol 84, No 2, pp 329-332

Investigates soly of N in liquid Fe-Cr alloys, contg 3.56 to 66% Cr, at N pressure of 735 and 512. Tabulates and compares results with those obtained by American investigators R. M. Brick and L. A. Creevy, showing similarity in general dependence of N soly on Cr concn. Certain discrepancy in abs values of data is explained by higher N content in solidified metal in which condition Brick and Creevy conducted their investigation. Submitted by Acad S. I. Vol'fkovich 17 Mar 52.

231T59

231T59

USSR/Chemistry - Silicon Dec 52

"Heat Content and the Specific Heat of Silicon at High Temperatures," N. N. Serebrennikov and P. V. Gel'd, Ural Polytech Inst imeni S. M. Kirov

"DAN SSSR" Vol 87, No 6, pp 1021-1024

The heat content and the heat capacity of silicon were measured at high temperatures in a specially constructed adiabatic calorimeter. The results are given in a table. Presented by Acad S. I. Vol'fkovich 18 Oct 52.

240T11

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

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

GEL'D, P.V.

The mutual solubility of calcium oxide and calcium carbonate. P. V. Gel'd, A. I. Pashilov, and S. K. Chuchmarev (S. M. Kirov Ural Polytech. Inst.). *Doklady Akad. Nauk S.S.S.R.* 91, 1115–17(1953).—The mutual soly. of $CaCO_3$ and CaO was studied at ~17° by the x-ray structural method (i.e., the precise detn. of lattice parameters of the pure components and of the products from the partial decompn. of the carbonate). The wt. % of CaO was varied from 0 to 100. The exptl. results show that $CaCO_3$ is only negligibly sol. in CaO. A soln. of 1% CaO in $CaCO_3$ changes the parameters of the latter. J. Rovtar Leach

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(2)

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. (MLRA 8:1)
(Metals--Heat treatment)

Gel'd PV

USSR/Chemical Technology. Chemical Products and Their Application. J-6
Mineral Salts. Oxides, Acids, Bases.

Abs Jour: Referat Zh.-Kh., No 8, 1957, 27433

Author : F.S. Maron, P.V. Gel'd
Inst : Uralsk Scientific Research Institute of Chemistry
Title : Influence of Alumina on Process of Calcium Carbide Formation

Orig Pub: Tr. Ural'skogo n.-i. khim. in-ta, 1954, vyp. 2, 156-165.

Abstract: The study was carried out in an airtight furnace by continual weighing of the charge. The initial substances were as follows: lime of the composition of (in %) CaO - 98, R_2O_3 - 0.7, SiO_2 - 0.2; graphite containing 0.2% of ashes and Al_2O_3 of the Kh.Ch. (chemically pure) brand. It was found that the introduction of up to 5% of Al_2O_3 into the charge lowered the temperature of the reaction of CaC_2 formation and intensified the reaction. The dependence of the percent content of CaC_2 in the product on the temperature of the system containing 3 and 5% of Al_2O_3 is des-

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USSR/Chemical Technology. Chemical Products and Their Application. J-6
Mineral Salts. Oxides, Acids, Bases.

Abs Jour: Referat Zh.-Kh., No 8, 1957, 27433

cribed by a curve with a maximum. A considerable part of Al_2O_3 together with CaO is reduced to metallic state and sublimated. The intensity of this process rises with the rise in temperature. Bibliography with 13 titles.

Card : 2/2

GEL'D, P.V.

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: .....

GEOL P.V.

Specific heat of ferroalloys at high temperatures. N. N. Serebrennikov and P. V. Gel'd. *Trudy Ural. Filiala Akad. Nauk SSSR, Inst. Met.* 1955, No. 1, 125–44. —The sp. heat of Si at a temp. range of 0–1250° and of a series of ferroalloys from room temp. to ~1400° was measured by a calorimetric method. Sp. heat of the alloys differed from the additive rule. Margaret Ketner

Characteristics of iron oxide dissociation. M. I. Kochnev, P. V. Gel'd, O. A. Esin, and N. N. Serebrennikov. *Trudy Ural. Politekh. Inst.* 1954, No. 49, 163–7; *Referat. Zhur., Khim.* 1954, No. 48828.—Partial pressure of O (P_O) of Fe_3O_4 was detd. at 800–1350°. In the region of small pressures (up to 1100°) the method of mol. efflux was used, in which samples of chemically pure Fe_3O_4 were placed in quartz ampuls and were degassed for 3–4 hrs. *in vacuo* at 600–800°. For temps. above 1150° P_O was detd. monometrically, porcelain app. being used. In the interval 1100–1430° $\log P_O = (-32{,}406/T) + 6.80$ and for temps. of 920–1100° $\log P_O = (-14{,}882/T) + 8.89$. The thermal effects of the reaction for the above are 148,200 and 68,084 cal./mole. At temps. 830 and 890–900° deviations from the above relations were observed; at these temps. P_O exceeds the calcd. values 100–300 times. The points of anomalous behavior correspond to transformation of Fe_2O_3. At 820° the red modification of Fe_2O_3 changes to black and at 817° α-Fe_2O_3 changes to γ-Fe_2O_3.

M. Hoch

USSR/ Chemistry - Physical chemistry

Card 1/1 : Pub. 22 - 32/46

Authors : Serebrennikov, N. N., and Cel'd, P. V.

Title : The specific heat of the zeta-phase of the Fe-Si system

Periodical : Dok. . AN SSSR 97/4, 695-698, Aug 1, 1954

Abstract : Data are presented on the thermal dependence of the mean specific heat of an alloy containing about 53.4% Si. The polymorphism of the zeta-phase of the investigated system was determined by the results of the specific heat measurements carried out at a temperature range of from 0 - 1200°. It was established that the polymorphism is connected with the presence of two (not one) polymorphous conversions, the first one of which takes place in reverse direction at a slow rate. Two USSR references (1914-1952). Table; graphs.

Institution : The S. M. Kirov Ural Polytechnicum

Presented by : Academician S. I. Vol'fkovich, March 22, 1954

GEL'D, P. V.

USSR/Chemistry - Dilatometric analysis

Card 1/1 : Pub. 22 - 19/48

Authors : Gel'd, P. V. and Serebrennikov, N. N.

Title : Dilatometric investigation of the zeta-phase of a Fe - Si system

Periodical : Dok. AN SSSR 97/5, 827-830, August 11, 1954

Abstract : Dilatometric investigation of alloys containing 53.38% Si, i. e., consisting only of the zeta-phase, is described. The polymorphism and the transformability of the zeta-phase of a Fe - Si system, was confirmed by the dilatomograms. It was established that the friability of alloys rich in Si is connected with the presence in these alloys of a solid P and Al solution, which easily reacts with moisture. Four references: 3-USSR and 1-USA (1912-1954). Diagrams.

Institution : The S. M. Kirov Ural Polytechnicum, Sverdlovsk

Presented by : Academician S. I. Vol'fkovich, March 31, 1954

KOZHEUROV, Vladimir Aleksandrovich; GEL'D, P.V., doktor tekhnicheskikh nauk, professor, redaktor; KEL'NIK, V.P., redaktor; KOVALENKO, N.I., tekhnicheskiy redaktor.

[Thermodynamics of metallurgical slag; statistical thermodynamics of ion solutions and their application of metallurgical slag] Termodinamika metallurgicheskikh shlakov; statisticheskaia terminodinamika ionnykh rastvorov i primenenie ee k metallurgicheskim shlakam. Sverdlovsk, Gos.nauchno-tekhn.izd-vo lit-ry po chernoi i tsvetnoi metallurgii, Sverdlovskoe otd-nie, 1955. 162 p.
(Slag) (MLRA 8:12)

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

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.

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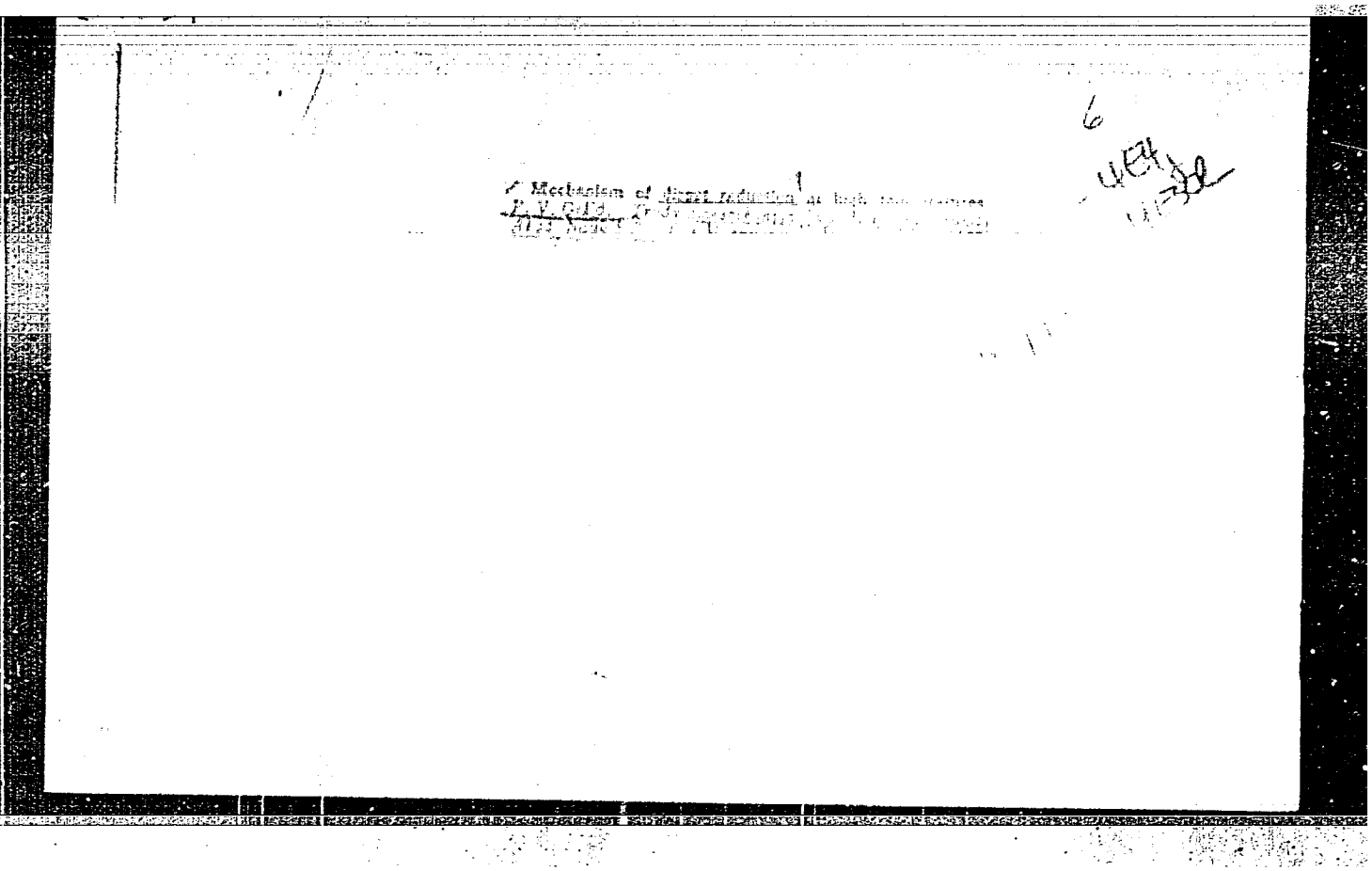

15-57-2-1781

Translation from: Referativnyy zhurnal, Geologiya, 1957, Nr 2, pp 91-92 (USSR)

AUTHOR: Gel'd, P. V.

TITLE: The Microscopic Inhomogeneity of Glass (Mikroneodnorodnost' stekol)

PERIODICAL: V sb: Stroyeniye stekla, Moscow-Leningrad, AN SSSR, 1955, pp 304-306

ABSTRACT: The microscopic inhomogeneity of glass is confirmed by experimental data. At lower temperatures this inhomogeneity should increase. The presence of an ordered arrangement of particles in the melt must necessarily be considered when investigating interparticle reactions, the thermodynamics of silicate glass and melts, and chemical properties. As examples of microscopic inhomogeneities in silicate melts, microlaminations were examined in the definite situations where

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The Microscopic Inhomogeneity of Glass (Cont.)

they grade into macrolaminations in the systems MeO-SiO_2. The relationship of lamination to the nature of the cations assumes a preparation toward making the system heterogeneous in view of developing microscopic inhomogeneity. Attempts to extend the theory of complete ionic solutions of M. I. Temkin to silicate systems gave unsatisfactory results because of the marked differences in the generalized moments of the individual ions in these systems, differences associated with the microscopic inhomogeneity of the melt. The microscopic inhomogeneity in liquids of silicate systems, in the author's opinion, embraces the entire bulk of the melt. Because of this it is impossible to speak of parts of the total volume giving rise to unordered regions.

Card 2/2 A. A. L.

GELD, P. V. and RYABOV, R. A.

"Speed of Diffusion of Hydrogen in Steel at High Temperatures' lecture given at the International Metallurgists' Conference, Moscow 26-30 June 56

Source CS-3,302,240, 11 Jan 57.

GEL'D, P. V.

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

Abs Jour : Ref Zhur - Fizika, No 2, 1957 No 3841

Author : Davydov, K.N., Gel'd, P.V.
Inst : Ural Polytechnic Institute, USSR
Title : On the Transformations of the Silicide Mn_3Si.

Orig Pub : Fiz. metallov i metallovedeniye, 1956, 2, No 1, 192

Abstract : A study was made of the thermal properties of alloys of silicon with manganese. It was noted that at a temperature of approximately 600° there is a sharp change in the character of the expansion curves of the alloys, a jump is seen in the temperature dependence of the heat content, and a rapid decrease in the electric conductivity of the specimens is observed. This leads to the conclusion that phase transformations may occur in the silicide Mn_3Si at a temperature of approximately 600°.

Card : 1/1

13069* (Russian.) Thermal Expansion of Silicon and Its Iron Alloys. **Termicheskoe rasshirenie kremniia i ego splavov s zhelezom.** P. V. Gel'd, N. N. Serebrennikov, and P. M. Sokharev. *Fizika Metallov i Metallovedenie*, v. 2, no. 2, 1956, p. 244-253.

A study of heat expansion curves of Fe-Si alloys within the 100-1000 C temperature range. Offers empirical formulas for the temperature dependence of linear expansion coefficients of Si and of some of its Fe alloys.

Ural Polytechnical Institute im. S. M. Kirova.

GELD, P. V., Prof. (Dr. Tech)

"Current Methods of High-Temperature Determination" paper read at the International Metallurgists' Conference, Moscow, 26-30 June 56

SO: CS-3,302,240, 11 Jan 57

Gel'd, P.V.

USSR/Statistical Physics - Heat D-4

Abs Jour : Referat Zhur - Fizika, No 5, 1957, 11454

Author : Kuprowskiy, B.B., Gel'd, P.V.

Inst : Ural' Polytechnic Institute

Title : Isotherms of Heat Conduction of Silicon and Its Alloys with Iron at High Temperatures.

Orig Pub : Fiz. metallov i metallovedeniye, 1956, 3, No 1, 132-183

Abstract : An investigation was made of alloys, containing one to 98.8% by weight of silicon in the temperature range t = 100 -- 950°. The method of radial flow in a thick-walled cylinder was used. The errors did not exceed 7%. For commercial silicon (98.8% Si) the authors obtain an empirical equation for the temperature dependence of the heat conduction coefficient: $\lambda = 0.222 - 0.368 \times 10^{-3} t + 0.219 \times 10^{-6} t_2 - 0.0018 \times 10^{5} t^{-2}$. Extrapolation to 10^{0}

Card 1/2

STRUKOV, I.N.; GEL'D, P.V.

Effect of "leboit" transformations on the stability of ferrosilicon. Fiz.met. i metalloved. 3 no.3:564-565 '56. (MLRA 10:3)

1. Ural'skiy politekhnicheskiy institut imeni S.M. Kirova.
(Iron-silicon alloys)

AID P - 4427

Subject : USSR/Heat Engineering

Card 1/1 Pub. 110-a - 7/13

Authors : Gel'd, P. V., Dr. Tech. Sci., B. B. Kuprovskiy and N. N. Serebrennikov, Kands. Tech. Sci. Ural Polytechnical Institute.

Title : Rate of temperature raise in steel at high temperatures.

Periodical : Teploenergetika, 6, 45-51, Je 1956

Abstract : Research on thermal capacity, conductivity and coefficient of expansion of steel containing from 1 to 4.4% Si at up to 1000°C is reported, with the aid of mathematical analyses. Results reportedly proved that thermal conductivity and temperature rate diminish with the increase of Si content in the steel. Five tables, 4 diagrams. Sixteen Russian references, 1935-1955; 2 English 1941, 1946; 5 German 1900-1935.

Institution : Ural'skiy politekhnicheskikh institut.

Submitted : No date

GELO, P. V.

Heat conductivity of cast irons. B. B. Kuprovskii and P. V. Gel'd. *Liteinoe Proizvodstvo* 1956, No. 9, 16–18.—Synthetic irons contg. C 2.5–4.1, Si 2.18–2.55, Mn 0.55–0.81 were halved in melting, one half cast as such, another modified with Mg. Samples were then graphitized at a high temp. to ferrite-graphite structure, and their heat cond. was measured by the radial-stream method. The heat cond. coeff. at 100° increased from 0.113 to 0.184 with increase of lamellar graphite; it dropped with the temp. from 0.112 to 0.0315 in the 112–905° range. Lamellar graphite had a higher heat cond. than did ferrite. Fe contg. nodulized graphite at 100° had a heat cond. of 0.090–0.087 independent of its C content. A similar study of 7 types of com. irons yielded comparable results. I. D. Gat

GELD, I.V.,

"Temperature and Pressure Influence on Direct oxide Reduction Kinetics,"

"Some Properties of FeSi-Si System," with I.N. Strukov.

lecture given at the Fourth Conference on Steelmaking, A.A. Baikov Institute of Metallurgy, Moscow, July 1 - 6, 1957

PHASE I BOOK EXPLOITATION 306

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

Card 1/15

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,

Shchedrovitskiy, Tsintel', Vartenberg, Khitrik, and others on the mechanism and kinetics of the reduction of silica; that Kerber, Samarin, and Chipman have clarified the thermodynamic characteristics of iron-silicon melts; and that the extensive investigations of Postnikov, Mikulinskiy, Frank, and Markovskiy have shed much light on the reduction of the oxide (CaO) and phosphates of calcium. For references, see Table of Contents.

TABLE OF CONTENTS:

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137-58-4-6549

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 4, p 33 (USSR)

AUTHORS: Davydov, K.N., Gel'd, P.V., Serebrennikov, N.N.

TITLE: The Specific Heat and Thermal Expansion of Alloys of Silicon and Iron, Chromium, and Manganese (Teployemkost' i termicheskoye rasshireniye splavov kremniya s zhelezom khromom i margantsem)

PERIODICAL: V sb.: Fiz-khim. osnovy proiz-va stali. Moscow, AN SSSR, 1957, pp 350-369. Diskus. pp 408-409

ABSTRACT: The temperature dependence of specific heat c was determined indirectly by measuring the heat content at various temperatures. The heating furnace had two windings and made it possible to raise the temperature to 1350°C. The calorimeter, of the mixture type, consisted of a massive copper block housed in a water bath. The error of measurement usually did not exceed 0.6%. Data on the heat capacity of 99.2% crystalline Si in the 0-1283° interval yielded an equation for the relationship of the mol. c of Si temperature.

$$C_p = 6.75 - 1.7 \times 10^{-3} T + 1.3 \times 10^{-6} T^2 - 1.37 \times 10^{5} T^{-2}.$$

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The Specific Heat and Thermal (cont.)

For engineering calculations, the following formula is handier: $C_p=5.65+0.8\times10^{-3}T-10^5T^{-2}$. The c of lebowite (53.38% Si + Fe) revealed jumps in c at 300, 650, and 910°, the first two being related to the presence of the lebowite phase, and the 910° jump corresponding to phase transformation. The c of lebowite is: $C_{p_1}=0.1635+21.18\times10^{-6}T-2588T^2$ at 910° and $C_{p_2}=0.1410+52.5\times10^{-6}$ for 910-1200°. The c of monosilicide (34.48% Si+Fe) is described adequately by the equation: $C_p=0.131+46.14\times10^{-6}T-250.7\times T^2$ for 0-1200°. The c of the η-phase (Fe_3Si_2) shows a point of inflection at about 500°, corresponding to magnetic transformation, and a sharp rise in the curve at 1020° related to the appearance of peritectic decomposition of the η phase. In the 0-500° interval, $H_T-H_{273.1}=23.7+0.091T+54.0\times10^{-6}T^2-1411T^{-1}$, and at higher temperatures $H_T-H_{273.1}=35.75+0.021T+70.68\times10^{-6}T^2-12770T^{-1}$. Analogous equations are also presented for alloys containing 1.04, 1.73, 4.07, 22.56, 28.84, 35.15, 36.42, 44.46, 67.21, 78.49, 86.73, 91.91% Si. The authors have come to the conclusion that Kopp's law for the Si-Fe system is satisfactorily applicable to alloys high in Si, and practically inapplicable to alloys low in Si. A check has shown that the c of electro-

The Specific Heat and Thermal (cont.)

lytic Cr is well described by the equation suggested by Kelly: $C_p = 5.84 + 2.362 \times 10^{-3} T - 0.875 \times 10^{5} T^{-2}$, while for technical Cr better results are given by the equation $C_p = 0.178 - 0.12 \times 10^{-3} T + 0.091 \times 10^{-6} T^2 - 0.037 \times 10^{5} T^{-2}$. Equations for the temperature dependence of c were derived for the following alloys: Cr_3Si (15.18% Si), Cr_3Si_2 (28.1% Si), CrSi (36.55% Si), $SrSi_2$ (51.05% Si), and alloys of Cr containing 46, 36, 49.66, 62.0, 68.25, and 76.10% Si. Investigation of the c of the Mn-Si alloy system showed that Mn_3Si(14.55% Si) is polymorphic. Phase transformation occurs at appx. 620° and is accompanied by a Joule effect of the order of 8.0 cal/g. The coefficient of linear expansion α was measured in the 20-350° interval by means of the Chevenard photographically-recording differential dilatometer. For technically pure Si, the experimental data may be described by the equation $10^6 \alpha = 3.1395 + 1.914 \times 10^{-3} t - 0.0945 \times 10^{-6} t^2$. Analogous equations are adduced for a number of alloys of the Fe-Si and Cr-Si systems. The isotherms of the coefficient of linear elongation exhibit maxima in the regions of the η and ε phases of the Fe-Si system and in the 50% Si interval of the Cr-Si system.

Bibliography: 10 references.

L. B.

Card 3/3

1. Silicon alloys--Thermal expansion 2. Iron alloys--Thermal expansion
3. Silicon alloys--Specific heat 4. Iron alloys--Specific heat

8 GEL'D, P.V

137-58-2-3888

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 2, p 230 (USSR)

AUTHORS: Kuprovskiy, B.B., Gel'd, P.V.

TITLE: Thermal Conductivity of Silicon-iron Alloys at High Temperatures (Teploprovodnost' splavov kremniya s zhelezom pri vysokikh temperaturakh)

PERIODICAL: V sb.: Fiz-khim.osnovy proiz-va stali. Moscow, AN SSSR, 1957, pp 370-386. Diskus., pp 408-409

ABSTRACT: The thermal conductivity λ was measured by a fixed absolute method employing a radial current in a thick-walled specimen. The specimens were disk shaped and had a central aperture for an internal heater, and 4 apertures along a diameter for the measurement of the temperature. The apparatus consisted of a cylindrical furnace, within which the specimens to be investigated were inserted. The furnace was insulated at its ends by a series of ceramic disks and supplementary end heaters. An internal heater that created a heat flow was inserted through the central hole in the specimens. λ was calculated by means of the equation $\lambda \approx 0.00835\, IU/(t_1-t_2)$, where I and U are the current and the voltage in the internal

Card 1/2

Thermal Conductivity of Silicon-iron (cont.)

heater, and t_1 and t_2 are the temperatures at different distances from the center of the specimen (disk). The maximum error by this method is about 7%. An experimental formula for the dependence of λ upon temperature for technical Si (98.8%) and for various phases of the Fe-Si system in the 100-950°C interval is presented. Extrapolation of the experimental data to 10° yields a value $\lambda_{Si} = 0.220$ cal/cm.sec.° which is in general in good agreement with the literature data, if it be considered that the values of λ for technical and pure Si differ by a factor of 1.3. The λ isotherms of the Fe-Si system drop rapidly when up to 4% Si is added to the Fe. It is assumed that this is due to a change in the nature of the bond between the Fe and Si atoms as they pass the 4% Si content level. On the Si side, the λ isotherms also drop on addition of Fe, but the decline is not as sharp. In the middle range of concentrations, λ is low and aries comparatively little with composition. This is due to a diminution in the concentration of the valence electrons, in connection with which fact λ is determined primarily by the phononic constituent. Investigation of the λ of iron containing flake and spheroidal graphite (G) showed that in the case of flake G the λ of iron increased as the G content increased. Iron with spheroidal G has a lower λ and is virtually independent of the G content. This is explained by the fact that in the case of spheroidal G the latter is localized and, therefore, does not have a significant effect upon the λ of iron. Bibliography: 12 references.

Card 2/2 L.B.

1. Iron-silicon alloys--Heat conductivity--Measurement 2. Iron-silicon alloys --Heat conductivity--Test results

137-58-2-3810

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 2, p 217 (USSR)

AUTHORS: Lipatova, V.A., Gel'd, P.V., Davydov, K.N.

TITLE: Thermoelectric Properties of Alloys of Silicon with Iron, Chromium, and Manganese (Termoelektricheskiye svoystva splavov kremniya s zhelezom, khromom i margantsem)

PERIODICAL: V sb.: Fiz.-khim. osnovy proiz-va stali. Moscow, AN SSSR, 1957, pp 387-398. Diskus., pp 408-409

ABSTRACT: The thermo-emf, E, of Fe-Si-, Cr-Si-, and Mn-Si alloys is investigated in accordance with the constitutions thereof. Measurements were made on a Korzh instrument (Zavodsk. lab. 1948, Vol 14, p 107). E is negative and small (not over 1.58mv at 100°C) for Fe alloys containing 4-6% Si. As the Si contents increase the E diminishes, reaching 0 at 17% Si. At 17-59% Si, E is positive, negligible in value, and little dependent upon the constitution of the alloy. A change in the Si content from 57 to 59% causes E to change from 0.67 mv at 100° to 0. As the Si contents are further increased, E becomes negative, and its value increases. In the case of cast (99.2%) Si, E is 51-60 mv at 100°. In Si-Cr alloys the

Card 1/2

137-58-2-3810

Thermoelectric Properties of Alloys (cont.)

E of pure Cr is +0.6 mv at 100°. As the Si content is increased, the E diminishes, changes sign, and is minus (0.9-1.0) mv at 100° for 10% Si. Subsequently E diminishes rapidly and acquires negative values. The E curve for Mn-Si alloys reveals points of inflection corresponding to stoichiometric constitutions and regions in which the chemical compounds are stable. The correlation between the E curves and the fusibility curves of the systems was found. It is assumed that alloys with negative E have a larger number (per unit volume) of small crystals with small n-type conductivity. The E of various modifications of lebowite in the sigma phase of Fe-Si were investigated. The low-temperature modification thereof has a positive E of 0.3-0.6 mv at 100°, which is little dependent upon the Si content. The equilibrium $\mathcal{E}_{\beta}$ is readily hardened at 650-908° and is characterized by high E values, strongly dependent in magnitude and sign upon the Si contents, at room temperature. The E of $\mathcal{E}_{\alpha}$ (920°) depends upon the concentration of the alloy in magnitude and sign.

A. M.

1. Silicon alloys--Thermoelectric properties 2. Manganese-silicon alloys --Thermoelectric properties 3. Chromium-silicon alloys--Thermoelectric properties 4. Iron-silicon alloys--Thermoelectric properties

Card 2/2

Gel'd, P.V.

132

AUTHOR: Ryabov, R.A. and Gel'd, P.V.

TITLE: Influence of the decomposition of austenite on the speed of diffusion of hydrogen in steel. (Vliyanie raspada austenita na skorost' diffuzii vodoroda v stali.)

PERIODICAL: "Fizika Metallov i Metallovedenie" (Physics of Metals and Metallurgy), 1957, Vol.IV, No.1 (10), pp.189-190 (U.S.S.R.)

ABSTRACT: The results described in this paper confirm the hypothesis that in graphs characterising the temperature dependence of the diffusion speed of hydrogen in various steels anomalous sections will exist, due to the fact that diffusion is a structurally-sensitive process, which will be located at temperature ranges at which the speed of decomposition of the austenite reaches high values. The results indicate that the process of elimination of hydrogen from Cr-Ni steels depends to a large extent on the cooling conditions of the metal and particularly on the isothermal holding in the range of the first and second stages of austenite transformation. This fact is of interest in conjunction with the problem of hydrogen brittleness of steel. One graph.

Ural Polytechnical Institute
imeni S.M. Kirov.

Recd. June 29, 1956.

Gel'd, P.V.

AUTHOR: Strukov, I.N. and Gel'd, P.V. 133

TITLE: On the eutectoidal decomposition of leboite. (Ob evtekoidnom raspade leboita).

PERIODICAL: "Fizika Metallov i Metallovedenie" (Physics of Metals and Metallurgy) 1957, Vol.IV, No.1 (10), pp. 190-191 (U.S.S.R.)

ABSTRACT: The heating curves of specimens which were subject to a preliminary stabilisation anneal at 850 °C indicate that the temperature range of stability of leboite depends on the silicon content of the alloys, and that leboite is stable in alloys containing below 50% Si only above 950 °C and in alloys containing over 50% Si above 915 - 925 °C. Additions of Al, P and Ca slow down the speed of decomposition of leboite. 2 Russian references.

Ural Polytechnical Institute imeni S.M. Kirov.

Recd. Sept. 28, 1956.

Gel'd, P.V.

126-1-38/40

AUTHORS: Strukov, I. N., Shumilov, M.A. and Gel'd, P. V.

TITLE: Influence of the heat treatment on the topography of calcium in ferrosilicon. (Vliyaniye termicheskoy obrabotki na topografiyu kal'tsiya v ferrosilitsii).

PERIODICAL: Fizika Metallov i Metallovedeniye, 1957, Vol.5, No.1, pp. 188-189 (USSR).

ABSTRACT: In earlier work (Refs.1 and 2), the authors showed that the stability of a high percentage commercial ferrosilicon during storing in humid air is dependent to a considerable extent on its thermal history. Particularly, it was found that annealing of ferrosilicon at temperatures which ensure decomposition of leboite leads to a sharp increase of the stability of the alloy. It was, however, not possible in the earlier work to solve unequivocally the problem of the causes of this effect during heat treatment, which could be explained on the one hand by the elimination from the alloy of a metastable phase, the decomposition of which is accompanied by an appreciable increase in volume and thus by occurrence of high internal stresses and on the other hand the possibility could not be excluded of redistribution of the admixtures which are responsible

Card 1/4

Influence of the heat treatment on the topography of calcium in ferrosilicon.

for the reduced stability of ferrosilicon (e.g. calcium-aluminium). For verifying the influence of heat treatment on the conditions of localisation of calcium, autoradiography investigations were carried out of hardened and annealed alloys. Ca^{45} was used as a radio-active isotope which has a β-radiation with a maximum energy of 0.255 MeV. Preliminarily, alloys were produced from mixtures of powders of commercial silicon and the Ca^{45} by heating inside an hermetically sealed ampule of armco iron in vacuum equipment at 900°C for two hours. The thus obtained material (fundamentally calcium silicide) was introduced with the iron ampule into the molten ferrosilicon containing 60 to 65% Si. After careful mixing of the metal in the crucible inside an induction furnace, specimens were prepared for investigation. On the polished surface photographic films НИКФИ, type MK, were placed; the exposure time was about ten days, the specific activity of the alloy was 0.8 to 1 m Curie/kg. Microscopic investigation of the autoradiographic pictures has shown that in the hardened specimens the calcium is distributed highly

Influence of the heat treatment on the topography of calcium in ferrosilicon.

non-uniformly, concentrating mainly along the crystallite boundaries. However, for annealed specimens the difference in the calcium concentration at the surface and in the volume of the crystallites is considerably lower, see Fig.1, showing the distribution of calcium in a ferrosilicon specimen containing 60% Si after hardening and after annealing respectively. Thereby, homogenisation of the calcium distribution increases with increasing annealing duration and, consequently, also with the completeness of leboite decomposition. Subsequent hardening of the annealed specimen from 1000°C leads again to a preferential separation of calcium in the intercrystallite range, which can be eliminated by repeating the stabilisation annealing. Thus, the obtained data indicate that the solubility of calcium in leboite and in its decomposition products differs appreciably. This permits controlling the topography of calcium in a high percentage ferrosilicon by means of heat treatment. Annealing, which brings about a homogenisation of the calcium distribution, prevents local accumulations which could serve as loci of active interaction with the air

Influence of the heat treatment on the topography of calcium in ferrosilicon.

moisture, i.e. as nuclei of disruption of the alloy. It is pointed out that annealing makes the alloy more stable also as a result of considerable breaking up of the grains. Consequently, heat treatment increases the stability of ferrosilicon during storage, apparently not only as a result of the considerations discussed in the earlier work (Refs.1 and 2) (internal stresses during ageing of the alloy) but also due to changes in the topography of calcium. It is, therefore, advisable to verify the effect of annealing on the distribution of other admixtures which play a role in the stability of the alloy.
(Note: This is a complete translation).
There are 1 figure and 2 references, both of which are Slavic.

SUBMITTED: January 23, 1957.

ASSOCIATION: Ural Polytechnical Institute imeni S. M. Kirov. (Ural'skiy Politekhnicheskiy Institut imeni S.M.Kirova).

AVAILABLE: Library of Congress.

Card 4/4

AUTHORS: Gel'd, P. V. and Ryabov, R. A. 126-1-40/40

TITLE: Speed of diffusion of hydrogen in iron-chromium alloys. (Skorost' diffuzii vodoroda v splavakh zhelezo-khrom).

PERIODICAL: Fizika Metallov i Metallovedeniye, 1957, Vol.5, No.1, pp. 191-192 (USSR).

ABSTRACT: The kinetic and the energy characteristics of diffusion should depend to a great extent on the forces of partial interaction in the crystal lattice of the alloy. For verifying these assumptions in the case of diffusion of gases in metals, the authors of this paper studied the temperature dependence of the speed of diffusion of hydrogen in alloys of iron with chromium, Si, V and C in the temperature range 300 to 1000°C. The measurements were effected on specimens in the shape of a hollow cylinder whereby the wall thickness was smallest for the part located in the isothermal zone of the furnace. The quantity of hydrogen diffusing across the thin wall and falling into the vacuum system was determined from the increase in pressure inside a calibrated volume. Seven alloys were investigated containing 1, 3, 6, 12, 17, 19 and 28% Cr. The results are graphed in Fig.1 showing the influence of Cr, V, Si and C on the temperature dependence

Speed of diffusion of hydrogen in iron-chromium alloys. 126-1-40/40

of the diffusion speed of hydrogen in the alloys of these elements with iron; this graph also contains results for "Steel 40" (0,4% C). In the temperature range between 300 and 700°C the diffusion speed obeys an exponential law. Near 700°C the curve of the temperature dependence of the diffusion speed has a bend corresponding to phase transformation. In accordance with the diagram of state of the system Fe-Cr such anomalies are observed only on the curves corresponding to the first three of the studied alloys, containing 1, 3 and 6% Cr respectively. The influence of Cr on the diffusion speed of hydrogen has certain particular features. Up to 12% Cr a sharp decrease in the diffusion speed is observed and an increase of the activation energy of the process, whilst for pure iron the activation energy according to numerous authors amounts to 1800 cal/mol. For an alloy containing 12% Cr it reaches the value of 30 000 cal/mol. A further increase of the Cr content in the alloys (up to 28%) has practically no effect on the speed of diffusion. Thereby, the activation energy also ceases to increase. These results are of interest in the light of investigations carried out by G. V. Kurdyumov and his

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team (Refs.1 and 2). The results obtained by them were also interpreted in terms of interatomic bond forces. They found that the bond forces in Fe-Cr alloys increase with increasing Cr concentration up to 8% Cr. A further increase in the Cr content up to 16% did not bring about an increase in the bond forces. Such analogy of the results definitely indicates that the bond forces between the atoms and the crystal lattice play an important role in the processes of diffusion. This is additionally confirmed by the results of investigation of the diffusion speed of hydrogen in an Fe-V alloy containing 4% V; the activation energy of the diffusion process proved equal (within the limits of experimental error) to the activation energy of pure iron (18 500 cal/mol). Compared with pure iron, the diffusion speed of hydrogen decreased only very slightly. It can be seen from the graph, Fig.1, that the influence of V is less pronounced than the influence of an equivalent quantity of Si and it is also less than the effect of adding 0.4% C to the iron. This is in good agreement with the above mentioned X-ray structural

Speed of diffusion of hydrogen in iron-chromium alloys. 126-1-40/40

investigations (Ref.2) in which it was found that V does not only increase but even weakens to some extent the bonds in the iron lattice.
(Note: This is a complete translation).

There are 1 figure and 2 references, both of which are Slavic.

SUBMITTED: September 28, 1956.

ASSOCIATION: Ural Polytechnical Institute imeni S. M. Kirov. (Uralskiy Politekhnicheskiy Institut imeni S.M.Kirova).

AVAILABLE: Library of Congress.

Card 4/4

Gel'd, P. V.

AUTHORS: Semenova, A. K., and Gel'd, P. V. 126-2-32/35

TITLE: On the protective effect of chromium during corrosion of Fe-Cr alloys by sulphur vapours. (O zashchitnom deystvii khroma pri korrozii splavov Fe-Cr parami sery).

PERIODICAL: Fizika Metallov i Metallovedeniye, 1957, Vol.5, No.2, pp. 378-379 (USSR)

ABSTRACT: According to earlier work of one of the authors (Ref.1), there is reason to assume that a deep analogy exists between the processes of oxide and sulphide corrosion of iron and its alloys,which is attributed to the fact that in both cases the oxidation products are non-stechiometric compounds with inadequate quantities of metal. On the basis of this assumption it was postulated (Ref.2) that, in the same way as during oxidation of Fe-Cr alloys by oxygen (Ref.3), chromium increases the stability of the alloy against sulphide corrosion due to accumulation and formation in the internal layers of the scale of inter-layers which are enriched in the sulphide spinel $FeCr_2S_4$. To verify this experimentally, investigations were made of the kinetics of oxidation of iron alloys with chromium (0 to 19.29% Cr) by means of sulphur vapours (P_{S2} = 50 mm Hg col) and also investigation

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126-2-32/35

On the protective effect of chromium during corrosion of Fe-Cr alloys by sulphur vapours.

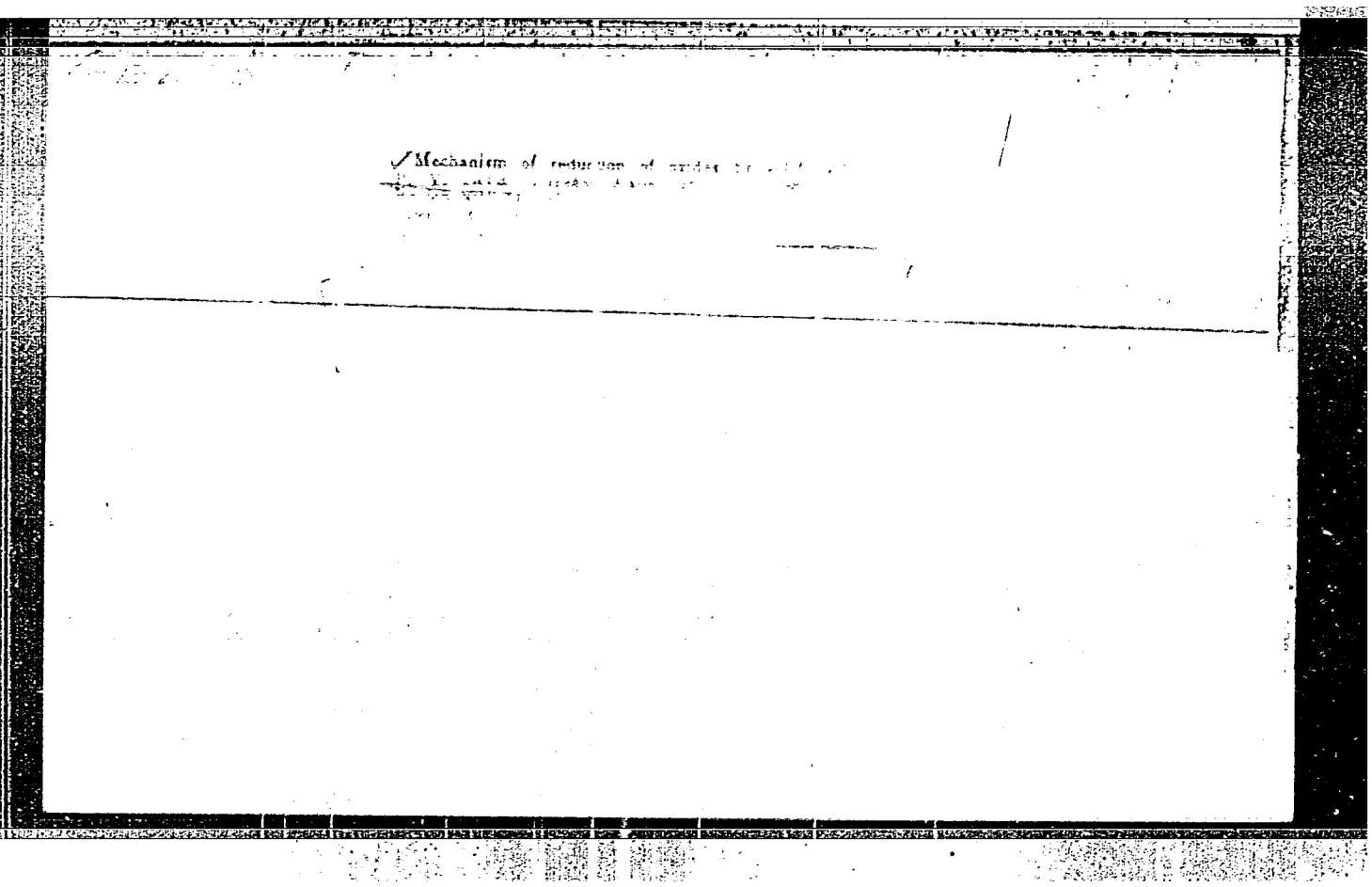
of the structural features of the forming scale. Some of the results are entered in a table, p.379. The obtained data confirm the assumption on the analogy of the two corrosion processes. Thus, the role of chromium during oxide and sulphide corrosion of alloys of chromium with iron is identical and, therefore, the principle of heat resistance proposed by Arkharov, V. I. (Ref.4) can be extended to sulphide corrosion of iron alloys. There are 1 table and four references, all of which are Slavic.

SUBMITTED: February 21, 1957.

ASSOCIATION: Ural Polytechnical Institute imeni S. M. Kirov. (Ural'skiy Politekhnicheskiy Institut imeni S.M. Kirova).

AVAILABLE: Library of Congress.

Card 2/2



PA - 2176

AUTHOR: GEL'D, P.V.

TITLE: The Thermal and Thermoelectric Properties of Alloys of Silicon with Transition Metals. (Russian)

PERIODICAL: Zhurnal Tekhn.Fiz. 1957, Vol 27, Nr 1, pp 113-118 (U.S.S.R.)

Received: 2 / 1957 Reviewed: 4 / 1957

ABSTRACT: This paper contains a short report on some results of the investigations of the alloys of Si with Fe, Cr and Mn carried out at the Physical professorial chair of the Polytechnic Institute "S.M.KIROV" of Ural under the author's supervision. The various authors of the individual parts of this paper are mentioned. The heat conductivity λ of the iron-silicon alloys containing from 1 to 99% silicon were investigated by the steady method of radial flow in a thick-walled sample. This method permits reliable measurements up to a temperature of approximately 1000°. Furthermore, the thermal capacity of the sample in the temperature interval of from 0 to 1200° C was determined by means of the classical mixing method. The isotherms of the heat- and temperature conduction of the iron-silicon alloys have sharply marked extremal properties. The addition of silicon to iron and also of iron to silicon causes a considerable reduction of λ and a. Here a denotes the temperature conductivity of the alloys. Thermal conductivity and temperature conductivity of technical silicon (~ 98% Si) decrease quickly with increasing temperatures and are

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PA - 2176

The Thermal and Thermoelectric Properties of Alloys of Silicon with Transition Metals. (Russian)

described satisfactorily by the following empirical equations:

$$\lambda = 0{,}1675 - 0{,}249.10^{-3}t + 0{,}151.10^{-6}t^2 + 0{,}0033.10^{5}t^{-2}$$

$$a = 0{,}3756 - 0{,}605.10^{-3}t + 0{,}366.10^{-6}t^2 + 0{,}0107.10^{5}t^{-2}.$$

Here t denotes the temperature in ^{o} C.
With an increase of concentration of the silicon in iron heat conductivity decreases, the temperature coefficient of heat conductivity, however, increases. The temperature coefficient of heat conductivities of alloys with from 35 to 85% Si is characterized by an inversion in the temperature range of from 500 to 700^{o} C. Here λ reaches its minimum.
Then the connection between the coefficients of the heat conductivity λ and the thermal expansion δ is discussed. The relation $1/\lambda = k\delta^2$ was found already previously. In the case of alloys of iron with silicon the proportionality coefficient k (at 20^{o} C) increases rapidly with the increase of the concentration of the Si from 0 up to 40%. A further increase of the silicon

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PA - 2176

The Thermal and Thermoelectric Properties of Alloys of Silicon with Transition Metals. (Russian)

content, however, changes this coefficient k irregularly and to a relatively small extent.
Finally, the measurement of the thermoelectromotive force of the alloys of Si with Fe, Cr, and Mn is discussed. The thermoelectromotive force of the alloys with less than 40% Si is low and depends on the concentration of Si in a complicated manner.

ASSOCIATION: Polytechnical Institute SVERDLOVSK, Ural
PRESENTED BY:
SUBMITTED:
AVAILABLE: Library of Congress

Card 3/3

137-58-6-13812

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 6, p 373 (USSR)

AUTHORS: Gel'd, P.V., Ryabov, R.A.

TITLE: Diffusion of Hydrogen in Alloys of Iron with Silicon (Diffuziya vodoroda v splavakh zheleza s kremniyem)

PERIODICAL: Tr. Ural'skogo politekhn. in-ta, 1957, Nr 67, pp 92-95

ABSTRACT: The influence of Si on the rate of diffusion of H_2(P) in transformer and dynamo steel and also in St-40, 33KhS, and 35KhGSA steel was studied. Curves of the variation of P in relation to temperature in the coordinates P-temp and log P - $1/T^{\circ}K$ were plotted. In the latter case, the energy of activation of the process was computed from the slope of the straight line obtained. Within the temperature region of transformation from α into γ the curve shows a break which corresponds to a sharp decrease of P in the region of transformation. It was shown that Si lowers P very strongly. The energy of activation for dynamo and transformer steel increased to 21-22 kcal/mole as against 17-18 kcal/mole for pure Fe. In steels 33 KhS and 35 KhGSA it increased insignificantly while the P of the latter grades of steel is considerably lower than that of St-40 steel. 1. Hydrogen--Diffusion 2. Iron silicon--Applications 3. Silicon--Metallurgical effects 4. Diffusion--Temperature factors

T.M.

Card 1/1

SOV/137-58-8-16353

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 8, p 17 (USSR)

AUTHORS: Davydov, K.N., Gel'd, P.V.

TITLE: Specific Heat and Expansion of Alloys of Silicon with Chromium and Manganese (Teployemkost' i rasshireniye splavov kremniya s khromom i margantsem)

PERIODICAL: Tr. Ural'skogo politekhn. in-ta, 1957, Nr 67, pp 96-107

ABSTRACT: The specific heat of alloys was calculated on the basis of their heat contents in the 0-1200°C range measured experimentally by the method of mixing. For alloys of various composition the equations of their true specific heat were obtained in the form of polynomials of the type: $C_p = a + bT + cT^{-2}$. In the indicated temperature range specific-heat anomalies which might serve as an indication of a polymorphism of Cr silicides are absent. The inapplicability of the Kopp and Neumann law to the alloys studied is established. In the investigation of the heat contents of alloys of Cr with Mn the existence of a sudden change is discovered in the vicinity of 620°, corresponding to the Mn_3Si silicide. The hypothesis of the polymorphism of the latter is confirmed by surface-tension and thermographic

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SOV/137-58-8-16353

Specific Heat and Expansion of Alloys of Silicon (cont.)

investigations. The temperature dependence of the coefficients of expansion of the alloys of Si with Cr (and, partly, with Mn) at temperatures of 100 to 1000° was also studied.

Yu.Z.

1. Chromium-Silicon alloys--Specific heat 2. Manganese-Silicon alloys--Specific heat 3. Mathematics

Card 2/2

OEL'D, P.V., prof.

Foreword. Trudy Ural. politekh. inst. no.72:3-4 '57. (MIRA 11:4)
(Alloys)

SOV/137-58-7-15613

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 7, p 242 (USSR)

AUTHORS: Lipatova, V. A., Gel'd, P. V., Davydov, K. N.

TITLE: Thermoelectric Properties of Alloys of Silicon with Iron, Chromium, and Manganese (Termoelektricheskiye svoystva splavov kremniya s zhelezom, khromom i margantsem)

PERIODICAL: Tr. Ural'skogo politekhn. in-ta, 1957, Nr 72, pp 105-120

ABSTRACT: Alloys of the type Fe-Si, Cr-Si, and Mn-Si were investigated throughout the full range of concentrations. Investigated in greater detail were Fe-Si alloys of a composition close to that of "lebowite" (40-60% Si). The initial materials used were Armco-Fe, electrolytic Cr, and 99.2-pure crystalline Si. Cylindrical specimens 2 mm in diameter and 40-50 mm long were obtained by drawing the melt from the crucible of an induction furnace into a thin quartz tube. The integral thermo-e.m.f. E was measured with the aid of the apparatus described earlier (Korzh, P. D., Zavodskaya laboratoriya, 1948, Vol 14, p 207) with an accuracy of up to 0.05 mv. It is established that, in an Fe-Si system, E is negative up to 4-6% Si and that it attains a maximum of 1.5 mv/100°C. Upon a further increase

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Thermoelectric Properties of Alloys (cont.)

in the concentration of Si, the absolute value for E decreases and at 17% Si it equals zero. Specimens containing 17 to 59% Si have a positive E insignificant in value and depending very little on the composition. In alloys containing >59% Si, E is negative and its numerical value increases rapidly on the enrichment of the alloy with Si, which is characteristic for semiconductors. The qualitative relationship of E to the composition is the same in Cr-Si and Mn-Si alloys as in the Fe-Si alloy. In all of the alloys the relationship between E and the composition corresponds to the phase diagram. The rectifying action of alloys rich in Si was investigated. Depending upon the location of the point contact either p-type or n-type conductivity was discovered which points to the microheterogeneity of the specimens, possibly related to an uneven distribution of impurities and a corresponding presence of impurity conductors with carriers of either type. The alloy with 51.0% Si has a semiconductive nature. It is assumed that $CrSi_2$ (51.8% Si), in contrast to other silicides, possesses detector properties. Bibliography: 20 references.

S. S.

1. Silicon alloys--Thermodynamic properties 2. Silicon alloys--Electrical properties

Card 2/2

SOV/137-58-8-17634

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 8 p 205 (USSR)

AUTHORS: Kuprovskiy, B. B., Gel'd, P. V.

TITLE: Heat Conductivity of Alloys of Silicon with Iron (Teploprovodnost' splavov kremniya s zhelezom pri vysokikh temperaturakh)

PERIODICAL: Tr. Ural'skogo politekhn. in-ta, 1957 Nr 72, pp 121-133

ABSTRACT: Ref. RZhMet, 1958, Nr 2, abstract 3888

1. Iron-silicon alloys—Heat transfer

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137-58-6-11660

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 6, p 62 (USSR)

AUTHORS. Strukov, I N., Giel'd, P V

TITLE. The Causes of the Slaking of Ferrosilicon in Storage (O pri-chinakh rassypaniya ferrosilitsiya pri khranenii)

PERIODICAL Tr. Ural'skogo politekhn. in-ta, 1957, Nr 72, pp 134-148

ABSTRACT The investigation is conducted with rapidly-cooled (quenched) Fe-Si, high in lebowite and containing Al, P, and Ca as impurities. It is observed that the process of slaking of the alloy (A) starts with the appearance of fissures and ends in most cases in the pulverization of the A. It is found that the greatest stability is possessed by A with 50% Si (sub-lebowite), intermediate stability by A with 70-80% Si(super-lebowite) and minimum stability by A with 50-65% Si (lebowite), this being explained by the presence in the A of eutectic decomposition in the latter two instances accompanied by an increase in the volume of the A and evoking internal stresses therein. A's not containing impurities did not slake, regardless of the [Si], whereas A's containing both Al and P slaked more intensely than A's containing either of these elements individually. An acceleration

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137-58-6-11660

The Causes of the Slaking of Ferrosilicon in Storage

of the slaking of A with increase in atmospheric humidity was observed, as well as a protective effect produced by coatings of paraffin and drying oil The decisive influence upon the stability of A, particularly when rich in Si, of a stabilizing anneal in the 750-850°C temperature interval, with holding dependent upon the content of impurities in the A, is noted Attention is drawn to the need to study the distribution of additions in lebowite between the crystalline base and the intergranular precipitates before and after annealing. Bibliography: 14 references.

A.Sh.

1. Silicon--Stability 2. Silicon--Properties 3. Silicon--Test results

Card 2/2

SOV/137-58-9-19840

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 9, p 248 (USSR)

AUTHORS: Strukov, I.N., Gel'd, P.V.

TITLE: On Transformations in Alloys Containing Lebowite (O prevrashcheniyakh v splavakh, soderzhashchikh leboit)

PERIODICAL: Tr. Ural'skogo politekhn. in-ta, 1957, Nr 72, pp 149-159

ABSTRACT: Transformations taking place in ferrosilicon containing 34-90% Si were investigated. Dilatometric curves representing heating of alloys containing more than 33.3% Si revealed the existence of significant volumetric effects. The nature of the dilatometric diagrams depends essentially not only on the composition of the alloy being investigated, but also on the preceding heat-treatment history of the latter. If the melt is cooled at a sufficiently rapid rate the lebowite, which forms in the process of crystallization, is stabilized in its high-temperature modification (ξ_α). Subsequent annealing results in a eutectoid decomposition, $\xi_\alpha \rightarrow \xi_\beta + Si$, accompanied by a considerable increase in the volume of the specimen. Eutectoid decomposition of α-lebowite occurs in hardened alloys containing less than 50% Si; in addition, at somewhat higher

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On Transformations in Alloys Containing Lebowite

temperatures (750-950°C), monosilicide reacts with Si (and partially with α lebowite) to form a low-temperature ξ_β phase. The presence of up to 2-2.5% of Al and 0.22% of P in the alloy has little effect on the kinetics of the decomposition of the α lebowite. By contrast, simultaneous presence of these elements results in an abrupt reduction in the rate of the decomposition process. Ca, even in small quantities down to 0.2-0.4%, considerably reduces the rate of lebowite decomposition. Metallographic and X-ray investigations, as well as measurements of thermo-emf and microhardness corroborated the ideas regarding the transformation processes in Fe-Si alloys based on data of the dilatometric analysis. Bibliography: 18 references.

Ya.L.

1. Iron-silicon alloys--Transformations 2. Iron-silicon alloys--X-ray analysis

Card 2/2

137-58-6-13158

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 6, p 282 (USSR)

AUTHORS: Ryabov, R.A., Gel'd, P.V.

TITLE: The Rate of Diffusion of Hydrogen Through Structural Steels at Elevated Temperatures (Skorost' diffuzii vodoroda pri vysokikh temperaturakh cherez konstruktsionnyye stali)

PERIODICAL: Tr. Ural'skogo politekhn. in-ta, 1957, Nr 72, pp 160-172

ABSTRACT: A study of the diffusion (D) of H through membranes of steel 40Kh, 34KhM, 35Kh3, 35N3, 40KhNMA, 38KhMYuA, and 40KhN at 300-1000°C. The membrane, a hollow specimen shaped as a complex cylinder, was fastened by Sn soldering onto a gently heated part of the machine. D took place through 1-mm thick walls of a capillary tube. The H_2 pressure which diffused into the vacuum part of the system was measured by a MacLeod manometer. To prevent decarburizing of the specimen, the space between the specimen and the housing of the diffusion block was filled with shavings of the same material. Cr perceptibly impairs D of H in steel. The energy of activation Q in a ferrite-carbide structure (in cal/mol) is 20,500 for 40Kh (0.89% Cr) (for pure Fe Q = 17,000-18,000), in austenite

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The Rate of Diffusion (cont.)

$\sim$ 30,000. For 35Kh3 (2.98% Cr) Q = 24,000-25,000. Ni diminishes D rate of H negligibly. For 35N3 (3.25% Ni) Q = 19,500. The other grades are similar in the diffusion qualities to 40Kh.

Ye.V.

1. Hydrogen--Diffusion 2. Steel--Properties 3. Diffusion--Temperature factors

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SOV/137-58-7-14221

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 7, p 37 (USSR)

AUTHOR: Gel'd P.V.

TITLE: Some Kinetic Characteristics of the Processes of Direct Reduction (Nekotoryye kineticheskiye kharakteristiki protsessov pryamogo vosstanovleniya)

PERIODICAL: Tr. Ural'skogo politekhn. in-ta, 1957, Nr 72, pp 173-178

ABSTRACT: The rate of processes of direct reduction of metallic oxides with solid carbon v_{Σ} is usually determined by the rate of gasification of the carbon v_{C,CO_2}. Under this condition the evaluation of the rate of the processes of direct reduction in the range of intermediate pressures and with a considerable remoteness of the gaseous phase compound from the equilibrium in the system C-CO-CO_2 is possible according to the formula:

$$v_{\Sigma} \cong v_{C,CO_2} = C_1 \cdot e^{(-E_{C,CO_2}+0.25A)/RT} \sqrt{\frac{P \cdot e^{-B/R} \cdot e^{-A/RT}}{1 + e^{-B/R} \cdot e^{-A/RT}}},$$

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Some Kinetic Characteristics of the Processes of Direct Reduction

where A and B are the coefficients in the polynomial $\Delta F^{o}_{CO} = A + BT = -RT \log K_{CO}$, which describes the variation of the free energy during indirect reduction of metallic oxides in relation to the temperature; P is the pressure; E_{C, CO_2} is the energy of activation of the process of gasification of carbon. In addition to the expression quoted, calculated with the aid of the equation of Yevropin, Kul'kova, and Temkin (1956) for the rate of gasification of carbon, it is also possible to apply a relationship based on the simpler equation of Yesin and Gel'd (1952):

$$V'_{\Sigma} \cong V'_{C, CO_2} = C_2 e^{-E_{C, CO_2}/RT} \left(\frac{P \cdot e^{-B/R} \cdot e^{-A/RT}}{1 + e^{-B/R} \cdot e^{-A/RT}} \right)^{n}$$

The resulting equations can be simplified for the examination of two boundary cases, namely, the readily reducible and the hard to reduce oxides. In the first case $K_{CO} \gg 1$ and, consequently,

$$V_{\Sigma} = C_1 \cdot e^{-E/RT} \sqrt[4]{P} \quad \text{or} \quad V'_{\Sigma} = C_2 \cdot e^{-E/RT} p^{n} .$$

Some Kinetic Characteristics of the Processes of Direct Reduction

In the second case

$K_{CO} \ll 1$ and $V_{\Sigma} = C'_1 \cdot e^{-E/RT} \sqrt[4]{P}$; $V'_{\Sigma} = C'_2 \cdot e^{-E/RT} P^n$.

Thereby, the rate of the process of direct reduction in the boundary cases varies with the variation of temperature according to an exponential law. An increase in pressure promotes a slow increase in the rate of the reaction because the latter is proportional to P to the fractional power ($0.25 \leq n \leq 1$). The apparent energy of activation of direct reduction in the case of various oxides, contrary to the previous statements, is not a value that varies slightly but one that increases in a regular manner with an increase in the stability of the oxide. A certain congruence exists between the rate of the process of direct reduction and the dissociation pressure of the oxides, in relation with which: $V_{Fe_2O_3} > V_{Mn_3O_4} > V_{Fe_3O_4} > V_{MnO}$.

Ye.V.

1. Metal oxides--Reduction 2. Carbon--Properties

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SOV/137-58-7-14223

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 7, p 37 (USSR)

AUTHOR: Yesin, Yu.O., Gel'd, P.V.

TITLE: Reduction of Chromium Oxide With Carbon (Vosstanovleniye okisi khroma uglerodom)

PERIODICAL: Tr. Ural'skogo politekhn. in-ta 1957, Nr 72, pp 179-191

ABSTRACT: The applicability of the two-stage theory (reduction with CO gas, regeneration of CO with carbon) to high-temperature processes of direct reduction was investigated. The process of direct reduction of Cr_2O_3 with carbon at a molecular proportion Cr_2O_3:C = 1:4.5 was studied by means of the observation of the loss of weight of a specimen with a simultaneous inspection of the composition of the products formed by the reaction. The gaseous phase consisted of practically pure CO. The process of reduction was studied in vacuo as well as with an accumulation of CO in the system. A sharply defined incubation period was discovered, the duration of which increases with a lowering of the temperature, also a period of increase in rate which points to the autocatalytic character of the process of

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Reduction of Chromium Oxide With Carbon

direct reduction of Cr_2O_3. At low temperatures an increase in pressure retards somewhat the interaction and at elevated temperatures it noticeably accelerates the process. It is shown that the substitution of metallurgical coke for graphite leads to a sharp decrease in the rate of reduction. Influence of salts of alkali metals was studied. The presence of K_2CO_3 and Na_2CO_3 increases considerably the rate of reduction, the action of either carbonate being about the same. The introduction of an activator in the form of a dry salt and the impregnation of the graphite with an aqueous solution show a similar effect. This leads to the conclusion that at a high temperature dry salts impregnate the C with their vapors and activate it. The activating effect of the salts on the rate of gasification of C with carbon dioxide is corroborated by a direct experiment at 1000°C. According to the conclusions of the authors, in the primary period of reduction of Cr_2O_3 by C the limiting stage of the process is the act of crystallochemical transformation of the oxide into the metal. During that period the energy of activation attains 140,000 cal/mol. During a definite stage of the reduction, when the formation of a reaction zone is completed, the kinetic complications, in relation to the regrouping of the lattice, decrease, and to a considerable extent the speed of the process begins to be determined by the speed of gasification

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Reduction of Chromium Oxide With Carbon

of the carbon, whereupon certain new kinetic mechanisms arise (relationship of the rate of reduction to the pressure of the gaseous phase, a decrease of the energy of activation of almost 50%, and others).

A.V.

1. Chromium oxides--Reduction 2. Carbon--Properties 3. Chromium oxides--Phase studies

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SOV/137-58-7-14224

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 7, p 38 (USSR)

AUTHORS: Yesin, Yu.O., ~~Gelld, P.V.~~

TITLE: Influence of Briquetting and the Pressure of the Gaseous Phase on the Rate of Direct Reduction of Zinc Oxide (Vliyaniye briketirovaniya i davleniya gazovoy fazy na skorost' pryamogo vosstanovleniya okisi tsinka)

PERIODICAL: Tr. Ural'skogo politekhn. in-ta, 1957, Nr 72, pp 192-195

ABSTRACT: By experimental reduction of ZnO with solid C in a vacuum it was demonstrated that the rate of reduction has no relation to the compression pressure in the range of 0 to 600 kg/cm^2. This emphasizes the important role of the gaseous phase and the two-stage character of the process of direct reduction. Upon changing the pressure of the gaseous phase it was discovered that the rate of reduction of ZnO in a partial vacuum is somewhat higher than in a high vacuum. Upon accumulation of reaction products a considerable retardation of the process is observed. Such an extreme dependence of the rate of the process upon pressure is explained by an acceleration of the reaction with an increase of p_{CO} (CO pressure) and a retardation with

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Influence of Briquetting and the Pressure of the Gaseous Phase (cont.)

an accumulation of Zn vapors. The complex role of the gaseous phase during direct reduction is emphasized. A.V.

1. Zinc oxides--Reduction 2. Zinc oxides--Phase studies 3. Carbon--Applications

Card 2/2

137-58-6-12651

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 6, p 238 (USSR)

AUTHORS: Semenova, A.K., Gel'd, P.V.

TITLE: Effect of Chromium on Sulfide Corrosion of its Alloys With Iron (Vliyaniye khroma na sul'fidnuyu korroziyu yego splavov s zhelezom)

PERIODICAL: Tr. Ural'skogo politekhn. in-ta, 1957, Nr 72, pp 196-206

ABSTRACT: A study of oxidation of Fe-Cr alloys the Cr content of which varied from 0 to 19.2% by S vapors at a vapor pressure of 50 mm Hg at temperatures 500-800°C. It is shown that the rate of corrosion diminishes rapidly with a lowering of temperature and increase of Cr content in the alloy. Small additions of Cr (3-4%) lower the average rate of oxidation by one-third to one-half; an addition of 12-17% increases corrosion resistance 10-20 times. X-ray and chemical examinations and measurement of the electric properties of external and internal layers of sulfide scale have revealed experimentally the analogy of the protective action of Cr against oxidation of alloys with O_2, as well as with S. It is shown that in the process of oxidation of alloys by sulfur the Cr concentrates almost entirely in the

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Effect of Chromium on Sulfide Corrosion of its Alloys With Iron

interior layer of the scale, forming a sulfide spinel $FeCr_2S_4$ which is structurally similar to $FeCr_2O_4$. With a content of 12.08% Cr in the alloy the interior layer of the scale contains 86% of sulfide spinel which sharply retards the diffusion of the S and Fe atoms, thereby making the alloy more resistant to corrosion. Bibliography 15 references.

P.S.

1. Chromium-iron alloys--Corrosion 2. Sulfide vapors--Corrosive effects
3. Corrosion--Temperature factors

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137-58-6-12852

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 6, p 238 (USSR)

AUTHORS: Semenova, A.K., Gel'd, P.V.

TITLE: Effect of Manganese on Sulfur Corrosion of its Alloys With Iron (Vliyaniye margantsa na sul'fidnuyu korroziyu yego splavov s zhelezom)

PERIODICAL: Tr. Ural'skogo politekhn. in-ta, 1957, Nr 72, pp 207-213

ABSTRACT: The corrosion of Fe-Mn-alloys (with contents of Mn from 0.01 to 15.32%) in vapors of S at 500-800°C has been examined. It was revealed that an increase of Mn to 15% lowers the rate of corrosion of alloys in the 500-800° interval in an approximately linear proportion. The chemical and X-ray analysis of layers of scale showed that with low concentrations of Mn in the alloy, the Mn distributes itself almost uniformly through the entire thickness of the scale. With 6-9% of Mn in the original alloy an accumulation of Mn in the form of MnS takes place in the interior layer of the scale. In high-manganese (15%) alloys the quantities of FeS and MnS contained in the interior layer are commensurate; the comparatively small inhibiting effect on corrosion (one-third at 800° with 15% Mn) is explained by

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