137-58-6-12852

Effect of Manganese on Sulfur Corrosion of its Alloys With Iron

the authors by stating that Mn gradually accumulating in the interior layer of the scale forms saturated phases of two types (Mn, Fe) S and (Fe, Mn) S, which are characterized by ready permeability relative to the diffusion of atoms of the metal and the metalloid.

P.S.

1. Iron-manganese alloys--Corrosion 2. Sulfur vapors--Corrosive effects
3. Corrosion--Temperature factors

Card 2/2

137-58-6-13166

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 6, p 283 (USSR)

AUTHORS: Gol'berg, A.I., Lipatova, V.A., Gel'd, P.V.

TITLE Electrical Properties of "Lebowite" (Elektricheskiye svoystva leboita)

PERIODICAL: Tr. Ural'skogo politekhn. in-ta, 1957, Nr 72, pp 252-254

ABSTRACT: An investigation of the relationship of Hall's constant R_x, the resistivity ρ, and the thermoelectromotive force α to the composition of an Fe-Si alloy in the range 47-59% Si at room temperature. Samples were prepared by smelting armco-Fe with technical (99.0%) Si. The melt was drawn into quartz capillaries of 2-4 mm diam. The samples were annealed at 800°C during 10-12 hrs or tempered at 1000° and quenched in water. Hall e.m.f. measurements were carried on by the usual method at a field intensity of 17,000-23,000 oersted. Measurements of α relative to Cu were taken with contact-temperature differences of 100°. The values of R_x and α are sufficiently large and change their sign in the range of 54-55% Si, which indicates semi-conductive properties of the alloys. With Si content $\sim$50% each of the three curves has a sharply

Card 1/2

Electrical Properties of "Lebowite"

defined maximum corresponding to the $FeSi_2$ compound. In general, the results of an examination of tempered samples are consistent with the results obtained for annealed samples; only R_x which corresponds to hole-type conductivity has little relation to composition. R_x and ρ in this case are two orders of magnitude smaller than in annealed samples. The high-temperature modification of "lebowite" is similar to metal in properties.

L.M.

1. Iron-silicon alloys--Electrical properties

Card 2/2

SOV/ 137-58-7-14207

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 7, p 35 (USSR)

AUTHORS: Gel'd, P.V., Petrushevskiy, M.S.

TITLE: Solubility of Carbon in Ferro-silico-manganese (Rastvorimost' ugleroda v ferrosilikomargantse)

PERIODICAL: Tr. Ural'skogo politekhn. in-ta, 1957, Nr 72, pp 255-258

ABSTRACT: The solubility of C at 1460°C in synthetic alloys of the types Fe-Si with up to 40% [Si] and Mn-Si and Fe-Mn-Si with up to 50% [Si]. According to the data, the solubility of C in Fe-Mn alloys increases linearly with the increase in their Mn content. The empirical equations for the calculation of the coefficients of C activity obtained on the basis of data for Fe-Mn-C, Fe-Si-C, and Mn-Si-C alloys, namely,

$\log_{10} \gamma_C^{Fe,\ Si} = 0.214N_{Mn}$, $\log_{10} \gamma_C^{Fe,\ Si} = 215N_{Si} + 2.25N_{Si}^2$ and $\log_{10} \gamma_C^{Mn,\ Si} = 0.8N_{Si} + 4.5N_{Si}^2$

demonstrates that γ_C is decreased fairly slightly by Mn and increased sharply by Si and that $\gamma_C^{Mn,\ Si} < \gamma_C^{Fe,\ Si}$. This

Card 1/2

Solubility of Carbon in Ferro-silico-manganese

is explained by the fact that Mn strengthens the C bonds considerably (since $\varepsilon_{Mn,\ C} > \varepsilon_{Fe,\ C,}$ and that Si forms durable groupings with atoms of Fe and Mn. In quaternary alloys Fe-Mn-Si-C, owing to the same cause, γ_C decreases with the substitution of Mn for Fe; with an increase in Si content the solubility of C decreases rapidly. The solubility of C in these alloys increases practically linearly with an increase in Mn content. Therefore, it is recommended that the C content in saturated four-component melts be determined according to the law governing mixing.

V.M.

1. Carbon--Solubility 2. Iron-manganese-silicon alloys--Properties

Card 2/2

SOV/137-58-9-18659

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 9, p 71 (USSR)

AUTHORS: Yesin, O.A., Kholodov, A.I., Gel'd, P.V., Popel', S.I.

TITLE: Electrochemical Refining and Alloying of Ferrous Metals (Elektrokhimicheskoye rafinirovaniye i legirovaniye chernykh metallov)

PERIODICAL: V sb.: Staleplavil'n. proiz-vo, Moscow, Metallurgizdat, 1958, pp 151-161

ABSTRACT: A description is offered of the results of experiments in 1948-1952 in the electrochemical refining and alloying of metals. The laboratory experiments were run in a resistance furnace with a Silit electrode and in a 50-kg high-frequency furnace. Electrochemical refining of metal proved feasible. The application of an external electrical field to a metal-slag system makes it possible to regulate the speed and completeness of transfer of S from the metal into the slag. Pilot-plant experiments at the Verkh-Isetsk Plant employed a D-C generator (1000 amps, 120 v). The metal was poured into a 300-kg ladle. The results of the industrial experiments showed that when an external electrical field was applied the removal of

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SOV/137-58-9-18659

Electrochemical Refining and Alloying of Ferrous Metals

sulfur from the steel proceeds with considerably greater efficiency than without electrolysis. Depending upon the initial composition of the metal and the slag and upon the quantity thereof, the S content diminished by 0.020-0.045% during the first 10 min. Simultaneously with the removal of S from the metal, an increase in Si content was observed. Current efficiency was from 20 to 96%. The experiments demonstrated the desirability of further development of the method and of its introduction into industrial practice.

L.K.

1. Ores--Processing 2. Metals--Production 3. Iron alloys--Production
4. Metals--Electrochemistry

Card 2/2

GEL'D, P.V.

Role of the gas phase in reducing oxides by carbon. Trudy Inst. khim. UFAN SSSR no.2:7-44 '58. (MIRA 12:12)
(Metallic oxides) (Reduction, Chemical)

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

Reduction of zinc oxide by carbon. Trudy Inst. khim. UFAN SSSR no.2:63-79 '58. (MIRA 12:12)
(Zinc) (Carbon)

MATVEYENKO, I.I.; GEL'D, P.V.

Mechanism of the reduction of calcium oxide by aluminum.
Trudy Inst. khim. UFAN SSSR no.2:133-142 '58.
(MIRA 12:12)

(Calcium) (Aluminothermy)

AUTHORS: Gel'd, P. V., Ryabov, R. A. SOV/163-58-3-31/49

TITLE: The Influence Exerted by the Austenite Transformation on the Rate of Penetration of Hydrogen in Steel (Vliyaniye austenitnogo prevrashcheniya na skorost' proniknoveniya vodoroda v stal')

PERIODICAL: Nauchnyye doklady vysshey shkoly. Metallurgiya, 1958, Nr 3, pp 189 - 195 (USSR)

ABSTRACT: The rate of the penetration of hydrogen in steel was carefully investigated. It is shown that the rate of the penetration of hydrogen depends on the change of the structure of the steel samples. At temperatures of 400 - 800°C an intense decomposition of austenite takes place in the steel alloy 34KhML; at the same time the diffusion rate of hydrogen considerably increases and the activation energy drops to E_α = 18 500 cal/mol H_2.

The influence of the temperature on the rate of penetration of hydrogen in the steel alloy 34KhN2M was found at 660 - 950°. All structural changes in the steel samples were accompanied by the change in the rate of penetration

Card 1/2

The Influence Exerted by the Austenite Transformation on the Rate of Penetration of Hydrogen in Steel

SOV/163-58-3-31/49

and the change of the activation energy of hydrogen. In dependence on the processing conditions at higher temperatures different phase diagrams occur which influence the gas saturation of the steel samples. There are 4 figures and 8 references, 6 of which are Soviet.

ASSOCIATION: Ural'skiy politekhnicheskiy institut (Ural Polytechnical Institute)

SUBMITTED: December 30, 1957

Card 2/2

SOV/78-3-11-2/23

AUTHORS: Alyamovskiy, S. I., Shveykin, G. P., Gel'd, P. V.

TITLE: On Low Niobium Oxides (O nizshikh okislakh niobiya)

PERIODICAL: Zhurnal neorganicheskoy khimii, 1958, Vol 3, Nr 11, pp 2437-2444 (USSR)

ABSTRACT: Experiments were carried out on the possibility of the existence of low niobium oxides. Most pure niobium and oxides produced from it by means of an annealing of the metal at 800-900°C served as initial materials. The following preparations were used: Nb_2O_5, $Nb_2O_{4,9}$ NbO_2, Nb_2O_3, Nb_3O_4, NbO, Nb_2O. The X-ray structure investigations of the phases of the system Nb-O produced by the reduction of Nb_2O_5-Nb-mixtures at a ratio of Nb : Nb_2O_5 = 3 : 1 were carried out at 1200°, 1580°, and 1650°C. The results showed that the following phases exist at the temperatures investigated: Nb_2O_5, NbO_2, NbO, and Nb. The phase NbO with the lattice constant a = 4430 X.E. is not produced in the system Nb-O. It was found that a phase with complex body-centered cubic lattice with the lattice constant

Card 1/2

On Low Niobium Oxides

a = 4201,3 X.U. exists at the equilibrium between the metal and the oxides. The low oxides Nb_2O, Nb_4O, Nb_3O_7, Nb_3O_5, Nb_2O_3, and Nb_3O_4 do not exist in the case of an interaction between niobium oxide and niobium, and in the presence of carbon. There are 2 figures, 1 table, and 24 references, 5 of which are Soviet.

SUBMITTED: October 24, 1957

Card 2/2

18(0)
AUTHORS: Gel'd, P. V., Krasovskaya, A. K. SOV/163-58-4-1/47

TITLE: Effect of the Curvature of Surface on the Reaction Diffusion (Vliyaniye krivizny poverkhnosti na reaktsionnuyu diffuziyu)

PERIODICAL: Nauchnyye doklady vysshey shkoly. Metallurgiya, 1958, Nr 4, pp 5-11 (USSR)

ABSTRACT: When investigating the process of reaction diffusion it is often assumed that the factors of diffusion are constant within the ranges of one-phase strata of reaction products and that the ratio of the flows of the reagents may be evaluated by the thickness of the inner and outer lower strata. Such assertions are not always correct and they may be the cause for wrong conclusions. The following peculiarities of interaction caused by the surface curvature of solid reagents may serve as an illustration. The corrosion process at high temperature was chosen for an analysis. At first, the kinetic properties appearing at the oxidation of a metallic specimen of regular shape, e. g. spherical shape, are investigated. The formulae (2) and (4) are derived, from which it is to be seen that the distribution of the concentration M in the stratum of the reaction product depends substantially upon the curvature of the

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stratum. By comparing the formulae (4) and (5) we can see that, in spherical strata, the sinter is enriched by a metalloid against the corresponding plane sinter. On corroding of specimens having positively curved surfaces, coatings enriched by metalloids form through the whole width. On the contrary, in the case of negatively curved boundary surfaces, a reduction of metalloid contents of the sinter is to be expected, as well as an approximation of its composition to the stoichiometric composition, i. e. a diminution of the concentration of vacancies, and therefore also a reduction of the factors of diffusion of the reagents. It is shown that D_M and D_{Me} do not only depend on temperature, time, and the coordinates of the point but also on the curvature of the sinter.
M - metalloid. Me - metal.
It is further shown that not only D_M and D_{Me} but also the ratio D_{Me}/D_M varies with changing curvature. The truth of this assertion was verified by testing the sulfide corrosion of iron. Besides, a correlation between the surface curvature and the ratio of the volumes of the outer and inner lower strata (V_1:V_2)

was ascertained. The mean content of sulfur in the outer lower stratum of concave sinter was found to be higher by about 1% than that of plane sinter under equivalent conditions. S - sulfur. The apparent reasons for the increase of D_S at growing nonstoichiometric ratios of the sulfide coating are indicated. Inasmuch as the energy barrier layers, due to the displacement of the big sulfur atoms, are larger as compared with the displacement of iron ions, the factors promoting the loosening of the crystal lattice and the aggravation of the part performed by the homeopolar bonds are bound to facilitate the diffusion of sulfur atoms to a higher extent than iron ions. In this connection, the vacancies that stand in mutual action with each other are particularly effective. There are 4 figures and 11 references, 9 of which are Soviet.

ASSOCIATION: Ural'skiy politekhnicheskiy institut (Ural Polytechnic Institute)

SUBMITTED: March 11, 1958

32-3-19/52

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

TITLE: The Determination of the Diffusion Velocity of Hydrogen in Metals (Opredeleniye skorosti diffusii vodoroda v metallakh)

PERIODICAL: Zavodskaya Laboratoriya, 1958, Vol. 24, Nr 3, pp. 306-308 (USSR)

ABSTRACT: The device into which the sample to be investigated is placed has a conical opening into which the neck of the sample fits exactly; it is filled up with lead so that it is hermetically closed. The middle part is heated, whereas the two ends are cooled with water. Hydrogen is fed through the vacuum conduction. For the purpose of measuring pressure changes (diffusion) a Mak-Leod manometer is used. The test sample itself is of a particular cone-like shape; the narrow part contains the capillary through which hydrogen diffuses. Before being measured the samples are investigated in order to find out whether larger pores and/or carbon inclusions exist. Diffusion velocity is calculated according to a formula the derivation of which is given. By means of the device described the number of iron alloys with carbon, chromium, silicon etc., as well as constructional steels are investigated. From the results

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The Determination of the Diffusion Velocity of Hydrogen in Metals

32-3-19/52

mentioned it may be seen that the diffusion velocity in alloyed steels obeys the law of the square root of hydrogen pressure at low as well as at high temperatures. There are 3 figures, and 8 references, 3 of which are Slavic.

ASSOCIATION: Ural Polytechnic Institute imeni Kirov (Ural'skiy politekhnicheskiy institut im. Korova)

AVAILABLE: Library of Congress

1. Iron alloys 2. Hydrogen-Diffusion-Velocity

Card 2/2

GEL'D, P.V., prof.; SEREBRENNIKOV, N.N., inzh.; KORSHUNOV, V.A., inzh.

Fusion heat of silicides. Izv. vys. uchab. zav.; chern. met. no.7:53-62 Jl '58. (MIRA 11:10)

1. Ural'skiy politekhnicheskiy institut.
(Silicides--Thermal properties) (Thermochemistry)

RYABOV, R.A., dots., kand.tekhn.nauk; GEL'D, P.V., prof., doktor tekhn.nauk

Effect of temperature and pressure on hydrogen diffusion in steels and iron-base binary alloys. Izv.vys.ucheb.zav.; chern.met. no.9:103-113 S '58. (MIRA 11:11)

1. Ural'skiy politekhnicheskiy institut.
(Iron alloys--Metallography) (Gases in metals)
(Metals, Effect of temperature on)

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

Reduction of zinc oxide by carbon. Zhur. prikl. khim. 31 no.7:986-995 Jl '58. (MIRA 11:9)
(Zinc oxide) (Carbon) (Reduction, Chemical)

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

Direct reduction of chromium oxide. Zhur. prikl. khim. 31 no.9: 1285-1293 S '58. (MIRA 11:10)
(Chromium oxides) (Reduction, Chemical)

AUTHORS: Semenova, A. K., Gel'd, P. V. 76-32-5-27/47

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

PERIODICAL: Zhurnal fizicheskoy khimii, 1958, Vol. 32, Nr 5, pp. 1087-1094 (USSR)

ABSTRACT: The influence of chromium on the oxidation kinetics of its iron alloys in sulfur vapors as well as the structural properties of the tinder formed on this occasion were investigated. From the experimental part can be seen that alloys with from 0 to 19.2% chromium were investigated which were melted in Shteynberg-Gramolin furnaces under the assistance by A. I. Pastukhov. The tests were carried out in a specially constructed vessel while the thermo e.m.f. was measured according to the method by G. D. Fedorov. The determinations of the velocity of corrosion took place at 500, 600, 700 and 800°C with different heating times. It was observed that the corrosion velocity decreases with the temperature drop and the increase of the chromium content, with also a decrease of the tinder layer having been observed. A stronger effect of chromium was noticed only to a content of 4-12%, so that, for in-

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stance, with additions of 12-17% chromium the corrosion resistance increases to the 1o-2o-fold. The x-ray structural and chemical investigations showed that the tinder consists of two different layers the thickness of which changes with the chromium content, with the chromium accumulating in the inner layer and with spinels having been found present. In determinations of the thermo e.m.f. it was observed that the inner layer has a greater activation energy which points at an energetic complicatedness in the charge transfer by the impinging of chromium ions. In evaluating the results the analogy of the oxidation with oxygen and sulfur is stressed, reasoned in detail and explained, and among others it is mentioned that the principle of heat resistance according to V. I. Arkharov (Ref 15) can also be extended to the sulfide corrosion, and that the corrosion resistance of the formation velocity of the spinel protective layer is dependent on a normal lattice parameter. There are 4 figures, 2 tables, and 15 references, 11 of which are Soviet.

ASSOCIATION: Ural'skiy politekhnicheskiy institut im. S. M. Kirova, Sverdlovsk

AUTHORS: Gel'd, P. V., Petrushevskiy, M. S. SOV/ 2o-12o-1-39/63

TITLE: The Solubility of Carbon in Ferrosilicomanganese (Rastvorimost' ugleroda v ferrosilikomargantse)

PERIODICAL: Doklady Akademii Nauk SSSR, 1958, Vol. 12o, Nr 1, pp. 144 - 147 (USSR)

ABSTRACT: Systematic details on the solubility of C in alloys Mn-Si-C and Mn-Si-Fe-C (References 1-3) are not available in technical publications. The authors therefore investigated the solubility of C in synthetic alloys Fe-Mn-Si at 1460° . As seen from the graphs (Figures 1-4) the replacement of iron by manganese (similar to the system Mn-Fe-C) leads to a linear increase of carbon solubility. Determination of the carbon content in saturated 4-component melting can be carried out according to the rule of mixtures:

$$[C]_{Mn,Fe,Si} = \frac{[Fe]\ [C]_{Fe,Si}}{[Fe]+[Mn]} + \frac{[Mn]\ [C]_{Mn,Si}}{[Fe]+[Mn]}$$

where $[C]_{Mn,Fe,Si}$, $[C]_{Fe,Si}$, $[C]_{Mn,Si}$ are the solubility figures of carbon in the alloys concerned, which are distinguished by

Card 1/2

The Solubility of Carbon in Ferrosilicomanganese SOV/20-120-1-39/63

the silicon concentration prescribed. The results of the examination of the 4-fold alloys are described in figure 4. The graph was constructed on the assumption that [Fe] + [Mn] + [Si] = = 100%. From this as well as from figure 2 it may be seen that carbon solubility decreases rapidly when the silicon content is increased. Apparently the concentration rise of manganese causes under the existing conditions a tighter linkage of the carbon atoms with the metal which means that the activity coefficient is reduced the more the manganese content in the alloy increases. There are 4 figures and 4 references, 2 of which are Soviet.

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

PRESENTED: September 6, 1957, by S. I. Vol'fkovich, Member, Academy of Sciences, USSR

SUBMITTED: September 6, 1957

1. Carbon--Solubility 2. Iron-manganese-silicon alloys--Solvent action

Card 2/2

GEL'D, P.V.

PHASE I BOOK EXPLOITATION SOV/3490

Termicheskaya obrabotka i svoystva krupnykh pokovok (Heat Treatment and Properties of Large Forgings), Moscow, Mashgiz, 1959. 165 p. 4,000 copies printed.

Reviewer: K.N. Sokolov, Candidate of Technical Sciences; Ed.: P.V. Sklyuyev, Candidate of Technical Sciences; Tech. Ed.: N.A.Dugina; Exec. Ed.(Ural-Siberian Division, Mashgiz): A.V. Kaletina, Engineer.

PURPOSE: This book is intended for technical personnel working in the shops, laboratories, and design offices of plants manufacturing heavy machinery and electrical equipment. It may also be of some interest to research personnel.

COVERAGE: This collection of articles describes methods employed by Uralmashzavod (Ural Heavy Machinery Plant, Sverdlovsk) for heat-treating heavy forgings. Research conducted at the plant is also discussed. Data for computing cooling rates in the quenching and normalizing of heavy forgings are given. A considerable portion of the book is devoted to information on the mechanical properties of rotors for heavy turbogenerators and one-piece steam-turbine rotors at various points along the body and neck of these parts. The main defects occurring in rotors of these types are described, their causes are analyzed, and methods of handling the problem are explained. Results of a study of heavy forgings made of vacuum-treated steel are given. No personalities are mentioned. References accompany most of the articles.

GEL'D, P. V.

with Gertman, Yu. M., "The thermochemistry of the solid and liquid silicides of Mn."

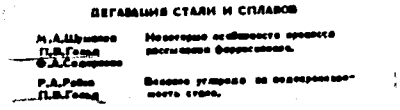
with KUSENKO, F. G. "The thermochemistry of the Oxides and carbides of Nb."

with Matveyenko, I. I. and Alyamovskiy, S. I., "Kinetika vosstanovleniya pyatiokisi vanadiya vodorodom."

with Matveyenko, I. I. and Alyamovskiy, S. I., "Utochneniye oblasti primenimosti printsipa posledovatelynosti prevrasheniy akad. A. A. Baykova."

with Serebrennikov, N. N. and Krentsis, R. P., "Ustanovka dlya issledovaniya teploemkosti tverdykh i zhidkikh splavov.

reports submitted for the 5th Physical Chemical Conference on Steel Production, Moscow, 30 June 1959.



24(6) PHASE I BOOK EXPLOITATION SOV/2117

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

Eksperimental'naya tekhnika i metody issledovaniy pri vysokikh temperaturakh; trudy soveshchaniya (Experimental Techniques and Methods of Investigation at High Temperatures; Transactions of the Conference on Experimental Techniques and Methods of Investigation at High Temperatures) Moscow, AN SSSR, 1959. 789 p. (Series: Akademiya nauk SSSR. Institut metallurgii. Trudy, vypusk 3) Errata slip inserted. Izdatel'stvo Akademii nauk SSSR, 2,200 copies printed.

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

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

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

TABLE OF CONTENTS:

I. DETERMINATION OF THERMODYNAMIC ACTIVITY AND METHODS OF INVESTIGATING THE KINETICS OF HIGH-TEMPERATURE PROCESSES

Gelld, F.V. Methods of Investigating the Kinetics and Equilibrium Characteristics of Certain Heterogeneous Reactions 5
The kinetics are investigated by: 1) studying the change in weight of condensed reagents with time 2) studying changes in pressure and volume of gas, and 3) other methods (thermographic, dilatometric, electrical, and magnetic). Equilibria are investigated by: 1) static methods (manometric methods, circulation methods, study of saturation of condensed phases, and construction methods) and 2) dynamic methods (jet method, control of pressure, thermal methods, and study of vaporization rate).

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Ryabov, R.A., and F.V. Gelld. Rate of Hydrogen Diffusion in Steels at High Temperatures 187
The rate of diffusion at a given temperature was determined on the basis of the quantity of hydrogen diffusing per unit time through a unit section of fixed thickness, as measured by the drop in pressure. The effect of alloying elements (carbon, chromium, vanadium, silicon, manganese, and nickel), decomposition of austenite, and pressure on the rate of diffusion were studied.

Petrova, Ye.F., and L.A. Shvartsman. Effect of Alloying Elements on the Thermodynamic Activity of Carbon in Gamma Iron 73
A method was developed for determining the thermodynamic activity of carbon in solid solutions. Data were obtained on the effect of additions of manganese, chrome, vanadium, and titanium on the activity of carbon in gamma iron; all these elements markedly decrease the activity of carbon in comparison with nonalloyed austenite. This indicates that the bond strength of carbon dissolved in gamma iron is considerably increased upon introduction of carbide-forming elements into a solid solution. The strongest effect on the activity of carbon, determined by the position of the investigated elements in the periodic table, was produced by titanium, and the weakest by manganese. The quantitative difference in the effect of titanium, vanadium, and chrome is small and approaches the accuracy of the measurements.

SOV/180-59-1-8/29

AUTHORS: Gel'd, P.V. and Shveykin, G.P. (Sverdlovsk)

TITLE: Some Peculiarities of the Carbon-Thermic Reduction of Niobium Pentoxide (Nekotoryye osobennosti ugletermicheskogo vosstanovleniya pyatiokisi niobiya)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1959, Nr 1, pp 44-49 (USSR)

ABSTRACT: It has been shown (Refs 1,2) that the direct production of niobium by reaction of the pentoxide with carbon is not suitable technically. A better method, probably, is to cause the pentoxide to react with carbon to give the carbide which is then heated with a further portion of pentoxide to give the metal. To provide technically useful information on the latter reactions the authors have studied the reaction kinetics. The Nb_2O_5, of 97.4 - 99.8% purity, was prepared in various ways (Table 1), the monoxide and dioxides were prepared by vacuum fusion of pentoxide-carbide mixture. The carbon was in the form of acetylene black, graphite, coaltar pitch and its coking products. The reagents were mixed, finely ground, pressed into briquettes and heated in vacuum with continuous weighing. Considerable differences were

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Some Peculiarities of the Carbon-Thermic Reduction of Niobium Pentoxide

found in the percent reduction vs. time (min) curves (Fig 1) for the various preparations of Nb_2O_5, previous heat treatment being an important factor since it alters the phase composition (as confirmed by an X-ray structural investigation carried out by S.I. Alyamovskiy). The T-phase, stable below 900°C, was found to be the most reactive as shown by the percent reduction vs. time (min) curves in Fig 2, of which curves 11 and 12 correspond to niobium-hydroxide calcining temperatures of 550 and 530°C respectively, 13 and 14 to 800°C, 15 and 16 to 900°C, 17, 18 and 19 to 1000°C and 20 to 1200°C. The curves show that the attainment of the NbO_2 stage does not correspond to slower reaction, and the authors attribute this to the disruption of grains in the first stage. The reduction proceeded rapidly at a pressure of 10^{-1} mm Hg, and even at 3-4 mm Hg. The presence of small amounts of potassium salts greatly accelerated the reduction, as did the use of a more finely divided reducing agent (Fig 4). Examinations were carried out on partially-reduced products: only Nb_2O_5, NbO_2 and NbC_x ($x = 0.86 - 0.89$) were found after reduction at 1050-1250°C, similar

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Some Peculiarities of the Carbon-Thermic Reduction of Niobium Pentoxide

conclusions being reached from other experiments. The authors recommend the technical adoption of a process in which the first stage is the production of a dioxide-carbide mixture from the low-temperature modification of Nb_2O_5 rather than the intermediate-carbide process. The reaction of a synthetic carbide (11.4% C) with oxide was found to be very slow below 1250°C; on raising the temperature to 1350, 1500 and 1600°C successive stages of reduction are reached (Fig 5). Further tests showed that at 1750-1800°C and a pressure of 5×10^{-3} mm Hg, 98.8 - 99.8-% Nb sponge could be obtained by direct reduction of Nb_2O_5 with coaltar pitch, from an oxide-carbide mixture or by reduction of Nb_2O_5 with the highest carbide of niobium. The advantages of the second method were confirmed in larger-scale (up to 3 kg of niobium) experiments. There are 5 figures, 3 tables and 11 references, 9 of which are Soviet, 1 English and 1 German.

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SUBMITTED: June 30, 1958

AUTHORS: Petrushevskiy, M.S. and Gel'd, P.V. SOV/80-59-1-14/44

TITLE: Equilibrium of Carbon With Liquid Alloys of Fe, Mn, Si, C (Ravnovesiye ugleroda s zhidkimi splavami Fe, Mn, Si, C)

PERIODICAL: Zhurnal prikladnoy khimii, 1959, Nr 1, pp 86-95 (USSR)

ABSTRACT: The purpose of the present investigation was to determine the solubility of carbon in manganese and its alloys with iron and silicon at a temperature of 1,460°C. As materials for experimenting were used armco-iron, electrolytic manganese and commercial silicon (~98.5% Si). The following systems were investigated: Fe - Si - C; Mn - Si - C; Fe - Mn - C, and Fe - Mn - Si - C. The results obtained led to the conclusions: 1. It was established for the binary alloys Fe, Si and Mn, Si that at 1,460°C the coefficient of carbon activity increases with the rise of silicon concentration, and the rate of increase is higher in the former system. In the alloys of Mn, Fe an increase in manganese concentration leads to an insignificant lowering of this coefficient, f_C · 2. The study of carbon solubility in alloys Fe, Mn, Si has shown that also in this case the carbon activity coefficient rises with the increase in silicon concentration. The substitution of Fe with Mn leads practically to the linear decrease of this coefficient. 3. These relationships are explained by that the binding energy of silicon with iron is higher than that

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Equilibrium of Carbon With Liquid Alloys of Fe, Mn, Si, C

with manganese, while for carbon the reverse is the case. It turned out that the quantitative relations derived can be approximately described by the equations following from the theory of strictly regular solutions.
There are 8 graphs and 18 references, 9 of which are Soviet, 8 American, 1 German and 1 Japanese.

SUBMITTED: May 21, 1957

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SOV/148-59-2-10/24

18(3)

AUTHORS: Ryabov, R.A., Candidate of Technical Sciences, and Gel'd, P.V., Professor, Doctor of Technical Sciences

TITLE: The Effect of Alloying Elements on Hydrogen Permeability of Steels and Iron-Basis Binary Alloys (Vliyaniye legiruyushchikh elementov na vodorodopronitsayemost' staley i binarnykh splavov na osnove zheleza)

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Chernaya metallurgiya, 1959, Nr 2, pp 83-92 (USSR)

ABSTRACT: In order to complete existing data experiments were carried out for the purpose of determining the effect of carbon, chromium, silicon, manganese, and nickel on hydrogen permeability of steels and iron-basis binary alloys. Data obtained were compared with results of investigations carried out by A.A. Shcherbakova, P.L. Gruzin, V.K. Kritskaya, G.V. Kurdyumov, T.I. Stelletskaya, and V.A. Il'ina. The experiments proved that the majority of admixtures (such as C, Si, Cr, Mn and possibly Al), considerably reduced the hydrogen diffusion rate. On the one hand the admixtures

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The Effect of Alloying Elements on Hydrogen Permeability of Steels and Iron-Basis Binary Alloys

caused changes of interparticle interactions in the ferrite lattice and the local distortions of the energy spectrum of electrons; on the other hand distortion of the crystalline lattice, changes of inter-atomic spaces and of interstitial space dimensions took place. Carbon had a retarding effect on hydrogen diffusion, reducing the solubility and transiti possibilities of hydrogen. Chromium strengthened inter-particle bonds. Silicon caused considerable static distortion of the lattice and of the energy spectrum of electrons. Increased hydrogen permeability, observed in steel with Nb and Ti admixtures, was caused by decarbonization and not by the effect of the admixtures on the ferrite lattice. The alloying element had a negative effect on hydrogen permeability if, after having bound the carbon, it formed part of

The Effect of Alloying Elements on Hydrogen Permeability of Steels and Iron-Basis Binary Alloys

the solid solution. It was confirmed that in the investigated process the part of inter-granular hydrogen migration was unimportant and that diffusion characteristics were mainly determined by the transcrystalline hydrogen flow. The author presents graphs showing the dependence of hydrogen permeability on different admixtures.
There are 9 graphs and 27 references, 21 of which are Soviet, 4 German and 2 English

ASSOCIATION: Ural'skiy politekhnicheskiy institut (Ural Polytechnical Institute), Kafedra fiziki (Chair of Physics)

SUBMITTED: June 25, 1958

MATVEYENKO, I.I., inzh.; GEL'D, P.V., prof.; ALYAMOVSKIY, S.I., inzh.

Reduction kinetics of vanadium pentoxide by hydrogen.
Izv. vys. ucheb. zav.; chern. met. 2 no.4:13-21 Ap '59.
(MIRA 12:8)

1.Ural'skiy politekhnicheskiy institut i Ural'skiy filial Akademii nauk SSSR.
(Vanadium--Metallurgy) (Oxidation-reduction reaction)

GERTMAN, Yu.M., inzh.; GEL'D, P.V., doktor tekhn.nauk prof.

Thermochemistry of silicomanganese. Izv.vys.ucheb.zav.; chern. met. 2 no.9:15-27 S '59. (MIRA 13:4)

1. Ural'skiy politekhnicheskiy institut. Rekomendovano kafedroy fiziki Ural'skogo politekhnicheskogo instituta.
(Thermochemisty) (Silicon alloys) (Manganese alloys)

18(6) SOV/78-4-5-27/46

AUTHORS: Kocherov, P. V., Gertman, Yu. M., Gel'd, P. V.

TITLE: The Formation Heat of the Alloys of Calcium With Aluminum (Teploty obrazovaniya splavov kal'tsiya s alyuminiyem)

PERIODICAL: Zhurnal neorganicheskoy khimii, 1959, Vol 4, Nr 5, pp 1106-1112 (USSR)

ABSTRACT: The formation heat of the pure intermetallic compounds of calcium with aluminum ($CaAl_2$ and $CaAl_4$) was calculated.

The alloy was produced from the purest electrolytic twice distilled calcium and electrolytic aluminum. Melting of the components took place in the purest argon atmosphere. By means of radiostructural and metallographical investigations the composition of the alloy was determined and the results are shown by table 1. Determination of the formation heat of the alloys was carried out by means of an ordinary isothermal calorimeter, viz. by the differential method as follows: First the combustion heat of the alloy, and then

The Formation Heat of the Alloys of Calcium With Aluminum

the equivalent combustion heat after composition of the mechanical mixtures of calcium and aluminum was investigated. From the difference between the average values the formation heat of the respective alloy was calculated. The accuracy of the method is 1.0 - 1.5 kcal/g-at. The combustion method, the oxidation heat of the purest metals, as well as the six alloys and their corresponding mechanical mixtures were investigated. The results obtained by calorimetric determinations carried out by the combustion method are shown by table 2. The combustion heat of the alloys and the mechanical mixtures of calcium and aluminum are shown by figure 3. For $\Delta H_{Al_2O_3}$ - 399 kcal/g-mol Al_2O_3 was found. This value agrees well with data found in publications; $\Delta H_{Al_2O_3}$ = -400±2.0 kcal/g-mol Al_2O_3. The dissolution heat of calcium and aluminum and of their alloys in 5 n hydrochloric acid was investigated. The

results obtained are shown by table 3 and figure 4. Figure 5 is a graphical representation of the formation heats of calcium- and aluminum alloys of various composition according to the combustion- and dissolution method. The experimentally obtained values agree well with those found in publications. The following values were found for the formation heat of the intermetallic compounds $CaAl_2$ and $CaAl_4$:

$\Delta H^{22.5^\circ}_{CaAl_2} = -17.5 \pm 1.5$ kcal/g-at and

$\Delta H^{22.5^\circ}_{CaAl_4} = -10.3 \pm 1.0$ kcal/g-at.

There are 5 figures, 3 tables, and 13 references, 2 of which are Soviet.

18(3), 24(6) SOV/170-59-6-13/20

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

TITLE: Effect of Carbon on Hydrogen Diffusion in Steel

PERIODICAL: Inzhenerno-fizicheskiy zhurnal, 1959, Nr 6, pp 88-90 (USSR)

ABSTRACT: Experimental data obtained previously by the authors [Refs 1, 2] indicate that the constant of permeability and the coefficient of diffusion of hydrogen in carbon steels decrease rapidly with an increase in carbon content. In the present paper the authors compare these experimental data with an equation of generalized permeability derived by Odelevskiy [Ref 3]. However, the use of his equation, Formula 4 in the text, necessitates the knowledge of permeability of cementite as well as that of ferrite. As the characteristics of cementite are not yet available, only relative permeabilities of steels were compared instead of absolute ones. The results are presented in Figure 1 in which the values of relative permeability Ψ were plotted versus the volume concentrations of ferrite. The results of measurements agree with Odelevskiy's formula under assumption that the permeability of

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cementite amounts to 4 or 5% of that for ferrite. The relationship found is characteristical only for the hydrogen permeability through steels of a definite structure, namely those containing lamellar perlite.
There are: 1 graph and 3 Soviet references.

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

24(3), 24(2), 18(3) SOV/126-7-2-37/39

AUTHORS: Gol'dberg, A. I., Lipatova, V. A. and Gel'd, P. V.

TITLE: The Effect of Decomposition of Leboite on Electrical Properties of Iron-Silicon Alloys (Vliyaniye raspada leboita na elektricheskiye svoystva splavov zheleza s kremniyem)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1959, Vol 7, Nr 2, pp 316-317 (USSR)

ABSTRACT: Leboite and disilicides of chromium and manganese exhibit semiconducting properties (Refs 1-6). These properties, in conjunction with their low thermal conductivity (Refs 3,7), give a special interest to these materials. For this reason the authors studied the effect of composition on the thermoelectric power, the Hall constant and electrical conductivity of FeSi-Si alloys. Measurements were carried out at room temperature on cast cylindrical samples. To obtain the high-temperature modification (α-leboite) the samples were annealed for four hours at 1000°C and then quenched in water. To stabilize β-leboite, raw samples were annealed for 10-12 hours at 800°C and then cooled gradually to room temperature. The Hall e.m.f. was

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measured at applied magnetic fields from 17000-25000 oersted. The electrical resistance and thermoelectric power were measured simultaneously with the Hall effect by a method described earlier (Ref 1). It was found that electrical properties of iron-silicon alloys are very sensitive to the phase state of leboite. This is due to the fact that the high-temperature α-phase has an electrical resistivity, Hall constant and thermoelectric power, about three orders lower than those of the low-temperature modification (β-leboite). Thermoelectric power α depends strongly on the alloy composition. It is comparatively small at low contents of leboite but rises strongly on approach to the stoichiometric composition of β-leboite and then falls rapidly, changing its sign above 55 wt.% of Si. At its maximum the value of α reaches 0.035 mV/°C. Other properties of these alloys also depend strongly on composition. In particular (Fig 1) the 20°C isotherms of electrical resistivity (ρ) and the Hall constant (R_x),

The Effect of Decomposition of Leboite on Electrical Properties of Iron-Silicon Alloys

are similar to the thermoelectric power isotherm. The maxima of α, ρ and R_x occur at practically the same composition. The high values of α, ρ (max. of 2.0 Ohm.cm) and R_x (max. of 20 c.g.s, units) confirm that β-leboite is a semiconductor. In alloys containing up to 55 wt.% of Si, the hole mechanism of conductivity predominates; the hole density is of the order of $(3-5) \times 10^{18}$ cm^{-3} and their mobility is of the order of 1 cm^2 sec^{-1} V^{-1}. Alloys with more than 55 wt.% of Si have predominantly electron conductivity. Electrical properties of alloys containing α-leboite are quite different. Up to the point when Si separates out (55 wt.% of Si) alloys with α-leboite exhibit low thermoelectric power, electrical resistivity and Hall constant (Fig 2). This indicates that the semiconducting properties are lost on transition from β-leboite to α-leboite. A certain scatter of values of electrical conductivity of quenched samples (with α-leboite) is due to microcracks which are produced by large volume changes on transition to α-leboite.

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The Effect of Decomposition of Leboite on Electrical Properties of Iron-Silicon Alloys

There are 2 figures and 9 Soviet references.

(Note: This is an abridged translation)

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

SUBMITTED: February 19, 1958

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67727

AUTHORS: Igishev, V. M. and Gel'd, P. V. SOV/126-7-3-34/44

TITLE: Temperature Dependence of the Electrical Conductivity of Leboite (Temperaturnaya zavisimost' elektroprovodnosti leboita)

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 7, Nr 3, pp 463-465 (USSR)

ABSTRACT: Earlier studies of the properties of Leboite (Ref 1) showed that it can exist in two modifications: a low-temperature β-form and a high-temperature α-form. The β-form, stable below 950°C, is a semiconductor. The α-form exhibits metallic conduction. All these data were obtained at room temperature. The present paper reports an extension of earlier work to a wider range of temperatures; the authors measured the electrical conductivity of leboite between 20 and 1000°C. Leboite was prepared from silicon with less than 0.03% of impurities and from electrolytic iron. For the sake of comparison one sample was prepared from technical materials: silicon of Kr-0 grade and transformer steel. Samples of 50 mm length and 3 mm diameter were prepared by sucking-in molten leboite into quartz tubes. Some of the samples were annealed at

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SOV/126-7-3-34/44

Temperature Dependence of the Electrical Conductivity of leboite

600°C for 20 hours in order to stabilize β-leboite. Other samples were subjected to homogenising annealing at 1100°C and subsequent quenching; this was done in order to fix the α-leboite structure. The electrical conductivity was measured by the usual compensation circuit. During measurement samples were heated in an atmosphere of purified nitrogen. The results are shown on a semi-logarithmic scale in Fig 1, where log σ is plotted against $10^3/T$. The even-numbered curves give the temperature dependence of the conductivity of stabilized samples and the odd-numbered curves give the characteristics of quenched samples. The even-numbered curves show that the electrical conductivity of β-leboite rises rapidly with temperature. The comparatively low electrical conductivity and the positive temperature coefficient confirm the semiconducting nature of β-leboite. The forbidden band width of β-leboite is 0.2 eV at room temperature and is not very sensitive to the silicon

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Temperature Dependence of the Electrical Conductivity of Leboite

content (curves 2, 4, 6) and the amount of impurities present (curve 8). Near the limit of stability of β-leboite the forbidden band width reaches 1.0-1.3 eV. The odd-numbered curves confirm the metallic nature of the conduction of α-leboite; its resistivity is comparatively small both in the case of samples prepared from pure materials (curves 1, 3, 5) and in the case of samples made from technical materials (curve 7). Quenched α-leboite was stable up to about 600-650°C. At higher temperatures it decomposed into β-leboite and silicon and its resistivity increased. The rate of transformation from α into β-form rose rapidly near 750-800°C which agreed well with earlier (dilatometric) results (Ref 4).
There are 1 figure and 4 Soviet references.

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

SUBMITTED: June 7, 1958

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4

SOV/126-7-4-18/26

AUTHORS: Krasovskaya, A.K. and Gel'd, P.V.

TITLE: Distribution of Chromium in Sulphide Scale on Iron-Chromium Alloys

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 7, Nr 4, pp 626-627 (USSR)

ABSTRACT: By means of X-ray and metallographic analysis, the authors studied the scale formed on iron-chromium alloys containing from 1 to 29% Cr held for 2 to 6 hours at 800°C in the presence of sulphur vapour. They found that scale formed under these conditions consisted of two layers: a surface layer and an under-layer with chromium in the form of $FeCr_2S_4$ (spinel), concentrated mainly in the outer part of the under-layer. In alloys containing less than 4% Cr, the $FeCr_2S_4$ grains were so small that they were not resolved at 600 magnification. They became larger (0.03 to 0.05 mm) in alloys containing 4 to 12% Cr, while in alloys with the chromium content higher than 12%. a continuous layer of $FeCr_2S_4$ was formed, separating the outer and the inner layers of the scale. A micro-photograph of scale formed on an alloy containing 17% Cr is reproduced in Fig 1, showing: A - the outer

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Distribution of Chromium in Sulphide Scale on Iron-Chromium Alloys

layer; B - the continuous layer of $FeCr_2S_4$; V - the under-layer. The temperature dependence of electrical conductivity, σ, of this ($FeCr_2S_4$) part of the scale and of pyrrhotine (FeS) was determined, and it was found that: (1) the activation energy of the process in spinel is higher than that in FeS (0.2eV against 0.04eV); (2) the conductivity of spinel is low: at -186°C/σ_{spinel}:$\sigma_{pyrrhotine} \approx$ 10 - 30. Thus, it was shown that the resistance of high chromium content steels to the action of sulphur at high temperatures is due to the formation of a protective layer of $FeCr_2S_4$. Regarding the fact that this compound is formed not in the immediate vicinity of the metal but at the interface of the two scale layers, the authors offer an explanation based on the possibility of the formation of divalent and trivalent chromium cations. The inner layer of the scale is formed by the interaction between the sulphur atoms diffusing through the sulphide layer and the atoms of both iron and chromium. Under the conditions of intimate contact with the metal which acts as a reducing agent ($Me + M^{3+} \rightarrow 2Me^{2+}$), sulphide, containing mainly

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Distribution of Chromium in Sulphide Scale on Iron-Chromium Alloys

divalent cations, is formed. Since in this region of the system the iron content is higher than the chromium content, and the number of lattice defects in pyrrhotine is small, the concentration of trivalent chromium cations due to reaction $Fe^{2+} + Cr^{3+} \rightleftarrows Fe^{3+} + Cr^{2+}$ will be quite small. For this reason, and also due to isomorphism and similarity of the parameters of CrS and FeS (which form a continuous series of solid solutions), pyrrhotine alloyed with chromium is formed in this part of the scale. Diffusion of the Fe and Cr cations to the outer layer of the scale results (due to higher mobility of Fe^{2+} cations) in an increase of the concentration of the Cr cations in the inner layer of the scale. Owing to this and to the growing number of defects in pyrrhotine, as the diffusing Cr cations approach the outer part of the under-layer, they change their charge and become trivalent. With increasing concentration of the trivalent Cr cations in the sulphide lattice, favourable conditions are created for the formation of spinel. The authors conclude by drawing attention to the fact that at higher temperatures (at which the activation energy of the diffusion and

Distribution of Chromium in Sulphide Scale on Iron-Chromium Alloys

electrical conduction processes in spinel is comparatively high) the protective power of chromium diminishes. Thus, the ratio of constants characterising the rates of oxidisation of alloys with 1.09 and 17.46% Cr at 500°C is equal to 570 and at 800°C only 55, which means that with rising temperature the permeability of the sulphide spinel increases more rapidly than that of pyrrhotine. There is 1 figure and 4 references, 3 of which are Soviet and 1 German.

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

SUBMITTED: May 16, 1958

SOV/126-7-5-16/25

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

TITLE: Relationship Between the Structural and Diffusion Properties of Steels (Svyaz' strukturnykh i diffuzionnykh kharakteristik staley)

PERIODICAL: Fizika metallov i metallovedeniye, Vol 7, Nr 5, pp 732-741 (USSR)

ABSTRACT: The authors undertook a detailed study of the dependence of the rate of hydrogen penetration through steel on the conditions under which the second transformation step is brought about. The rate of hydrogen penetration J was determined by measuring the quantity of hydrogen M passing through a flat steel membrane of thickness e and cross-sectional area s in time τ by the formula $J = M/\tau s$ (Ryabov, Ref.5); hence the penetration constant

$$P = Je/\sqrt{p_1}$$

where p_1 is the hydrogen pressure on entering the membrane. An apparatus was used consisting of a hydrogen generator,

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Relationship Between the Structural and Diffusion Properties of Steels

a diffusion block with the specimen and a vacuum block for de-gassing the apparatus at the beginning of the experiment as well as for measuring the quantity of hydrogen diffused (Fig.2). The results of the study of steel 3KhN3M which tends to develop the second transformation step are shown in Fig.3. In Fig.4 the influence of temperature on the penetration of hydrogen through the steel 3KhN2M is shown. Measurements were carried out during cooling. In Fig.5 the dependence of hydrogen penetration through steel 9Kh2V on temperature is shown. Measurements were taken during cooling. Fig.6 shows the influence of the temperature from which steel 34KhN2M is cooled on hydrogen penetration. Measurements were carried out during cooling. Fig.7 shows the influence of temperature and thermal history of the specimen on the penetration of hydrogen through steel 20Kh2N4A. Measurements were carried out during cooling. Fig.8 shows isobars of hydrogen penetration through the steel 40KhNMA. The authors arrive at the following conclusions:

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1. In temperature ranges in which an intense decomposition of austenite takes place the constant of hydrogen penetration in steel sharply increases with simultaneous decrease in the

Relationship Between the Structural and Diffusion Properties of Steels

activation energy of the process.
2. In different steels the completeness of austenite decomposition in the first step and hence the extent of decomposition in the second step are different and can be determined by the chemical composition of the steel as well as by its cooling rate. These relationships are fully reflected in the curves representing the temperature dependence of the constant of hydrogen penetration through steel. This enables the use of this method for the study of structural transformations in steels on the one hand, and on the other (and this is in practice more important) it enables the influence of various types of thermo-mechanical treatment of steels on their gas saturation to be estimated.
There are 8 figures and 14 references, of which 11 are Soviet, 2 English and 1 German

ASSOCIATION: Ural'skiy politekhnicheskiy institut imeni S. M. Kirova (Urals Polytechnic Institute imeni S. M. Kirov)

SUBMITTED: May 17, 1957

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66239
SOV/126-8-3-26/33

AUTHORS: Sidorenko, F.A., Gel'd, P.V. and Dubrovskaya, L.B.

TITLE: On the Type of Defects in α-Leboite

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 3, pp 465-466 (USSR)

ABSTRACT: In view of the fact that the lattice parameters decrease with increase in silicon content in the γ_α-phase (α-leboite) of the Fe-Si system, the assumption was made by Phragmen (Ref 1) that iron bi-silicide-base substitutional solid solutions are formed. A precise determination of the densities of leboite alloys and their lattice parameters have, however, led to results which contradict this assumption. An investigation has been carried out with alloys prepared in a tungsten vacuum furnace from pure (99.95% Si) silicon and P-4 carbonyl iron. The alloys were homogenized in vacuum at 1080° C for 100 hours. The densities of powders, crushed in an agate mortar, were measured by a pycnometric method in an evacuated pycnometer. The lattice parameters were determined with a RPC-3 camera. Their dimensions for alloys of different compositions (see Table) show that the phase under investigation is stable in the concentration

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Ural Polytechnic Inst. im S. M. Kirov

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On the Type of Defects in α-Leboite

range 53.5 to 56.5% Si, which agrees with Haughton and Becker's data (Ref 2). From the density and lattice parameters the number of atoms of iron and silicon per unit cell have been calculated (see Table). It was found that in the whole α-leboite range there are almost exactly 2 atoms of silicon (1.99) per unit cell and the number of atoms of iron decreases steadily from 0.87 (53.5% Si) to 0.77 (56.5% Si) which points to the formation of holes in the iron sublattice. A comparison between X-ray and experimental densities confirms the above conclusion. X-ray determination of thermal expansion coefficients along the axes of the α-leboite lattice has shown that the expansion coefficients increase on transition to low-iron leboite; the expansion coefficient increases particularly in the (001) planes along iron atoms which corresponds to the hole model structure of the β α-phase. There are 1 table and 2 English references.

Card 2/3 n.b. This is a complete translation, except Table.

18.8100, 24.7600

66242

SOV/126-8-3-30/33

AUTHORS: Gol'dberg, A.I., Lipatova, V.A. and Gel'd, P.V.

TITLE: The Electrical Conductivity and the Hall Effect in Alloys of Iron and Silicon, Containing Leboite, at High Temperatures

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 3, pp 472-475 (USSR)

ABSTRACT: In an earlier paper (Ref 1) the authors reported their results of investigation of the electrical properties of β-leboite at room temperature; it was concluded that, in contrast to the α-phase, the β-phase is a semiconductor. To check this conclusion, the authors studied the temperature dependence of the electrical conductivity and the Hall effect of alloys of iron and silicon containing from 40 to 80% Si (by weight) at temperatures from 20 to 350°C. The alloys were prepared in an induction furnace using silicon of Kr.0 grade and Armco iron. Samples were prepared by sucking in the melt into quartz capillaries of 2.5 to 4.0 mm diameter. The low-temperature modification of leboite was obtained by annealing at 800°C (Ref 2,3). All measurements were carried out employing the usual compensation apparatus and pressure contacts. It was found that alloys with more than 45% Si exhibit the typical

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The Electrical Conductivity and the Hall Effect in Alloys of Iron and Silicon, Containing Leboite, at High Temperatures

semiconductor type of variation of the electrical resistance with temperature. The exponential dependence of the resistance on temperature is particularly clear in samples containing 49 to 51% Si. These samples are closest in their composition to the β-phase. Moreover, their compositions are the same as those at which maxima of the electrical resistance, the Hall constant and the differential thermo-electric power occur on the curves representing composition against property; such maxima are found both at room and at higher temperatures. Outside the leboite region, all samples also exhibit semiconducting properties but the latter are less pronounced. In alloys containing 40 to 45% Si metallic conductivity predominates. Fig 1 shows the experimental data obtained for some of the samples plotted in coordinates of log σ (σ is the conductivity) against T^{-1} (T is the absolute temperature). Fig 1 shows that the conductivity of samples containing 50 to 55% Si is considerably greater than that of all the other samples and that alloys with 49 to 51% Si have the lowest

The Electrical Conductivity and the Hall Effect in Alloys of Iron and Silicon, Containing Leboite, at High Temperatures

conductivity. From the straight lines of Fig 1, the following impurity-centre activation energies (in eV) were obtained (the values in brackets denote % Si by weight): 0.13 (48%), 0.20 (49,51), 0.18 (53), 0.17 (55), 0.13 (57), 0.12 (59), 0.08 (65), 0.04 (75,80). The latter values show that there is a maximum in the dependence of the activation energy on the amount of silicon at compositions close to that of β-leboite. The temperature dependence of the Hall constant was measured only for some of the samples since, in the case of others, no reliable values could be obtained because of high scatter. Magnetic fields of 10^4 Oe were applied during these measurements and two directions of the field and current were used. The results obtained are given in Fig 2 which shows that the absolute value of the Hall constant of all samples decreases with increase of temperature. This indicates that the impurity carrier density rises with increase of temperature. Samples with 49 to 51% Si have positive Hall constants, ie their

Card 3/5 conductivity is of the hole type. This conclusion agrees

The Electrical Conductivity and the Hall Effect in Alloys of Iron and Silicon, Containing Leboite, at High Temperatures

with earlier measurements of the thermoelectric power (Ref 1). Outside the leboite region, the Hall constant is negative and its sign is reversed at 53 to 54% Si. In the same region of concentrations a reversal of the sign of the differential thermoelectric power was observed earlier; it is due to the presence of silicon crystallites in the alloys. The measurements carried out can be used to estimate the values of the current-carrier density and mobility. For example, the carrier density in the alloys of leboite composition at room temperature was found to be 7×10^{18} cm^{-3}, assuming that the Hall constant R_x is given by $R_x = 1/ne$. The current-carrier mobility for the same alloys amounted to 0.7 $cm^2 sec^{-1} v^{-1}$. The authors conclude that the results reported above confirm the earlier suggestion (Ref 1) of semiconducting properties of the low-temperature modification of leboite. There are 2 figures and 3 Soviet references.

Card 4/5 n.b. This is a complete translation except for figures.

5.4700,18.8100

77132
SOV/148-59-9-2/22

AUTHORS: Gertman, Yu. M. (Engineer), Gel'd, P. V. (Doctor of Technical Sciences, Professor)

TITLE: Concerning the Thermochemistry of Manganese-Silicon

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, 1959, Nr 9, pp 15-27 (USSR)

ABSTRACT: An investigation of the change of enthalpy during the formation of some solid silicides and also of the heats of mixing liquid manganese and silicon. Some data regarding the specific heats and heats of melting silicides of manganese were published before. The dependence of the activity of silicon and manganese on the composition of melts Mn-Si-C, Mn-Si, and Mn-Fe-Si-C was studied previously by O. A. Yesin, N. A. Vatolin, V. A. Kozheurov, N. I. Sablin and B. P. Burylev. The electrolytic manganese (about 0.01% C; about 0.01% P; 0.05% S) of Zestafoni Ferroalloy Plant (Zestafonskiy ferrosplavnoy zavod) and crystalline silicon (98.5% Si; 0.8% Fe; 0.5% Al; 0.2% Ca) of Chelyabinsk Ferroalloy Plant (Chelyabinskiy ferrosplavnoy zavod) were used for the experiments. The flakes of electrolytic manganese

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were subject to the preliminary melting in corundum crucibles in the argon atmosphere. The same crucibles were used for the preparation of synthetic alloys Mn-Si of different compositions. The heats of formation of solid solutions (at 20° C) were determined by the method of burning, that is, by the difference of heats of burnt alloy and of burnt mixture of pure components of the same composition. The determination of the heat of formation of solid silicides of manganese (Fig 2), of the heat of mixing liquid manganese and silicon (Fig 4 and Fig 6), and also of the heat of dissolving silicon in the liquid ferromanganese and in ferrosilicomanganese (Figure 7) are discussed. During the study of the heat of formation of solid manganese silicides, it was found that for the monosilicide $\Delta H = -17.0$ kcal/mole. The study of the heat of mixing of liquid manganese and silicon showed that the "first heat" of mixing is close to 25 kcal/mole. The integral heat of mixing changes in accordance with the composition, reaching a maximum (-9.3 kcal/g atom) for equiatomic alloy. The authors advanced an idea

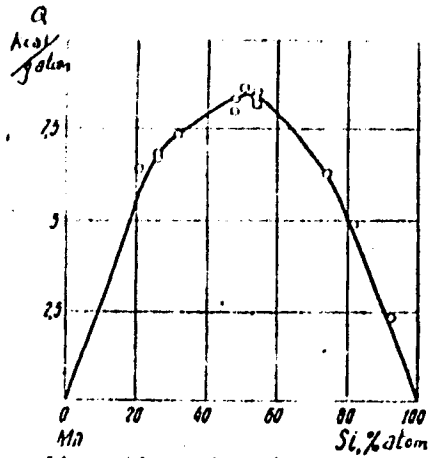

Fig. 2. The heat of formation of solid alloys of manganese and silicon at 20° C.

regarding the microheterogeneity of the melt and the presence in it of "sibotaxis," enriched by the twin complexes MnSi. (Abstracter's Note: The word "sibotaxis" is unknown in American or Russian scientific literature. The following may be probable components of this synthetic work, as obtained from the Webster's Dictionary: Taxis (Greek) -arrangement, order; cibation-a process of feeding with fresh material during the course of operation. Therefore

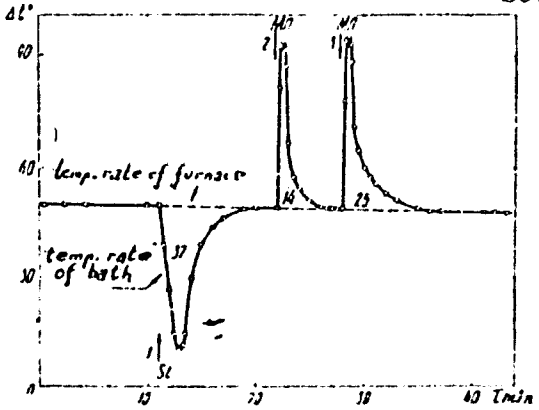

Fig. 4. The change of temperature of liquid silicon with consecutive addition to it of one portion of silicon and two portions of manganese.

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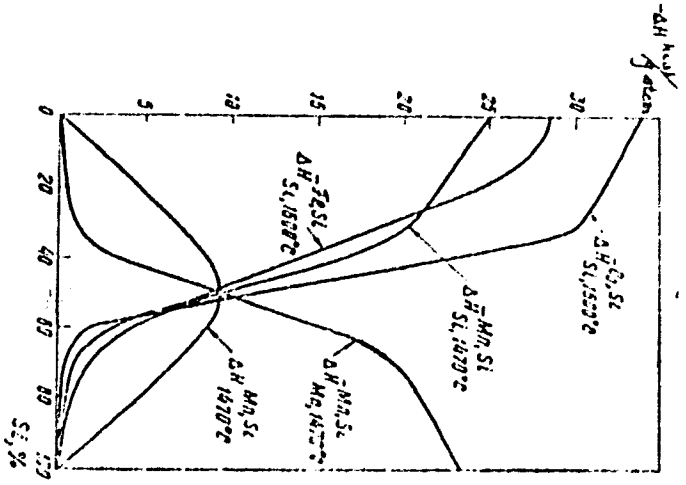

Fig. 6. A comparison of concentration relationship of partially molar heat content of silicon in its alloys with iron (1,600° C), cobalt (1,600° C), and manganese (1,470° C).

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Concerning the Thermochemistry of Manganese-Silicon

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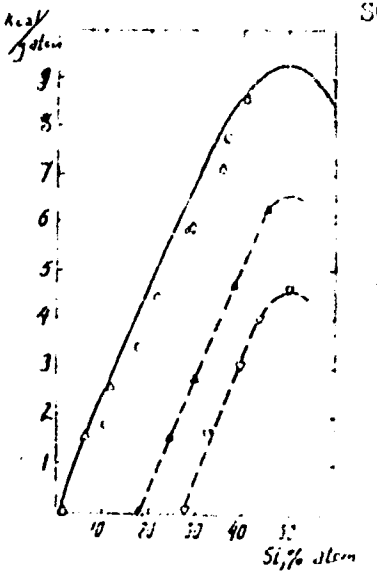

Fig. 7. The heats of mixing liquid silicon with commercial manganese, ferromanganese, and silicomanganese. Solid line--a characteristic of the pure Mn-Si system.

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"sibotaxis" probably is the author's version of an idea of microheterogeneity of the melt and of a continuous feeding of same with fresh material enriched by the twin complexes MnSi). In this connection it is noted that there is a rather limited applicability of the theory of regular solutions to the properties of the studied systems. It was shown that the "first heats" of dissolving the silicon in commercial manganese, ferromanganese, and manganese-silicon (taking into account the silicon which is present in them) differ very little from those established for the synthetic alloys Mn-Si, amounting to 25-26 kcal/mole. There are 7 figures; 4 tables; and 20 references; 13 Soviet, 4 German, 1 Belgian, 2 U.S. The U.S. references are: Chipman, J., Grant, N., Trans. Amer. Soc. Metals, 31, 365, 1943; Naylor, B. F., J. Chem. Phys., 13, 329, 1945.

ASSOCIATION: Ural Polytechnic Institut (Ural'skiy politekhnicheskiy institut)

SUBMITTED: April 20, 1959

SUCHIL'NIKOV, S.I.; GEL'D, P.V., doktor tekhn.nauk

Certain peculiarities in the roasting of molybdenum concentrates.
Trudy Ural.politekh.inst. no.75:219-232 '59.
(MIRA 13:4)

(Molybdenum--Metallurgy)

KUSENKO, F.G.; GEL'D, P.V.

Heat capacity and changes of the isothern-isobar potential during the formation of niobium dioxide. Trudy Ural. politekh. inst. no.92:121-124 '59. (MIRA 13:12)
(Niobium oxide--Thermal properties)

ALYAMOVSKIY, S.I.; GEL'D, P.V.; SHVEYKIN, G.P.

Niobium carbides. Trudy Ural. politekh. inst. no.92:125-134 '59.
(MIRA 13:12)

(Niobium carbide)

KOCHEROV, P.V.; GEL'D, P.V.

Elasticity of calcium vapors above fused calcium - aluminum systems.
Trudy Ural. politekh. inst. no.92:141-146 '59. (MIRA 13:12)
(Aluminum alloys) (Vapor pressure)

PHASE I BOOK EXPLOITATION SOV/4548

Akademiya nauk SSSR. Komissiya po fiziko-khimicheskim osnovam proizvodstva stali

Primeneniye vakuuma v metallurgii (Use of Vacuum in Metallurgy) Moscow, Izd-vo AN SSSR, 1960. 334 p. Errata slip inserted. 4,500 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut metallurgii imeni A.A. Baykova. Komissiya po fiziko-khimicheskim osnovam proizvodstva stali.

Resp. Ed.: A.M. Samarin, Corresponding Member, Academy of Sciences USSR; Ed. of Publishing House: G.M. Makovskiy; Tech. Ed.: S.G. Markovich.

PURPOSE: This collection of articles is intended for technical personnel interested in recent studies and developments of vacuum steelmaking practice and equipment.

COVERAGE: The book contains information on steel melting in vacuum induction furnaces, and vacuum arc furnaces, reduction processes in vacuum, and degassing of steel and alloys. The functioning of apparatus and equipment, especially vacuum furnaces and vacuum booster pumps is also analyzed. Personalities are mentioned in connection with some of the articles and will appear in the Table of Contents. Three articles have been translated from English. Some of the

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29036
S/081/61/000/018/007/027
B104/B101

18.7540

AUTHORS: Gel'd, P. V., Kocherov, P. V.

TITLE: Regulation of liquid calcium - aluminum alloys

PERIODICAL: Referativnyy zhurnal. Khimiya, no. 18, 1961, 51, abstract 18B363 (Sb. "Stroyeniye i svoystva zhidk. metallov". M., 1960, 194 - 199)

TEXT: The enthalpy of two Ca-Al alloys containing 42.55 and 24.3% by weight of Ca was investigated as a function of temperature in the range of ~200 - 1200°C. According to its composition, the first of these alloys is similar to the congruently melting compound $CaAl_2$ (melting point 1079°); the second is similar to the incongruently melting compound $CaAl_4$ (melting point 700°C). Results of measurements were compared with quantities calculated according to the additivity rule. To explain the divergences obtained it is assumed that during the melting process of the intermetallic compounds and during superheating a considerable change of the potential energy of the atoms occurs. This is caused by a change of the degree of

Card 1/2

Regulation of liquid...

order of fusion and by a change of the distance between particles and their interaction. [Abstracter's note: Complete translation.]

Card 2/2

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77767
SOV/148-60-1-30/34

AUTHORS: Sidorenko, F. A., Gel'd, P. V.

TITLE: Concerning the Structure of High-Temperature Leboite

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, 1960, Nr 1, pp 171-174 (USSR)

ABSTRACT: The electric properties of leboite, i.e., semiconducting ζ (α-phase in Fe-Si system, are very sensitive to changes in the composition and alter abruptly at the transformation from high- to low-temperature modifications. According to G. Phragmen and other investigators, leboite of about $FeSi_2$ composition is tetragonal; its space group is D_{4h}^1 = P4/mmm; 1 molecular weight per unit cell; some Fe positions are occupied by Si atoms. The authors produced technically pure and highly pure leboite specimens of $FeSi_2$ composition (51.1 to 53% Si) by melting 99.95% pure silicon with iron carbonyl in quartz crucible placed in tungsten furnace in 0.001 to

Card 1/2

0.0001 mm vacuum, powdered the specimens, homogenized in vacuum at 1,050° C for 75 hrs, hardened in air and took powder diffraction photographs with camera VRS-3 and Co radiation, or with camera URS-50I and Fe radiation. Some specimens were powdered again and annealed at 1,050° C before taking the diffraction photographs. No difference in the diffraction intensity of different specimens was evident at visual inspection if photographs had been taken with VRS-3 and Co radiation. On the other hand, the intensity differences of different diffraction lines could be measured having taken the diffraction photographs from powder layers in slides with camera URS-50I and Fe radiation. The unit cell dimensions were found to be a = 2.69 kX and c = 5.13 kX; the Si-to-Si interatomic distance = 2.26 kX and Si-to-Fe = = 2.38 kX. There are 2 figures; 2 tables; and 6 references, 5 Soviet, 1 U.K. The U.K. reference is G. Phragmen, J. Iron and Steel Inst., 114, 397-403, 1926.

ASSOCIATION: Ural Polytechnic Institute (Ural'skiy politekhnicheskiy institut)

SUBMITTED: November 17, 1958

APPROVED FOR RELEASE: 08/23/2000 CIA-RDP86-00513R000514620001-2"

KOCHEROV, P.V.; GEL'D, P.V.

Equilibrium of gaseous calcium with Ca-Al alloys. Izv. vys. ucheb. zav.; chern. met. no.2:59 '60. (MIRA 15:5)

1. Ural'skiy politekhnicheskiy institut.
(Vapor-liquid equilibrium)
(Intermetallic compounds)

69656

5.2200(T)
5.4700

S/180/60/000/02/012/028
E111/E135

AUTHORS: Gel'd, P.V., and Kusenko, F.G. (Sverdlovsk)

TITLE: Heat Content and Specific Heat of Niobium Oxides and Carbides at High Temperatures

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, Nr 2, pp 79-86 (USSR)

ABSTRACT: The authors outline the present partly unsatisfactory position on the specific heats and heats of formation of substances involved in the increasingly important carbothermic process for the reduction of niobium oxides. Table 1 compares heat-of-formation values given by various workers (Refs 12-16), showing considerable differences. They go on to describe their own investigation of the heat contents of niobium oxides and carbides at 273 to 1840 °K. The niobium pentoxide used for preparation was purified by fractional precipitation and vacuum heating. Lower oxides were prepared by vacuum heating of briquettes made of this with niobium, finally at 1800 °C. Chemical compositions were determined as described by Gurevich and Ormont (Ref 19) for V - C - O; phase compositions by X-ray diffraction with a type RKD

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E111/E135

Heat Content and Specific Heat of Niobium Oxides and Carbides at High Temperatures

camera. For temperatures up to 1500 °K the classical method of mixtures was used, the apparatus and differential method being as described by Serebrennikov and Gel'd (Ref 21), with 12-g samples, carefully degassed, sealed in a Pt - 10% Rh capsule. Experimental errors are estimated as not exceeding 0.8-1.0%. For determinations at 1500-1840 °K a vacuum high-temperature calorimeter was used, the thermal equivalents of both calorimeters being determined electrically against the reliably known (Refs 22, 23) thermal capacity of corundum. Heat capacities of capsules were found in a special series of experiments. As previously (Ref 21) experiments at 0-25 °C were carried out to convert ΔH values to 298.16 °K. The heat contents for Nb_2O_5 are shown in Table 3. The authors represent their data which relate to the high-temperature modification, by

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$$\Delta H^T_{298.16} = 38.76\ T + 1.77 \cdot 10^{-3} T^2 + 7.318 \cdot 10^5 T^{-1} - 14162 \quad \text{(Eq 1)}$$

Heat Content and Specific Heat of Niobium Oxides and Carbides at High Temperatures

and compare (Fig 2) their results with those of Orr (Ref 18). The same Table gives the data for NbO_2; they are represented in Fig 3. The relation is

$$\Delta H^T_{298.16} = 14.681\,T + 3.078\cdot10^{-3}T^2 + 2.421\cdot10^5T^{-1} - 5460 \quad \text{(Eq 4)}$$

while above 1080 °K it is

$$\Delta H^T_{298.16} = -8060 + 21.28T \quad \text{(Eq 6)}$$

The results for NbO and Nb are shown in Table 4 and Fig 4. The relations are represented by, respectively,

$$\Delta H^T_{298.16} = 10.04T + 1.175\cdot10^{-3}T^2 + 0.783\cdot10^5T^{-1} - 3359 \quad \text{(Eq 8)}$$

and

$$\Delta H^T_{298.16} = 5.60T + 0.655\cdot10^{-3}T^2 - 1727 \quad (10)$$

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The latter relates to a sample with 0.5% by weight of dissolved and combined oxygen. For carbides the results

Heat Content and Specific Heat of Niobium Oxides and Carbides at High Temperatures

are shown in Tables 5 and 6 and Fig 5. The relationships are:

$$Nb\,C_{0.50}: \Delta H^{T}_{298.16} = 7.94T + 0.750\cdot10^{-3}T^2 + + 1.025\cdot10^{5}T^{-1} - 2776 \quad (14)$$

$$Nb\,C_{0.749}: \Delta H_{298.16} = 8.95T + 1.127\cdot10^{-3}T^2 + + 1.26\cdot10^{5}T^{-1} - 3190 \quad (16)$$

$$Nb\,C_{0.867}: \Delta H_{298.16} = 9.70T + 0.995\cdot10^{-3}T^2 + + 1.51\cdot10^{5}T^{-1} - 3485 \quad (18)$$

$$Nb\,C_{1.00}: \Delta H^{T}_{298.16} = 10.79T + 0.863\cdot10^{-3}T^2 + + 2.15\cdot10^{5}T^{-1} - 4013 \quad (20)$$

The authors point out that their data together with available data can be used for thermodynamic calculations on equilibria in the systems Nb - C - O and Nb - H - O and related ones.

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69656

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E111/E135

Heat Content and Specific Heat of Niobium Oxides and Carbides at High Temperatures

There are 5 figures, 6 tables and 24 references, of which 12 are Soviet, 10 English and 2 German.

Card 5/5

SUBMITTED: November 30, 1959

IGISHEV, V.N.; GEL'D, P.V.

Electric conductivity of solid silicon solutions in iron at high temperatures. Izv. vys. ucheb. zav.; chern. met. no.2: 90-94 '60. (MIRA 15:5)

1. Ural'skiy politekhnicheskiy institut.
(Iron-silicon alloys—Electric properties)
(Metals at high temperatures)

GEL'D, P.V.

82440

S/149/60/000/004/003/009

5.2200

AUTHORS: Kusenko, F.G., Gel'd, P.V.

TITLE: On Some Properties of NbO_2

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Tsvetnaya metallurgiya, 1960, No. 4, pp. 102-106

TEXT: In a paper published recently on the heat capacity of NbO_2 within a temperature range of 298-1,500°K, the authors assumed that there was a phase transformation near 750°C. To check this assumption and to study the properties of NbO_2 near the temperature of the supposed transformation, the authors investigated the heat content, electric conductivity and thermal expansion of synthetic NbO_2 within 298-1,500°K. The NbO_2 compound was prepared from a briquetted mixture of purified niobium pentoxide and niobium metal powder, by annealing at 1,500°C in a tungsten vacuum furnace. The temperature dependence of the NbO_2 heat content was investigated by the differential mixing method. To protect the preparation from oxidation, it was placed in a platinum-rhodium alloy ampoule. The heat content of the empty ampoule and of one containing the sample was investigated in an adiabatic calorimeter. The temperature was measured by a potentiometer. Results of the experiments are shown in Graph 1. The temperature dependence of NbO_2 heat

Card 1/2

content up to 1,010°K can be expressed by the Mayer-Kelly formula (1): $\Delta H_{298}^{T} = -5460 + 14.681\ T + 3.078 \cdot 10^{-3}T^2 - 2.421 \cdot 10^{5}T^{-1}$. The temperature dependence of the NbO_2 heat capacity is described by formula (2): $C_p = 14.681 + 6.156 \cdot 10^{-3}T - 2.421 \cdot 10^{5}T^{-2}$. Above 1,080°K the heat content increases linearly with temperature up to 1,500°K. In the range of 1,010-1,080°K the heat content increases at an anomalously high rate, resembling temperature dependences of substances undergoing phase transformations of second order. The heat capacity increases rapidly but monotonously with raising temperature up to 1,010°K. It is constant over 1,080°K. Between 1,010 and 1.080°K a typical λ-point is observed. The data obtained indicate the possible phase transformation of NbO_2 near 750°C. To verify this, the temperature dependence of electric conductivity and thermal expansion of NbO_2 were studied. It was established that NbO_2 was a semiconductor whose energy gap changed from 0.66 ev at 298° - 715°K to 1.41 ev at 950°-1.050°K. The transformation of NbO_2 appears on a graph (3) where the curve $\sigma = \varphi(T)$ suffers an abrupt bend at 1.050°K. Dilatograms of two NbO_2 samples (Fig. 4) reveal clearly the changes in the temperature curves of expansion near 1.050°K. Consequently, the conclusion is drawn that NbO_2 undergoes a phase transformation near 1.040°K. There are 4 graphs and 9 references: 7 Soviet and 2 English.

ASSOCIATION: Ural'skiy politekhnicheskiy institut (Ural Polytechnic Institute)

SUBMITTED: September 18, 1959

85736
S/148/60/000/004/003/006
A161/A029

24.7700 1035, 1559, 1143

AUTHORS: Gol'dberg, A.I., Lipatova, V.A., Gel'd, P.V.

TITLE: Electrical Properties of the FeSi-Si Alloy System

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy - Chernaya metallurgiya, 1960, No. 4, pp. 121-127

TEXT: The low-temperature modification of the $\varepsilon\beta$-phase of the Fe-Si system has semiconductor properties, which has been proven before (Ref. 1.2), but the material investigated was of commercial purity. To get more accurate data an investigation has been carried out of alloys made of electrolytic iron and splinters of single crystal p-silicon molten in quartz crucibles in a high-frequency induction furnace. The alloys contained Al, Mg, Mn, Pb, Ni and Cr in a quantity not above 0.001 %. The conductivity, the Hall constant and thermoelectric motive force was measured in the temperature range from 20 to 400°C. A potentiometric device described in (Ref. 3) was used that makes simultaneous measurements of all these three characteristics possible. The data obtained are illustrated by graphs. Pronounced semiconductor properties of the $\varepsilon\beta$ - phase and electronic conductivity were proven. Alloys with 38 to 100 % Si had a low conductivity (Fig. 2) with positive temperature coefficient indicating

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Electrical Properties of the FeSi-Si Alloy System

semiconductor properties. Judging by polytherms (Fig. 2), alloys with high content of β-leboite were up to 350-400°C conductive through alloying constituents, and then eigenconductive in a relatively narrow temperature range. Alloys with higher Si content had a comparatively long characteristical transition range between 200°C and excitation of eigenconductivity at about 400°C. This agrees well with literature data (Ref. 4) on the properties of Si of different purity. In general, the characteristics of commercial alloys and pure alloys studied here are considerably different. First of all, the current carriers in β-leboite have different sign: commercial alloys have hole conductivity, and purer alloys electronic conductivity. This is directly connected with the Al content (about 0.2 % in commercial leboite), whose effect is known since long (Ref. 9). It is expected that p-n transfers may be obtained in β-leboite, e.g., by alloying it with aluminum, and that pure leboite can be utilized in couple with alloyed aluminum in thermocouples with high emf for temperatures measurements in high ranges up to 800-900°C in corrosive environment. Further investigations of the FeSi-Si system are necessary, mainly to determine the effect of different constituent elements and for the content

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A161/A029

Electrical Properties of the FeSi-Si Alloy System

of the semiconductive β-phase of leboite. There are 8 graphs and 9 references: 7 Soviet, 2 English.

ASSOCIATION: Ural'skiy politekhnicheskiy institut (Ural Polytechnical Institute)

SUBMITTED: July 14, 1959

Figure 2:
Polytherms of Electric Conductivity

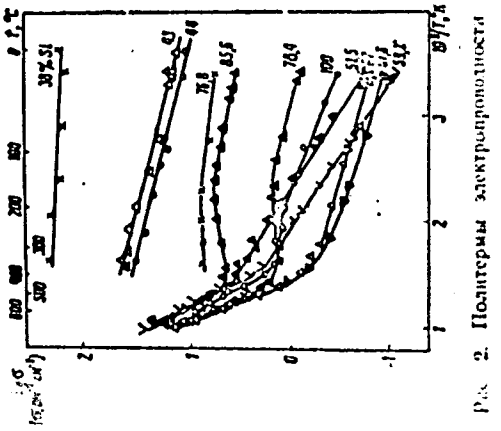

Рис. 2. Политермы электропроводности

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88042

S/139/60/000/006/004/032
E032/E314

9.4300 (and 1143, 1155)

AUTHORS: Korshunov, V.A. and Gel'd, P.V.

TITLE: The Electrical Resistivity and Thermoelectric Power of Magnanese-silicon Alloys. I. Technical Alloys Containing Mn_3Si and Mn_5Si_3

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 1960, No. 6, pp. 29 - 34

TEXT: Preliminary results of the work now reported were published in Ref. 4. It was shown there that some of these alloys have semiconducting properties. This conclusion was confirmed by Guseva and Ovechkin (Ref. 5) and Dorfman (Ref. 6) in the case of $CrSi_2$ and $MnSi_2$. The present paper reports data on the temperature dependence of the resistivity σ in the temperature interval 20 - 1 350 °C and the thermoelectric power α in the temperature interval 20 - 700 °C for alloys of technical Si and electrolytic Mn containing between 14 and 22% Si by weight. The alloys were prepared from electrolytic Mn (99.88% Mn; C, P, Al, Si, Ti approximately 0.01% each)

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S/139/60/000/006/004/032
E032/E314

The Electrical Resistivity and Thermoelectric Power of Manganese-silicon Alloys. I. Technical Alloys Containing Mn_3Si and Mn_5Si_3

and crystalline silicon of type KpO (KrO) (98.5% Si, ~ 0.5% Fe, ~ 0.2% Ca and ~ 0.2% Al). Weighed portions of these materials were placed in quartz containers and outgassed at 700 - 800 °C. The quartz containers were then sealed-off and the alloys were produced by heating in an induction furnace. The resistivity was measured both in solid and liquid states, using the method described by Regel' in Ref. 11. The resistivity was measured to an accuracy of 4-5%. In the case of the thermoelectric power measurements, temperature differences of the order of 10 °C were produced by special nichrome heaters. Thermal expansion corrections for σ were introduced in accordance with the method described by the present authors in Ref. 12. It was found that the temperature coefficient of resistivity changes from "metallic" to "semiconducting" at a temperature of about 500 °C. The

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E032/E314

The Electrical Resistivity and Thermoelectric Power of Manganese-silicon Alloys. I. Technical Alloys Containing Mn_3Si and Mn_5Si_3

semiconducting character of the curve representing the resistivity as a function of temperature is preserved on transition to the liquid state. Thermal e.m.f. studies showed that hole-type conductivity obtains. It is suggested that the current-carrier gas at room temperature is degenerate. There are 3 figures and 20 Soviet references.

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

SUBMITTED: January 14, 1960

Card 3/3

18.1200 1454, 1449 S/180/60/000/006/024/030 86704
E111/E335

AUTHORS: Gel'd, P.V., Korshunov, V.A. and Petrushevskiy, M.S. (Sverdlovsk)

TITLE: Some Peculiarities of Liquid Alloys of Silicon With Iron, Manganese and Chromium

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, No. 6, pp. 129 - 134

TEXT: The authors point out that the thermodynamic properties of liquid alloys of silicon with transition elements of the fourth period deviate substantially from the laws of both ideal and regular solutions (Refs. 1, 2). They class such silicide solutions as solutions with strongly interacting particles, whose theory has not yet been fully developed. Of the various models proposed to represent the structural characteristics corresponding to these features, the authors favour those envisaging a micro-heterogeneous structure with closest order. They cite evidence against the alternative model with uniform (statistical) particle distribution and survey critically

Card 1/3

Some Peculiarities of Liquid Alloys of Silicon With Iron, Manganese and Chromium

coefficient in Fe-Si-C than in Mn-Si-C (Ref. 18) (Fig. 3) is understandable in that iron atoms are more weakly combined with carbon particles (and more strongly with silicon) than manganese atoms. Because of the lower bonding energy of chromium with silicon and higher with carbon, the solubility of carbon in Fe-Cr-Si-C is higher (Fig. 4) than in the other systems considered; the influence of iron on chromium is also more pronounced. The differences in separation of carborundum crystals from the different melts is due to such effects. Of the authors, Gel'd has made many contributions in this field.
There are 4 figures and 18 references: 15 Soviet and 3 non-Soviet.

SUBMITTED: August 26, 1960

86705

18.1200 1454, 1449 S/180/60/000/006/025/030
E111/E335

AUTHORS: Gel'd, P.V. and Gertman, Yu.M. (Sverdlovsk)

TITLE: Interparticle Interaction in Liquid Alloys of Silicon with Iron and Nickel

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, No. 6, pp. 134 - 137

TEXT: Numerous studies of liquid alloys of silicon with transition metals of the fourth period have indicated that alloying is accompanied by a great increase in particle interaction. Gel'd et al (Refs. 1, 2) have proposed the formation of quasimolecules with directed bonds which produce the cybotactic microheterogeneous structure. This has been confirmed (Ref. 3). To obtain further information the authors determined density isotherms at 1500 °C for alloys of silicon with iron and nickel. Density, d, g/cm^3, as a function of vol. % iron (0-100) is shown in Fig. 1; density values are above additive throughout. On fusion silicon density rises

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E111/E335

Interparticle Interaction in Liquid Alloys of Silicon with Iron and Nickel

by about 9%, about double the reported rise for germanium (Refs. 6, 7) and fusion is probably associated with an increase in coordination number, delocalisation of valency electrons (Refs. 7, 9) and a large decrease in resistivity (Ref. 7). Density changes suggest that in silicon-high liquid alloys there are stable groupings structurally related to alpha-lebeauite and the ε-phase. Nickel silicon alloys provide a further illustration of the role of coordination. Here, the greatest deviation of density from the additivity relation occurs at compositions corresponding to the congruently melting Ni_2Si (Fig. 2). The comparatively small decrease in volume on forming the Ni-Si melt is understandable in terms of coordination effects