18(3)

AUTHORS: Yakovlev, V.V., Filippov, S.I., Arsent'yev, P.P., Surovtsev, G.S. SOV/163-58-4-3/47

TITLE: Intensification of the Steel Melting Processes Under the Influence of the Jet of the Oxidizing Agent (Intensifikatsiya staleplavil'nykh protsessov pri vozdeystvii strui okislitelya)

PERIODICAL: Nauchnyye doklady vysshey shkoly. Metallurgiya, 1958, Nr 4, pp 17 - 22 (USSR)

ABSTRACT: The conditions for a rational air-blast supply into the metal furnace are experimentally investigated by considering, firstly, utilization of the possibilities offered by blast oxidation and, secondly, regulation of both sequence and speeds in the oxidation of the admixtures contained in the metal smelt. In the smelting tests the influence of the main factors named in the following on the order and on the speed of oxidation of the admixtures to pig-iron was examined: 1.) Intensity of feeding the bath with oxygen (supplying speed of the oxidizing agent and its composition), 2.) method of feeding the oxidizing agent into the bath (refining of molten metal or blasting of the oxidizing agent at the surface). In the course of analyzing primary data a series of relations was

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obtained, a part of which will be studied here. The data obtained clearly show the effect of temperature on the speed of carbon oxidation in the melt and confirm the supposition, expressed at an earlier date (Ref 2), of the existence of a temperature threshold at decarburization. - At the same time, it is stated that the conditions of feeding the bath with oxygen may somewhat change the influence of the temperature. In the case of weakly oxidizing puddling, the influence exercised by the critical temperature is less marked and increases noticeably with an increase of the oxygen concentration in the fan blast. By intensifying the air blast supply a noticeable increase of the decarburization speed at a mean temperature of the bath of somewhat below 1500 ^{o} is observed. The testing of a combined supply of the oxidizing agent to the bath while simultaneously blasting and injecting the oxidizing agent into the metal proved to be very interesting. By one jet a 100 % oxygen and by another jet a mixture of 50 % oxygen and 50 % carbon dioxide was injected. The jets lead into the interior and onto the surface of the metal changed place in the 1st and the 3rd melt section. Of the two variants: 1) refining with 100 % oxygen and blasting with a

mixture of 50 % O_2 + 50 % CO_2, and 2) refining with 50 % O_2 + 50 % CO_2, blasting with 100 % oxygen, the latter proved to be more effective. This means that the use of a more intense oxidizing agent for blasting the bath, ensuring higher absolute speeds for the oxidation of the elements, was more effectful. The employment of combined blasting, at both variants, lead to an intensification of the processes of oxidizing the admixtures of molten metal. There are 6 figures and 2 references, 1 of which is Soviet.

ASSOCIATION: Moskovskiy institut stali (Moscow Steel Institute)

SUBMITTED: June 14, 1958

Translation from: Referativnyy zhurnal. Metallurgiya, 1958, Nr 12, p 18 (USSR) SOV/137-58-12-24045

AUTHORS: Filippov, S. I., Klyuyev, M. M., Simonov, V. I.

TITLE: Regularities of Steel-refining Processes in a Current of Gaseous Oxidizer. I. The Kinetics of the Oxidation of Carbon (Zakonomernosti protsessov rafinirovaniya stali v potoke gazoobraznogo okislitelya. I. Kinetika okisleniya ugleroda)

PERIODICAL: Sb. Mosk. in-t stali, 1958, Vol 38, pp 64-78

ABSTRACT: The regularities governing oxidation of C in Fe-C melts under the influence of a gaseous oxidizer are studied by a dynamic method which eliminates the development of secondary reactions in the gas phase. The essence of the method lies in the forced delivery of CO_2 to the surface of the metal (Me), which is melted by induction heating in an alundum crucible mounted on a fixture in a quartz tube, and in measuring the gas flow rates at the system inlet and outlet by capillary rheometers. The actual amount of gas emitted (v_f) is calculated, with consideration of the viscosity of the gas-phase components, in accordance with the equation $v_f = 100\, v_r / (x + yK_{CO} + zK_{Ar})$, where v_r

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Regularities of Steel-refining Processes in a Current of Gaseous Oxidizer.

is the quantity of gas measured by the rheometer; x, y, and z are the contents of CO_2, CO and Ar, respectively, in %; and K_{CO} and K_{Ar} are coefficients which account for the viscosities of CO and Ar. The rate of carbon removal from the Me, v_s, during various stages of the process is calculated from the equation $v_s = 0.000523 \, v_f \, J/m$, where m is the Me weight. As the result of the experiment it is established that v_s in the heat is determined by the oxidizing properties of the furnace atmosphere and is a constant at a given temperature and constant rate of delivery of oxidizer to the metal bath. When the bath is constantly supplied with oxidizer, v_s is not dependent upon [C] and increases with an increase in rate of oxidizer supply to the bath. However, as the intensity of delivery of oxidizer increases, the coefficient of utilization thereof diminishes. It is shown that the results obtained are explained by the previously suggested theory of the inhibiting oxygen link. According to that theory the case of development of the process in the region of diffusion reaction, which is of practical importance, is inhibited by the stage of delivery of the oxygen to the reaction zone. The existence of a critical point (~1500°C) in Fe-C melts, which corresponds to the temperature threshold of a sharp change in v_s due to a change in the chemical activity of the reacting C, is confirmed.

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V. M.

24(8) PHASE I BOOK EXPLOITATION SOV/2117

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

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

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

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

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

Experimental Techniques and Methods (Cont.) SOV/2117

25(1) PHASE I BOOK EXPLOITATION SOV/2804

Filippov, Sergey Ivanovich, Petr Pavlovich Arsent'yev, and Valentin Viktorovich Yakovlev

Konverternaya plavka stali (Converter Steelmaking) Moscow, Metallurgizdat, 1959. 432 p. 3,000 copies printed.

Ed.: Ye. A. Kazachkov; Ed. of Publishing House: L. V. Yablonskaya; Tech. Ed.: P.G. Islent'yeva.

PURPOSE: This book is intended for metallurgical engineers, workers in scientific research institutes, and students specializing in steelmaking and the technology of metals.

COVERAGE: The book contains a review of the theoretical principles and practical methods of contemporary steelmaking in Bessemer converters. The thermodynamic and kinetic laws controlling the content of impurities during the melting process are outlined, and contemporary views on the causes of lowered properties of converter steel are discussed. The relation of such properties as impact strength, aging, and weldability to impurities is examined. Methods of im-

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proving converter steel, including the use of oxygen blow, vacuum treatment, and certain additives are listed. The authors thank I.F. Filichkin, S.G. Afanas'yev, A.Yu. Pol'yakov, and Ye.A. Kazachkov for their assistance. There are 161 references: 70 Soviet, 45 English, 37 German, 6 French, 2 Swedish, and 1 Polish.

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Converter Steelmaking SOV/2804

AVAILABLE: Library of Congress (TN736.F52)

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1-15-60

18(3)

AUTHORS: Filippov, S. I., Yakovlev, V. V., Chelyadinov, L.M.

SOV/163-59-2-3/48

TITLE: The Kinetic Factors of Interaction Between Metal Melt and Oxidizing Atmosphere in the Rotary Induction Furnace (O kineticheskikh faktorakh vzaimodeystviya metallicheskogo rasplava s okislitel'noy atmosferoy vo vrashchayushcheysya induktsionnoy pechi)

PERIODICAL: Nauchnyye doklady vysshey shkoly. Metallurgiya, 1959, Nr 2, pp 15 - 19 (USSR)

ABSTRACT: This report deals with experiments in which a magnesite crucible with liquid iron was tilted and slowly rotated (8 - 10 rpm); the oxidizing atmosphere (50% CO_2 + 50% O_2) was supplied to the metal either on the surface or by an immersed quartz tube into the interior. The experimental plant is illustrated in figure 1. Figures 2 and 3 show the course, with respect to time, of the oxidation of carbon, manganese and silicon in dependence on the intensity of the gas supply. The results are as follows: With a rise in the supply of the oxidizing gas phase, the oxidation of the impurities

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increases. The other variations of the experiment, rotation, supply of gas on the surface or into the interior, proved to be ineffective. The authors explain this circumstance by the fact that the electromagnetic intermixture in the induction furnace was much more intensive, and therefore concealed the other effects including that of slow rotation.
There are 3 figures and 2 Soviet references.

ASSOCIATION: Moskovskiy institut stali
(Moscow Steel Institute)

SUBMITTED: November 10, 1958

18.3000

77680
SOV/148-60-1-3/34

AUTHORS: Dun, E., Filippov, S. I.

TITLE: Study of Factors Limiting Oxidation of Carbon in Molten Iron

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, 1960, Nr 1, pp 16-23 (USSR)

ABSTRACT: This is a study of kinetic factors and a determination of limiting conditions during the interaction between the stream of oxidizer and the surface of molten metal. The experiments were conducted on an installation shown in Fig. 1.

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Study of Factors Limiting Oxidation of Carbon in Molten Iron

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SOV/148-60-1-3/34

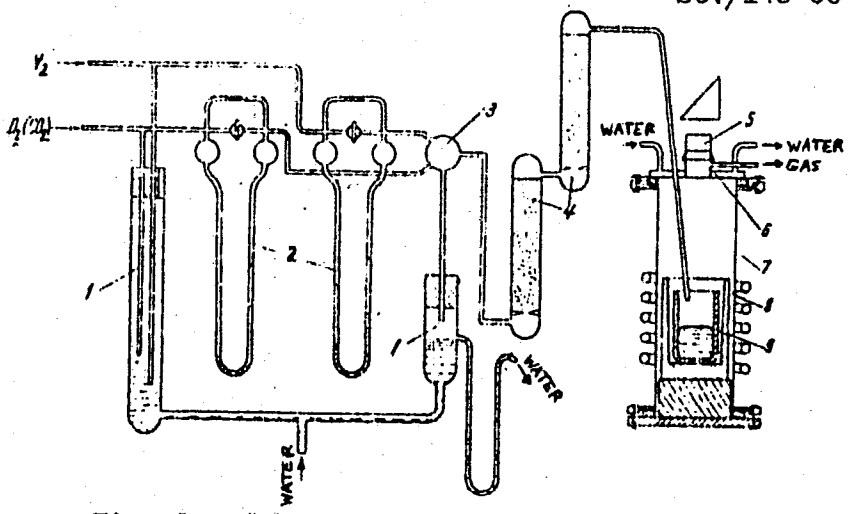

Fig. 1. Schematic diagram of the installation: (1) monostat; (2) rheometers; (3) mixer; (4) driers; (5) glass hood; (6) furnace cap; (7) quartz tube; (8) screen; (9) crucible with metal.

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The rate of feeding the components (forming the oxidizing mixture) was kept constant by the rheometers. A special arrangement of monostats provided a constant differential of pressures and a steady flow of blast to metal (notwithstanding the fluctuations of pressure during the test melt). The initial metal (soft iron) had the following chemical composition (%): 0.014 C; 0.14 Mn; 0.02 Si; 0.029 S; and 0.014 P. It was melted by the high-frequency heating in porous magnesite crucible (45 x 90 mm). The weight of metal was 400-600 g. The experimental results and some characteristic relationships are given in Figs. 2-6. The main kinetic factors of the investigated process are shown in Fig. 2.

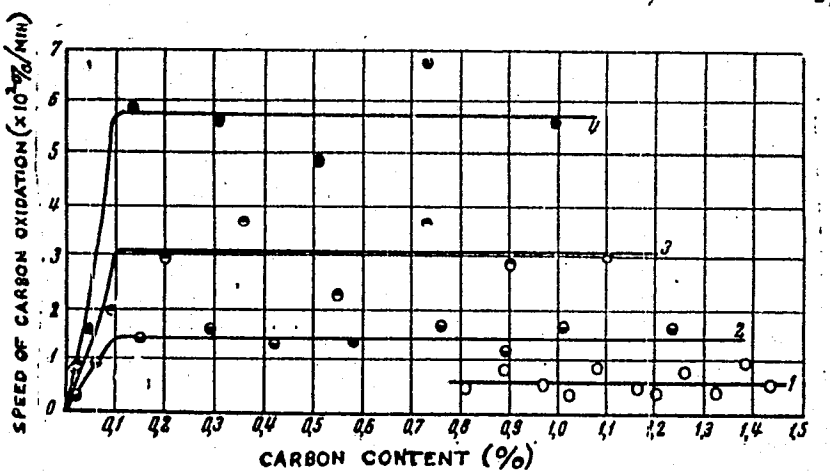

Fig. 2. The effect of blast composition on the speed of decarbonization of metal (at 1,000 ml/min): (1) 4% O_2 in blast; (2) 10% O_2 in blast; (3) 20% O_2 in blast; (4) 40% O_2 in blast.

Study of Factors Limiting Oxidation of Carbon in Molten Iron

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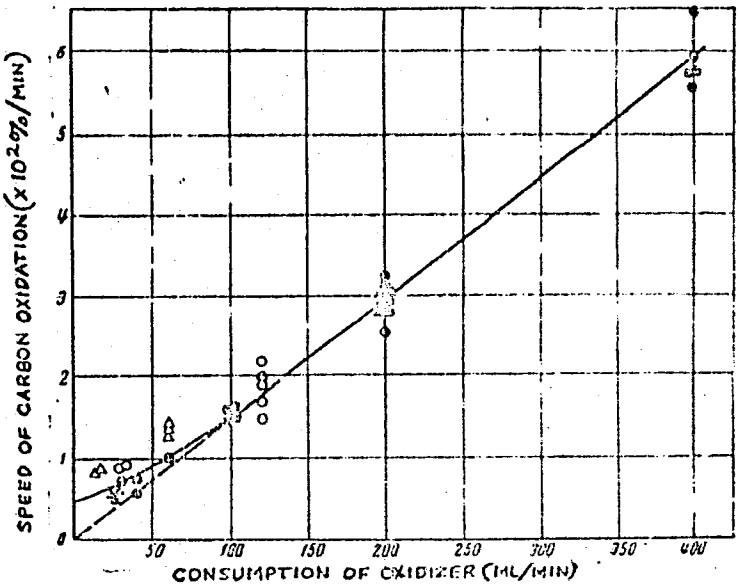

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See Card 6/13 for caption to Fig. 3.

See Card 5/13 for Fig. 3.

Fig. 3. Relationship between the speed of carbon oxidation and the intensity of feeding the oxidizer to metal: (○) oxidizer O_2, consumption 300 ml/min; (◑) 500 ml/min; (●) 1,000 ml/min; (△) oxidizer CO_2, consumption 300 ml/min; (▲) 1,000 ml/min.

Study of Factors Limiting Oxidation of Carbon in Molten Iron

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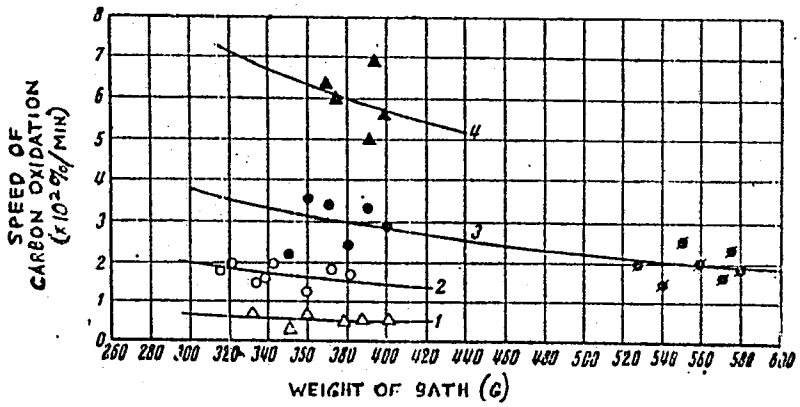

Fig. 4. Relationship between the speed of decarburization of metal and the weight of metal bath (1) 5% CO_2, 1,000 ml/min; (2) 10% O_2, 1,000 ml/min; (3) 20% O_2, 1,000 ml/min; (4) 40% O_2, 1,000 ml/min.

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Study of Factors Limiting Oxidation of Carbon in Molten Iron

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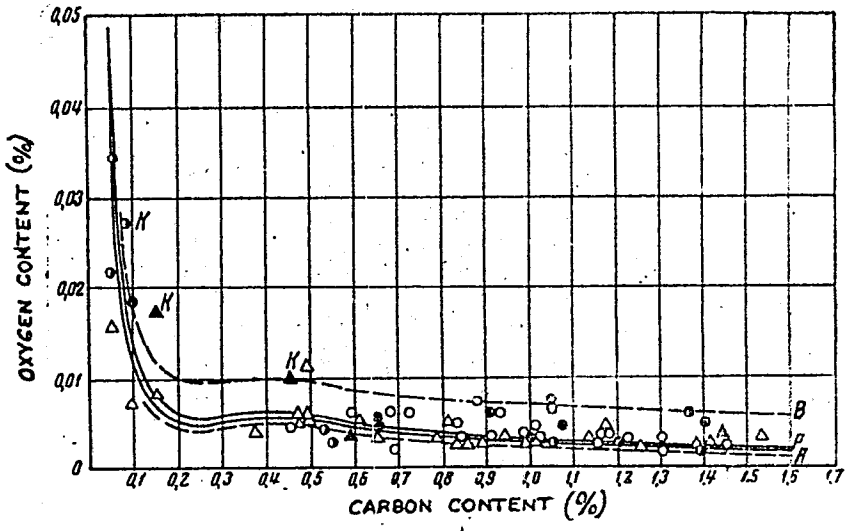

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Study of Factors Limiting Oxidation of Carbon in Molten Iron

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See Card 8/13 for Fig. 5.

Fig. 5. Oxygen content in metal of various compositions of bath and speeds of decarburization: (P) equilibrium data according to Ref 3 (S. I. Filippov, Theory of the Process of Steel Decarburization, Metallurgizdat, 1956); (A,B) boundaries of test values; (O) $v_c <$ 0.01%/min; (△) v_c = 0.01-0.02%/min; (●) v_c = 0.02--0.03%/min; (⊙) v_c = 0.03-0.04%/min; (▲) v_c = 0.05-0.06%/min. Where v_c = actual consumption based on oxidation speed of carbon. Points at the curve indicated by the letter K fix the composition of easily rimming metal.

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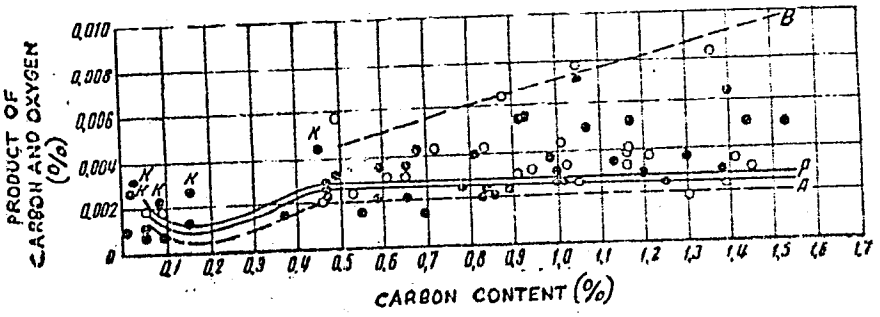

Fig. 6. The value of the product of carbon and oxygen concentrations using various compositions of bath and oxidizers: (P) equilibrium data according to Ref 3; (A,B) boundaries of test values; (O) oxidizer CO_2; (●) oxidizer O_2.

All of the above studies brought the authors to the conclusion that the process of oxidation of carbon, which is dissolved in liquid iron, develops in the diffusion region of reaction. Until approximately 0.1% C (carbon content in metal) the limiting condition is the introduction of oxidizer from the gas phase to the reaction surface. The tests were conducted under the conditions eliminating any bubble formation or rimming of metal bath. The surface of reaction practically coincided with the surface of the bath. The speed of the chemical reaction proper (including the adsorption of reagents in the reaction layer and the desorption of the product of reaction, carbon monoxide) should be sufficiently high. The gaseous particles of oxidizer arrive at the metallic surface, they are adsorbed on it, and they instantly enter into a chemical reaction with the sufficiently abundant carbon. The carbon monoxide, which is formed in this process, is desorbed in the gas phase. When carbon content in the bath is below the critical value (about 0.1% C), the delivery of carbon from the

metal to the reaction surface becomes a limiting condition. The amount of carbon inflow becomes insufficient for a given flow of oxidizer. Such a change of one limiting condition to another (with sufficient amount of oxidizer) is closely related to the change of structure of the surface reaction layer. The established individual mechanisms of speed can be generally written into a kinetic equation:

$$-\frac{dc}{d\tau} = \frac{1}{V_M}\eta w P_0, \qquad (10)$$

where $\frac{dc}{d\tau}$ = speed of decarbonization of metal mole/cm^3. sec; V_M = volume of metal bath cm^3; w = blast consumption cm^3/sec; η = coefficient of utilization of oxidizer; P_o = a content of active particles of oxidizer in the blast, mole/cm^3. There are 6 figures; and 3 references,

Study of Factors Limiting Oxidation of Carbon in Molten Iron

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SOV/148-60-1-3/34

2 Soviet, and 1 U.S. The U.S. reference is: R. Taylor, Journal of the American Chemical Society, Vol 59, Nr 9, 1937, 1605.

ASSOCIATION: Moscow Steel Institute (Moskovskiy institut stali)

SUBMITTED: February 5, 1959

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18.3200

77682
SOV/148-60-1-5/34

AUTHORS: Dun, E., and Filippov, S. I.

TITLE: The Laws Governing the Absorption of Nitrogen by Metal During Oxidation Smelting

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, 1960, Nr 1, pp 28-32 (USSR)

ABSTRACT: This is a study of nitrogen absorption by the steel under the conditions of oxidizing smelting with direct interaction of blast with the surface of the metal bath. The initial material was commercial iron with addition of graphite. The reaction gaseous phase consisted of nitrogen and oxygen or carbon dioxide in a given proportion. In most of the cases the interaction was taking place on a killed metal surface without rimming. The method of investigation and the installation was previously described (Dun, E. and S. I. Filippov. Study of the factors limiting the oxidation of carbon in molten iron.

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The Laws Governing the Absorption of Nitrogen by Metal During Oxidation Smelting

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SOV/148-60-1-5/34

Scientific papers of the higher school, Metallurgy, 1960, Nr 1, p 16). The results of investigation show a pretty clear picture of absorption of nitrogen by the metal simultaneously with decarburization. Figure 1 shows that nitrogen content in the bath (under the action of a blast) is continuously increasing and it takes a sharp dip only at the rimming of the bath.

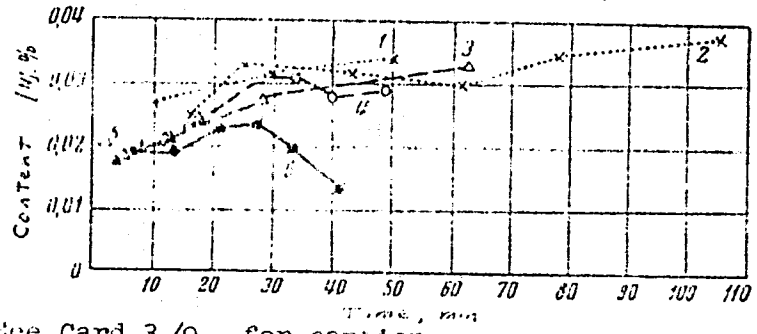

Fig. 1

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See Card 3/9 for caption.

Caption to Fig. 1.

Fig. 1. The change in nitrogen content in metal during oxidizing melting with various nitrogen content in the blast and at various temperatures (blast consumption 1000 ml/min): (1) 96% N_2, 1600 C; (2) 96% N_2, 1465 C; (3) 90% N_2, 1480 C; (4) 80% N_2, 1480 C; (5) 60% N_2, 1490 C; (6) 60% N_2, 1595 C. (The crossed points indicate rimming of bath.)

The direct relation between the completeness of nitrogen absorption by metal, decarburization, and composition of the bath is shown in Fig. 2.

The Laws Governing the Absorption of Nitrogen by Metal During Oxidation Smelting

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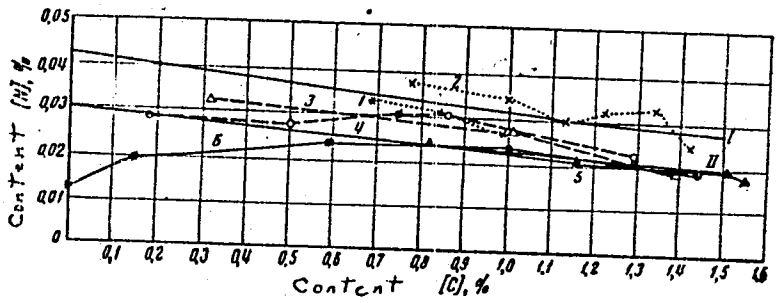

Fig. 2. Saturation of metal by nitrogen depending on carbon content in metal at various nitrogen contents in the blast and at various temperatures (same designations as in Fig. 1).

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The Laws Governing the Absorption of Nitrogen by Metal During Oxidation Smelting

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The experimental data, obtained at the maximum partial pressure of nitrogen in the blast, were developed by the method of least squares. Hence, an equation of the upper limit of nitrogen solubility for investigated range of temperatures was written as:

$$\lg[N] = -1,3679 - 0,1275[C]. \quad (1)$$

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The Laws Governing the Absorption of Nitrogen by Metal During Oxidation Smelting

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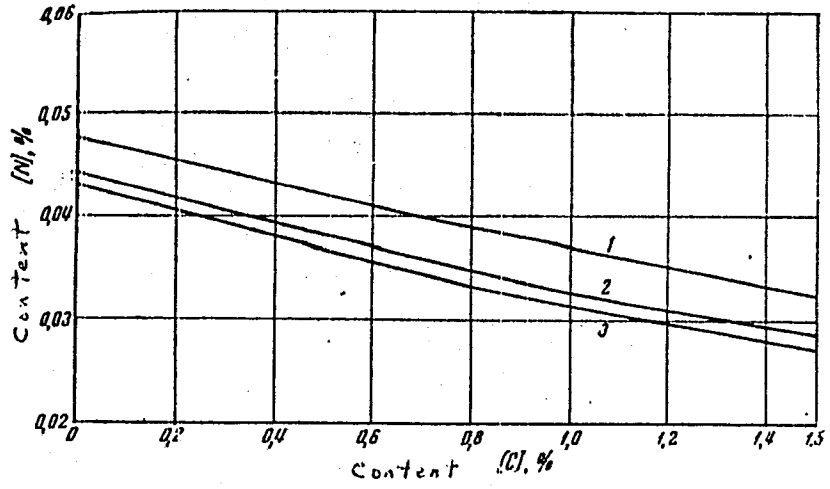


Fig. 3

Card 6/9 Caption to Fig. 3 on Card 7/9

Caption to Fig. 3.

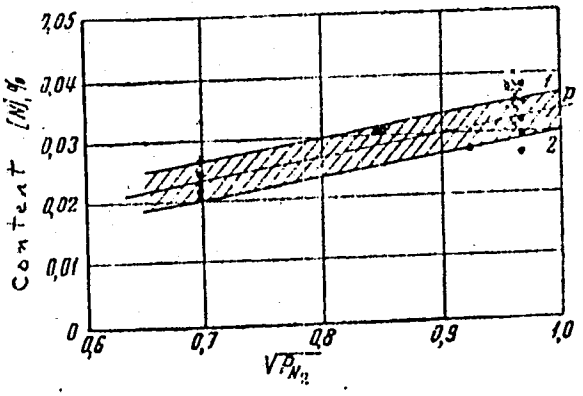
Fig. 3. The curves of maximum absorption of nitrogen by metal, depending on carbon content P_{N_2} = 1 atm: (1) oxidizer CO_2; (2) oxidizer O_2; (3) data by T. Kootz.

The results were favorably compared with data of Kootz T. Kootz, Archiv. f. d. Eisenhuettenwes., 15, 2, 77-82, 1941/42 and I. Dardel. Metal Progress, 1947, 52, 2, 252-256). The authors derived an equation of solubility of nitrogen in Fe-C melts for 1,460-1,600° C range of temperatures.

$$\lg[N] = -1{,}3538 + \frac{1}{2}\lg P_{N_2} - 0{,}1275[C], \qquad (4)$$

where (N) nitrogen content in metal, %; (P_{N_2}) partial pressure of nitrogen in the atmosphere, atm.; (C) carbon concentration in metal.

Fig. 4



Card 8/9 Caption on Card 9/9

The Laws Governing the Absorption of Nitrogen by Metal During Oxidation Smelting

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Caption to Fig. 4.

Fig. 4. Solubility of nitrogen in iron depending on the nitrogen pressure in the blast: (●) deoxidizer O_2; (X) deoxidizer CO_2; (P) calculated equilibrium curve.

It follows that experimental points of oxygen blast are located between straight lines 1 and 2 on parallel lines P calculated by equation (4) for an average carbon content of 95%. There are 4 figures; and 5 references, 3 Soviet, 1 German, 1 U.S. The U.S. reference is: I. Dardel, Metal Progress, 1947, 52, 2, 252-256.

ASSOCIATION: Moscow Steel Institute (Moskovskiy institut stali)

SUBMITTED: February 11, 1959

Card 9/9

DUN, E.; FILIPPOV, S.I.

Investigating kinetics and the mechanism of oxidation of additives to the molten iron on the basis of critical concentration concepts. Izv.vys.ucheb.zav.; chern.met. no.5: 28-38 '60. (MIRA 13:6)

1. Moskovskiy institut stali.
(Steel—Electrometallurgy)

S/137/61/000/011/006/123
A060/A101

AUTHOR: Filippov, S. I. (Prof., Dr. Tech Sci)

TITLE: Laws of carbon-oxidation kinetics at low C content in metal

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 11, 1961, 11, abstract 11A73 (V sb. "Novoye v teorii i praktike proiz-va martenovsk. stali". Moscow, Metallurgizdat, 1961, 15-21. Discussion 79-88)

TEXT: The method and the results are described of a laboratory investigation of the kinematic laws of the decarbonizing of steel under interaction of the melt with a stream of CO_2 oxidizer. Experimental heats (70 - 100 grams by weight) were carried out in a high-frequency furnace with a quartz reaction crucible. The metal was melted in an argon atmosphere. When the experimental temperature was attained, a continuous stream of CO_2 was fed to the metal surface from a tube. The rate of CO_2 progress and the output rate of the reaction products were measured by capillary rheometers. Periodically, the gas composition was determined by the usual volumetric method, on the basis of which corrections were introduced into the rheometer readings. The metal temperature was measured by an optical pyrometer; in the course of the smelting metal samples were taken

Card 1/3 Moscow Steel Inst.

by sucking it up into quartz pipettes. The results of the experimental heats are represented in a table and graphically. They testify that in a definite time interval, even at a continuous lowering of the C-content in the metal, the decarbonizing rate remains constant. Starting at a definite instant, closely connected with the attainment of a definite critical C concentration, one observes a slow-down in the process. Experiments have shown that to every given feed-intensity of O_2 to the vat there corresponds a process rate which does not depend upon the C content. The slow-down in the process rate should occur at a definite critical C concentration in the metal, when a shift in the surface reaction zone takes place. Then, less C comes into the reaction zone than can be oxidized. The value of the critical concentration should increase as the oxidizer input rate into the vat increases and should decrease as the C feed-in to the reaction zone is intensified with an increase in the mixing intensity of the metal. At C concentrations in the metal below the critical concentration, the laws of diffusion kinetics are operative with the limiting factor being the feed rate of oxidized C to the reaction zone. The decarbonization process should depend upon the C content in the metal and obeys the kinematic equation $-dC/d\tau = S/V \cdot \left\{[C]/(1/\beta + 1/K_x)\right\}$, where S/V is the ratio of the reaction surface to the volume of the vat; β, K_x are the rate constants of the oxidizer

Laws of carbon-oxidation kinetics ...

input and the chemical reaction, respectively. At a very intense oxidation of the melt the process may develop in two stages, to each of which corresponds a definite value of the process rate constants. In the second stage either a retardation or an acceleration of the process is possible. A retardation of the decarbonizing process in the second stage is connected with the appearance of a slag phase upon the metal surface. An acceleration of the process in the second stage is connected with the intensification of gas formation and stirring of the vat.

I. Polyak

[Abstracter's note: Complete translation]

Card 3/3

FILIPPOV, S.I.; MARTYNOV, S.Z.

Kinetic regularities of direct oxidation of additions in molten iron. Izv. vys. ucheb. zav.; chern. met. no. 1:5-11 '61.
(MIRA 14:2)

1. Moskovskiy institut stali.
(Steel--Metallurgy)

S/148/61/000/011/001/018
E071/E180

AUTHORS: Kazakov, N.I., and Filippov, S.I.

TITLE: Kinetics of oxidation of carbon in liquid steel under conditions of electromagnetic stirring

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Chernaya metallurgiya, no.11, 1961, 15-21

TEXT: The influence of magnetic stirring on the kinetics of oxidation of carbon was investigated on a laboratory apparatus. In preliminary experiments, using mercury as a liquid metal, the most suitable position of a stator (from a two-pole motor) and the necessary voltage to obtain an energetic rotation of the metal in a small crucible were established. Carbon dioxide was chosen as an oxidising gas. Heats were treated at CO_2 flow rates of 75, 125, 200 and 325 ml/min. As a starting material soft iron and pig iron smelted from electrolytic iron were used. [Abstractor's note: Electrolytic iron contains no carbon; how can it give pig iron?] The weight of a charge was 300-350 g (the diameter of the magnesite crucible - 31 mm). A nozzle of 3 mm diameter was 30 mm above the surface of the metal in all heats; the position

of the metal in respect to the stator and heater was also constant. Altogether 28 experiments were carried out with and without stirring the metal, at temperatures of 1540-1570 °C. In some heats the metal was stirred in both directions. Kinetic curves of decarburisation were obtained for each series of heats with a given rate of supply of the oxidising gas. In the range of higher carbon concentrations (up to about 0.2%) the experimental points obtained with and without stirring fell on the same straight line. The experimental results agreed well with the kinetic equation for the decarburisation of metal at carbon contents above the critical concentration:

$$-\frac{d[C]}{d\tau} = \frac{1}{V_M} \cdot \eta \cdot W \cdot P_{O_2} \qquad (1)$$

The rate of oxidation of carbon $\left(-\frac{d[C]}{d\tau}\ \text{mole/cm}^3\ \text{min}\right)$ is determined by the rate of blowing the oxidising atmosphere (W cm^3/min), the content of oxidant (P_{O_2}, mole/cm^3) and the volume of the metallic bath (V, cm^3). The coefficient expressing the

utilisation of the oxidant η reflects the flow characteristics of the oxidant stream and the surface conditions of the metal. In the range of carbon concentrations above the critical, the rate of decarburisation is independent of stirring, and the limiting factor is the transfer of oxidant from the stream to the reaction zone. At carbon concentrations below the critical, the limiting factor is the transfer of carbon to the reacting surface and the experimental results conform to an equation;

$$-\frac{d[C]}{d\tau} = \gamma_c \cdot S/V_M \cdot [C], \quad (2)$$

$$\gamma_c = -2.303 V_M/S \cdot \frac{\Delta \log [C]}{\Delta \tau} \quad (3)$$

The rate of decarburisation depends on the reacting surface of the metal (S, cm^2), its volume (V_M, cm^3) and is directly related to the concentration of carbon [C], mole/cm^3. The effect of stirring can be evaluated from the ratio K of the diffusion coefficients of carbon in liquid metal, with (γ_c') and without (γ_c)

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stirring, corrected for the change in the surface area of the bath S/S':

$$K = \gamma_c'/\gamma_c \quad (4)$$

The influence of electromagnetic stirring can be presented by a general equation expressing the dependence of K on the voltage applied to the stator (U):

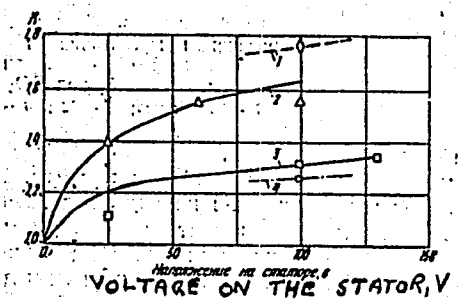
$$K = A \cdot U^n + B \quad (5)$$

where A and B are coefficients, n is the power index. Under experimental conditions $n < 0.5$. According to experimental data (Fig.6) the influence of stirring depends on the applied voltage and the rate of supplying oxidant to the metal. Electromagnetic stirring can also speed up other refining processes providing the concentration of an admixture is below the critical one. I.M. Kirko is mentioned in the paper in connection with his contributions in this field.
There are 6 figures and 5 references: 3 Soviet-bloc and 2 non-Soviet-bloc. The English language reference reads as follows:
Ref.1: S. Fornander, F. Nilsson. J. of Metals, v.188, no.1-2,1950.
Card 4/5

Kinetics of oxidation of carbon ... S/148/61/000/011/001/018
E071/E180

ASSOCIATION: Moskovskiy institut stali (Moscow Steel Institute).
SUBMITTED: June 15, 1961.

Fig.6 The influence of stirring on the decarburisation of metal at carbon concentrations below critical. Rate of supply of CO_2: 1 - 75 mℓ/min; 2 - 125; 3 - 200; 4 - 325 mℓ/min.



Card 5/5

KRASHENINNIKOV, M.G.; FILIPPOV, S.I.

Surface reaction and boiling of the metal bath during decarburization. Izv.vys.ucheb.zav.; chern.met. 4 no.5:17-27 '61. (MIRA 14:6)

1. Moskovskiy institut stali.
(Steel—Metallurgy) (Surface chemistry)

KRASHENINNIKOV, M.G.; FILIPPOV, S.I.

Mechanism of the nucleation of the gas phase during the oxidation of carbon in molten metals. Izv. vys. uchab. zav.; chern. met. 4 no.7:18-25 '61. (MIRA 14:8)

1. Moskovskiy institut stali.
(Liquid metals)
(Gases in metals)

KRASHENINNIKOV, M.G.; FILIPPOV, S.I.

Properties of iron-carbon melts on viscosimetry and electric conductivity basis. Izv.vys.ucheb.zav.; chern.met. 4 no.9: 21-31 '61. (MIRA 14:10)

1. Moskovskiy institut stali.
(Liquid metals--Electric properties) (Viscosimetry)

KAZAKOV, N.I.; FILIPPOV, S.I.

Kinetics of carbon oxidation in liquid steel during electromagnetic stirring. Izv. vys. uchab. zav.; chern. met. 4 no.11:15-21 '61. (MIRA 14:12)

1. Moskovskiy institut stali.
(Steel--Electrometallurgy)

KRASHENINNIKOV, M.G.; FILIPPOV, S.I.

Characteristics of the temperature function in the rate of the liquid steel deoxidation process. Izv. vys. ucheb. zav.; chern. met. 5 no.1:20-32 '62. (MIRA 15:2)

1. Moskovskiy institut stali.
(Steel—Metallurgy)

ARSENT'YEV, P.P.; YAKOVLEV, V.V.; FILIPPOV, S.I.

Possibility of arsenic removal during the refining of Kerch pig iron in a rotary furnace. Izv. vys. ucheb. zav.; chern. met. 5 no.7:19-26 '62. (MIRA 15:8)

1. Moskovskiy institut stali i splavov.
(Iron—Metallurgy) (Rotary-hearth furnaces)

YAKOVLEV, V.V.; FILIPPOV, S.I.

Kinetic characteristics of the initial stage of the decarburization of molten iron. Izv. vys. ucheb. zav.; chern. met. 5:31-38 '62. (MIRA 15:10)

1. Moskovskiy institut stali i splavov.
(Steel—Metallurgy)

ARSENT'YEV, P.P.; FILIPPOV, S.I.

Critical concentrations of arsenic and the possibility of its removal during the refining of iron-carbon melts. Izv. vys. ucheb. zav.; chern. met. 5 no.5:25-33 '62. (MIRA 15:6)

1. Moskovskiy institut stali.
(Iron-metallurgy)
(Arsenic)

FILIPPOV, S.I.; KRASHENINNIKOV, M.G.; IOFFE, I.I.

Experimental study of the gaseous phase formation process in metallic melts. Izv.vys.ucheb.zav.; chern.met. 6 no.1:8-16 '63. (MIRA 16:2)

1. Moskovskiy institut stali i splavov.
(Liquid metals) (Vapor-liquid equilibrium)

S/148/63/000/001/002/019
E111/E451

AUTHORS: Filippov, S.I., Krasheninnikov, M.G., Ioffe, I.I.

TITLE: Experimental study of the process of the formation of a gas phase in a metallic melt

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, no.1, 1963, 8-16

TEXT: A study was made of the gas inclusions in Fe-C-O melts, in which two methods were compared, (a) determination of the anomalies in the oscillations of a freely damped suspended body immersed in the melt and (b) determination of the anomalies in a rotating magnetic field. The melts were obtained by adding graphite and partly oxidized electrolytic iron to technically pure iron. In (b) the probability K_ρ of the formation of heterogeneities in the melt is proportional to ratio of the number of oscillations with disturbances to the total number of oscillations. Similarly, with (a) the probability K_ν is proportional to the ratio of the number of oscillations not falling on a logarithmic straight line to the total number of oscillations. The results confirm the authors' conjecture that

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Experimental study of the process ...

the heterogeneity is due entirely to the decarburization reaction. In (a) the difference between the maximum and minimum anomalies $\Delta\alpha_\rho$ was examined and was found to be as good a qualitative guide as K_ρ to heterogeneity. In (b) the sum of the maximum positive and negative anomalies $\Delta\alpha_\nu$ was also examined and was found to be preferable to K_ν as a guide. Both methods were sensitive to the appearance of inclusions due to the formation of nuclei followed by the growth of small bubbles on them. From Frenkel's theory of liquids, it is concluded that both methods show the early stages when, in the presence of excess oxygen, cracks and discontinuities in the liquid develop into nucleating cracks and holes from which fine bubbles appear. This mechanism has been confirmed by determination of changes in viscosity. There are 6 figures.

ASSOCIATION: Moskovskiy institut stali i splavov
(Moscow Steel and Alloy Institute)

SUBMITTED: October 3, 1962

Card 2/2

ARSENT'YEV, P.P.; VINOGRADOV, B.G.; FILIPPOV, S.I.

Viscosity and electric conductivity of iron-carbon melts with additions of manganese and silicon. Izv. vys. ucheb. zav.; chern. met. 6 no.3:11-19 '63. (MIRA 16:5)

1. Moskovskiy institut stali i splavov.
(Iron alloys—Testing) (Liquid metals—Testing)
(Electric conductivity)

PRONIN, L.A.; FILIPPOV, S.I.

State of liquid metals on the basis of acoustical data. Izv. vys. ucheb. zav.; chern. met. 6 no.5:10-18 '63. (MIRA 16:7)

1. Moskovskiy institut stali i splavov.
(Liquid metals)
(Ultrasonic waves—Industrial applications)

KURZINA, T.P.; FILIPPOV, S.I.

Regularities of iron reduction from ore under the simultaneous influence of hydrogen and carbon monoxide. Izv. vys. ucheb. zav.; chern. met. 6 no.7:21-26 '63. (MIRA 16:9)

1. Moskovskiy institut stali i splavov.
(Iron--Metallurgy) (Reducing agents)

KURZINA, T.P.; FILIPPOV, S.I.

Kinetics of iron oxide reduction by mixtures of carbon oxide and hydrogen. Izv. vys. ucheb. zav.; chern. met. 6 no.9:5-10 '63. (MIRA 16:11)

1. Moskovskiy institut stali i splavov.

PRONIN, L.A.; FILIPPOV, S.I.

Characteristics of the state of liquid metals. Izv. vys. uchab. zav.; chern. met. 6 no.11:11-16 '63. (MIRA 17:3)

1. Moskovskiy institut stali i splavov.

FILIPPOV, Sergey Ivanovich; ARSENT'YEV, Petr Pavlovich; PTITSYNA, V.I., red.izd-va; EN'YAKOVA, G.M., tekhn. red.

[Experiments on the theory of metallurgical processes] Eksperimental'nye raboty po teorii metallurgicheskikh protsessov. Izd.2., perer. i dop. Moskva, Metallurgizdat, 1964. 165 p. (MIRA 17:2)

BAYDOV, V.V.; KRASHENINNIKOV, M.G.; FILIPPOV, S.I.

Regularities in the reduction of iron from molten ores by hydrogen. Izv. vys. uchsb. zav.; chern. met. 7 no.1:13-19 '64. (MIRA 17:2)

1. Moskovskiy institut stali i splavov.

DROZDOV, N.N.; SIMONOV, V.I.; GONCHAROV, I.A.; FILIPPOV, S.I.

Kinetic principles of the control and automation of the steel decarburization process during the period of the oxygen blowing of the metal. Izv. vys. ucheb. zav.; chern. met. 7 no.3:16-22 '64. (MIRA 17:4)

1. Moskovskiy institut stali i splavov.

PRONIN, L. A.; KAZAKOV, N. B.; FILIPPOV, S. I.

Ultrasonic measurement of molten cast iron. Izv.vys.ucheb.zav.; chern.met.7 no. 5:12-16 '64. (MIRA 17:5)

1. Moskovskiy institut stali i splavov.

DROZDOV, N.N.; SIMONOV, V.I.; FILIPPOV, S.I.

Kinetic principles of the control and automation of the chromium oxidation process during the oxygen blowing of metal. Izv. vys. uchab. zav.; chern. met. 7 no.9:16-23 '64. (MIRA 17:6)

1. Moskovskiy institut stali i splavov. 2. Otvetstvennyy redaktor zhurnala "Izvestiya vysshikh uchebnykh zavedeniy; chernaya metallurgiya."

ACCESSION NR: AP4042546 S/0148/64/000/007/0077/0083

AUTHOR: Vaynshtok, M. I.; Arsent'yev, P. P.; Filippov, S. I.

TITLE: Macrostructure and chemical inhomogeneity of 18-ton ingots of low-carbon steel with additions of aluminum

SOURCE: IVUZ. Chernaya metallurgiya, no. 7, 1964, 77-83

TOPIC TAGS: low carbon steel, 08kp steel, rimmed steel, killed steel, ferrosilicon deoxidized rimmed steel, aluminum deoxidized rimmed steel, steel macrostructure, steel inhomogeneity

ABSTRACT: Partial or complete deoxidation of rimmed steel in molds by aluminum or silicon is one of the means of reducing its chemical inhomogeneity and of increasing the yield of quality metal. The corresponding experiments were carried out with 18-ton ingots of 08kp rimmed steel deoxidized by ferromanganese in a furnace, and additionally by aluminum (130 g/ton) in the ladle. Semikilled and killed steel was produced by adding 0.2 and 0.4 kg/ton, respectively, of aluminum shot during pouring into molds; the metal of two ingots was deoxidized in the mold by an 0.2 kg/ton addition of 45% ferro-

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ACCESSION NR: AP4042546

silicon. All ingots had a dense crust, 20—40 mm thick. A specific feature of the ingots of killed and semikilled steel was the presence of a more or less dense bridge. A partial preservation of this bridge, by limiting the crop to 2%, will ensure welding of shrinkage defects during rolling, thus increasing the yield of quality metal to 93%. The macrostructure of the ingot deoxidized by ferrosilicon was close to that of the rimmed-steel ingot; the semikilled steel macrostructure was close to that of the killed. Ferrosilicon in the amount of 0.2 kg/ton of steel does not ensure a sufficiently uniform distribution of sulfur and carbon in low-carbon rimmed steel. A larger amount of ferrosilicon would increase the silicon content in the steel and impair its plastic properties. The addition of 0.4 kg Al/ton of rimmed steel sharply reduces the inhomogeneity of the ingot with respect to its sulfur and carbon content. A larger addition of aluminum (0.9 kg/ton) has no further effect on ingot inhomogeneity but is needed to neutralize the nitrogen and obtain nonaging steel. However, the ingots of the steel deoxidized by aluminum have a highly nonuniform distribution of aluminum, which in low-carbon steels containing less than 0.02% residual Al can promote strain aging. Orig. art. has: 3 figures and 2 tables.

Card 2/3

ACCESSION NR: AP4042546

ASSOCIATION: Moskovskiy institut stali i splavov (Moscow Steel and Alloys Institute)

SUBMITTED: 23Jan64 ATD PRESS: 3070 ENCL: 00

SUB CODE: MM NO REF SOV: 003 OTHER: 000

Card 3/3

L 19838-65 EPA(s)-2/EWT(m)/EPF(n)-2/EWP(t)/EWP(b) Pt-10/Pu-4
IJP(c) JD/WW/JG

ACCESSION NR: AP4049062 S/0148/64/000/011/0011/0015

AUTHOR: Kazakov, N. B.; Pronin, L. A.; Filippov, S. I.

TITLE: Acoustic experiments on liquid Sb-Zn alloys

SOURCE: IVUZ. Chernaya metallurgiya, no. 11, 1964, 11-15

TOPIC TAGS: antimony alloy, zinc alloy, liquid alloy, sound transmission, ultrasound velocity

ABSTRACT: The antimony-zinc system was studied and the dependence of the speed of sound on temperature from the melting point to 1000C for Sb and to 850C for Zn was determined by the impulse method conceived by L. A. Pronin and S. I. Filippov. The speed of sound in zinc decreases slightly with increasing temperature while it remains fairly constant in antimony. Above 850C the experiment becomes difficult as both metals tend to [illegible] and 900C. Three alloys consisting of 31, 59, and 81 at. % Zn were studied [illegible] temperature intervals of 200C from the melting point. Chemical analyses were performed both before and after experimentation, a thick layer of neutral slag was used to lower boiling loss, and a platinum-platinorhodium thermocouple was used to control temp. The speed of ultrasonic waves for isotherms [illegible] adiabatic compressibility or reciprocal of the product of density and speed of sound at those temperatures, and the change in the temperature coefficient of the speed of ultrasonic waves were

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L 19838-65

ACCESSION NR: AP4049062

plotted as functions of composition. The fact that the increasing curves for the speed of ultrasonic waves cross each other, as do the decreasing curves for adiabatic compressibility, serve to indicate a region between 30 and 80% Zn where intermetallic compounds are formed. Between 650 and 850C, the speed of sound in and the conductivity of Sb seem to be independent of temperature. The area of intermetallic compounds in the Sb-Zn system demands further experimentation. Orig. art. has: 4 graphs, 1 table, and 1 formula.

ASSOCIATION: Moskovskiy institut stali i splavov (Moscow Institute of Steel and Alloys)

SUBMITTED: 27Jul64 ENCL: 00 SUB CODE: MM

NO REF SOV: 004 OTHER: 007

Card 2/2

VAYNSHTOK, M.I.; ARSENT'YEV, P.P.; FILIPPOV, S.I.

Macrostructure and chemical heterogeneity of 18-ton, low-carbon steel ingots with an addition of aluminum. Izv. vys. ucheb. zav.; chern. met. 7 no.7:77-83 '64 (MIRA 17:8)

1. Moskovskiy institut stali i splavov.

KAZAKOV, N.B.; PRONIN, L.A.; FILIPPOV, S.I.

Acoustical investigations of liquid Sb-Zn alloys. Izv. vys. ucheb. zav.; chern. met. 7 no.11:11-15 '64. (MIRA 17:12)

1. Moskovskiy institut stali i splavov.

GONCHAROV, I.A.; FILIPPOV, S.I.

Mechanism of surface and volume decarburization of molten iron.
Izv. vys. ucheb. zav.; chern.met. 8 no.1:10-16 '65
(MIRA 18:1)

1. Moskovskiy institut stali i splavov.

MAZHENOV, M.A.; RYZHONKOV, D.I.; KNYAZEV, V.F.; FILIPPOV, S.I.

Kinetic characteristics of the reduction of iron ore pellets by hydrogen and methane. Izv. vys. ucheb. zav.; chern. met. 8 no.7:11-15 '65. (MIRA 18:7)

1. Moskovskiy institut stali i splavov.

KAZAKOV, N.B.; PRONIN, L.A.; FILIPPOV, S.I.

Acoustical investigation of liquid alloys. Izv. vys. ucheb. zav.; chern. met. 8 no.9:5-7 '65. (MIRA 18:9)

1. Moskovskiy institut stali i splavov.

YAVOYSKIY, V.I., otv. red.; BIGEYEV, A.M., red.; BORKO, Ye.A., red.; GLINKOV, M.A., red.; ZARVIN, Ye.Ya., red.; KAPUSTIN, Ye.A., red.; KOCHO, V.S., red.; KUDRIN, V.A., red.; LAPITSKIY, V.I., red.; LEVIN, S.L., red.; OYKS, G.N., red.; ROMENETS, V.A., red.; UMRIKHIN, P.V., red.; FILIPPOV, S.I., red.

[Theory and practice of the intensification of processes in converters and open-hearth furnaces; transactions] Teoriia i praktika intensifikatsii protsessov v konverterakh i martenovskikh pechakh; trudy. Moskva, Metallurgiia, 1965. 552p. (MIRA 18:10)

1. Mezhvuzovskoye nauchnoye soveshchaniye po teorii i praktike intensifikatsii protsessov v konverterakh i martenovskikh pechakh. 2. Moskovskiy institut stali i splavov (for Filippov). 3. Zhdanovskiy metallurgicheskiy institut (for Kapustin). 4. Ural'skiy politekhnicheskiy institut (for Umrikhin).

L 12078-66 EWT(1)/EWT(m)/EPF(n)-2/T/EWP(t)/EWP(k)/EWP(b) JD/WW/JG/GG

ACC NR: AP6000170 SOURCE CODE: UR/0148/65/000/009/0005/0007

67
65

AUTHOR: Kazakov, N. B.; Pronin, L. A.; Filippov, S. I.

ORG: Moscow Institute of Steel and Alloys (Moskovskiy institut stali i splavov) B

TITLE: Acoustic studies of molten alloys

SOURCE: IVUZ. Chernaya metallurgiya, no 9, 1965, 5-7

TOPIC TAGS: acoustic speed, molten metal, ultrasonics, temperature dependence, semiconductor theory, gallium, antimony

ABSTRACT: The temperature dependence of the speed of ultrasound is an important factor in determining the physical and structural characteristics of semiconductor compounds in solid and molten state, but so far this factor has remained relatively uninvestigated. Hence, the authors performed a comparative investigation of the concentration and temperature dependencies of the speed of ultrasound for two systems with a different character of transition to conducting state. To this end, molten alloys of the Sb-Ga system were investigated by the method described earlier by the authors (Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, 1964, no. 11, 11). It was found that the curve of temperature dependence of the ultrasound flattens out with increasing Sb content of the alloys and, in the range of from 750 to 950°C (see Fig. 1), the temperature coefficient for the alloy with >50% (at.) Sb may

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UDC: 669.75.87-154:534.6

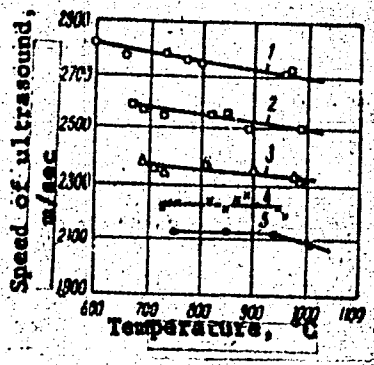

Fig. 1. Speed of ultrasound as a function of temperature and composition for molten alloys of the Sb-Ga system.

1 - 100% (wt) Ga; 2 - 30% (wt) Sb; 3 - 50% (wt) Sb; 4 - 69.5% (wt) Sb; 5 - 80% (wt) Sb

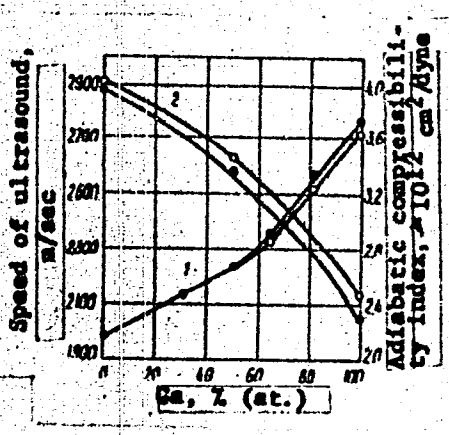

Fig. 2. Isotherms of speed of ultrasound (1) and adiabatic compressibility index (2) for molten alloys of the Sb-Ga system

● - 750°C; o - 950°C

be considered zero. It may be assumed that the type of temperature dependence of the speed of ultrasound reflects structural changes in the molten alloy, but this requires postulating a definite physical model of interaction between particles. So far this problem has not been solved, but qualitative analogies may be based on the following simplified picture of the structure of molten metals: ion composition and free electrons. Assuming that ion composition is incompressible and that compressibility depends on free electrons, a correlation between compressibility (speed of the ultrasound) and electron conduction must exist. Such a relationship can be observed for the systems investigated: The obtained curve of adiabatic compressibility with increasing temperature for GaSb (Fig. 2) coincides with the increase in electric resistance; at the same time, molten ZnSb is characterized, over some interval of temperatures, by a decrease in adiabatic compressibility and electric resistance. Orig. art. has: 2 figures, 1 table.

SUB CODE: 11, 20/ SUBM DATE: 08Jun65/ ORIG REF: 005/ OTH REF: 001

L 13189-66 EWT(m)/EPF(n)-2/T/EWP(t)/EWP(b)/EWA(h)/EWA(c) IJP(c) JD/WW/JG

ACC NR: AP5028572 SOURCE CODE: UR/0148/65/000/011/0005/0008

AUTHOR: Kazakov, N. B.; Pronin, L. A.; Filippov, S. I.

ORG: Moscow Institute of Steel and Alloys (Moskovskiy institut stali i splavov)

TITLE: Structure of metal melts with a positive temperature coefficient of the speed of ultrasound

SOURCE: IVUZ. Chernaya metallurgiya, no. 11, 1965, 5-8

TOPIC TAGS: ultrasonics, temperature dependence, molten metal, semiconductor alloy, cadmium, antimony

ABSTRACT: At the present work is a continuation of a previous investigation dealing with the temperature and concentration dependencies of the speed of ultrasound for melts of the Zn-Sb system over a certain range of melt compositions, which established that the speed of ultrasound has a positive temperature coefficient, which previously has been observed for no other fluid except water (N. B. Kazakov, L. A. Pronin, S. I. Filippov. Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, 1964, no. 11, 11-14). Now the investigation is extended to the temperature dependence of the speed of ultrasound for melts of the Cd-Sb system. Positive temperature coefficients of the speed of ultrasound are observed also in this system for alloys of a composition resembling intermetallic compounds. For example, a greater increase in

Card 1/4 UDC: 669.73'6:541.12.03

L 13189-66
ACC NR: AP5028572

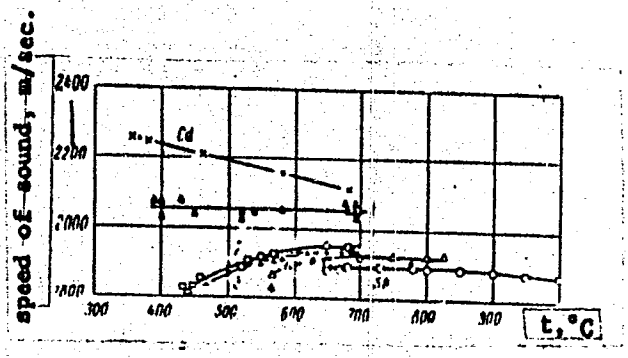

Fig. 1. Speed of ultrasound as a function of temperature for various compositions of Cd-Sb melts:

1 - 26% (at.) Sb; 2 - 41.5% (at.) Sb; 3 - 52% (at.) Sb;
4 - 69% (at.) Sb

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L 13189-66
ACC NR: AP5028572

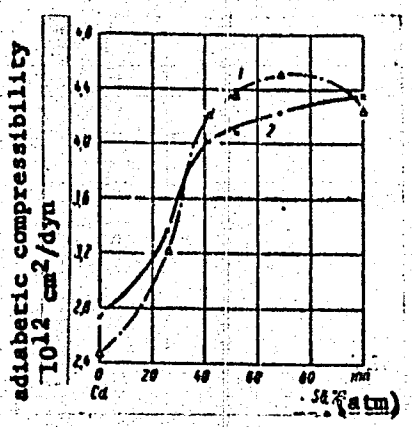

Fig. 2. Concentration changes in adiabatic compressibility for Cd-Sb melts:

1 - at liquidus temperature; 2 - at heating to 200°C above liquidus temperature

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L 13189-66

ACC NR: AP5028572

the speed of ultrasound is established for the alloy containing 41.5% (at.) Sb (Fig.1). In this case the measurements of the speed of ultrasound at high temperatures were complicated by the low melting point of Cd (765°C). The melts were covered with a thick layer of flux (composition: KCl + 60% LiCl). The composition of each alloy was checked by taking samples for chemical analysis before and after measurements. The speed of the ultrasound was measured by the pulsed method. Further, the values of adiabatic compressibility for Sb-Cd alloys as a function of temperature are tabulated on the basis of experimental findings on the speed of sound and the density of the melts. The concentration changes of adiabatic compressibility for Cd-Sb melts at liquidus temperatures and on heating 200°C above liquidus are illustrated in Fig. 2. The finding that adiabatic compressibility decreases with increasing temperature for alloys with 41.5 and 69% (at.) Sb is difficult to explain; one possible explanation is change in the structure of the melts as in the case of water: it is known that in water, which represents a combination of three structures, the proportion of the closely packed structure increases with rising temperature and compressibility correspondingly decreases. As the elevated temperatures continue, owing to thermal loosening, the compressibility of the water begins to increase. It may thus be assumed that in the alloys investigated the structure at first becomes more compact on heating; the packing coefficient increases and, as a result, compressibility decreases. As the heating continues, the structure gets loosened, the coordination number decreases, and compressibility again increases. Orig. art. has: 4 figures, 1 table.

SUB CODE: 11, 20/ SUBM DATE: 06Aug65/ ORIG REF: 004/ OTH REF: 001

Card 4/4

L 11016-66 EWT(m)/EWP(w)/T/EWP(t)/ETI IJP(c) WW/JG/JD

ACC NR: AP6021706 (N) SOURCE CODE: UR/0148/66/000/003/0008/0014

AUTHOR: Filippov, S. I.; Kazakov, N. B.; Pronin, L. A.

ORG: Moscow Institute of Steel and Alloys (Moskovskiy institut stali i splavov)

TITLE: Speed of the ultrasound and compressibility in molten metals and the relation of these two characteristics to various physical properties

SOURCE: IVUZ. Chernaya metallurgiya, no. 3, 1966, 8-14

TOPIC TAGS: ultrasonic velocity, adiabatic compression, molten metal, atomic property, melting point, heat of vaporization

ABSTRACT: This investigation deals with measurements over a broader temperature range and for a greater number of metals than the study by V. V. Baydov and L. L. Kunin (V sb. "Teoriya metallurgicheskikh protsessov," vyp. 40, TsNIIChM, 1965, 94-104). To this end, quartz rods as well as rods of metallic tungsten (coated with silver to protect it against dissolution in the molten metals) were employed as the guides for the ultrasonic waves. For most molten metals the speed of sound decreases in a near-linear manner with increasing temperature. But for Bi and Sb over a certain temperature range above their melting points

Card 1/3 UDC: 669.1-154:541.12.03:621.034

the speed of sound changes insignificantly (Fig. 1). The mass of the atom and valent electrons

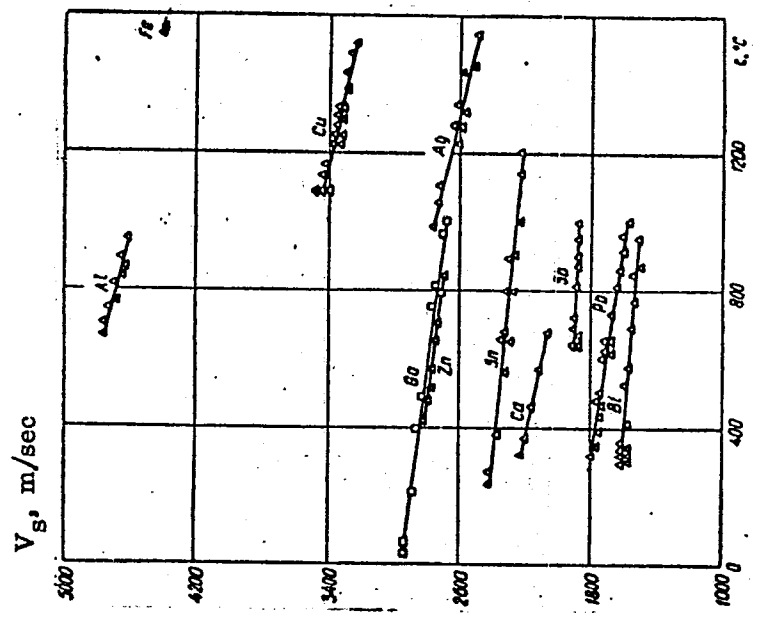

Fig. 1. Speed of sound in molten metals as a function of temperature

L 41016-66
ACC NR: AP6021706

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evidently play a major role in the mechanism of the passage of sound waves across metal. The speed of transmission of the sound pulse is determined not only by particle mass but also by the forces of cohesion between particles. These forces are estimated according to the heat of vaporization or sublimation. Analogously, one of the most important thermodynamic characteristics -- isothermal compressibility, may be computed on the basis of data on the speed of the ultrasound, density, and specific heat. The compressibility of molten metals, like that of solid metals, periodically increases with atomic number; certain alloys, however, e.g. Zn-Sb and Cd-Sb, are exceptions to this rule. This also applies to the process of the crystallization of Bi, Ga and other semi-metals, when, as a result, atomic volume increases but compressibility decreases. Orig. art. has: 7 figures, 4 tables.

SUB CODE: 20, 11, 13/ SUBM DATE: 03Dec65/ ORIG REF: 005/ OTH REF: 004

Card 3/3 hs

L 04807-67 EWT(m)/EWP(t)/ETI IJP(c) WW/JD/JG

ACC NR: AP6027006 (N) SOURCE CODE: UR/0148/66/000/005/0131/0134

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41
B

AUTHOR: Filippov, S. I.; Kazakov, N. E.; Pronin, L. A.

ORG: Moscow Institute of Steel and Alloys (Moskovskiy institut stali i splavov)

TITLE: Effect of ultrasonic treatment on the crystallization of metal melts

SOURCE: IVUZ. Chernaya metallurgiya, no. 5, 1966, 131-134

TOPIC TAGS: ultrasonic effect, metal crystallization, molten metal, metallography, metallurgic research

ABSTRACT: Using the method described by K. G. Plass (Akustische Beihefte, 1963, Hf. 1, 240-244) (variation in a fixed ultrasonic signal on the oscilloscope screen during crystallization of metal melts) the authors observed changes in the signal during cooling of molten Sn, Pb, Bi, Sb, Ga, Zn, Cd, Cu and Al through which ultrasonic waves are passed (pulsed method, frequency of ultrasound 2.5 mega-cps), as illustrated in Fig. 1 which presents the potentiometrically recorded values of the ultrasonic signal during the crystallization of zinc. The variation in signal during the crystallization is chiefly determined by two opposite factors. On the one hand, the segregation of crystals from the melt produces in increase in the absorption

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and scattering of sound waves at the numerous crystal-molten metal interfaces whereas, on

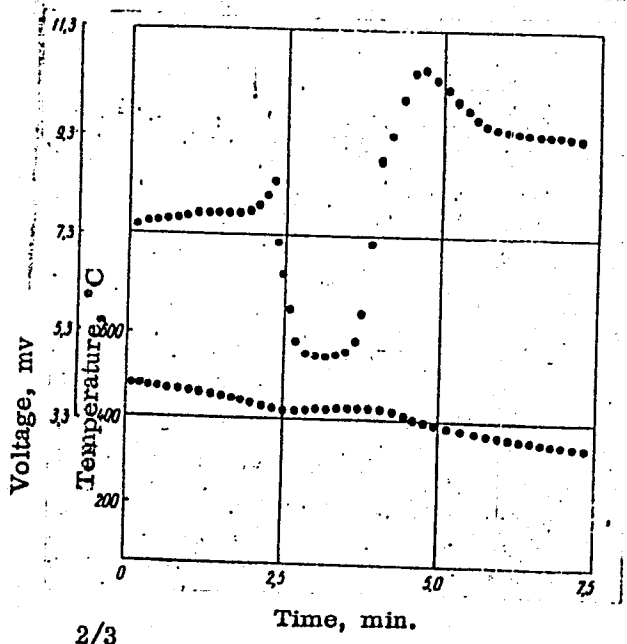

Fig. 1. Recording of the acoustic signal and temperature during the crystallization of zinc

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the other, as the metal solidifies and its elastic properties increase, the intensity of the ultrasound passed through it will increase. Observations of the cooling of melts of the binary systems Pb-Sn, Zn-Cd, Ga-Sb, Zn-Sb, Cd-Sb, Cu-Sn, Fe-C indicate that the variation in the ultrasonic signal for these alloys in liquid-solid and solid state is associated with the corresponding phase equilibrium diagrams. Thus, e.g. for the melt Sn-30 wt.% Cu the signal sharply decreases at liquidus temperature and sharply increases at eutectic temperature; microstructural examination reveals that this effect at near-liquidus temperatures is attributable to the segregation of large, well-formed ϵ-phase dendrites. Thus, the variation in ultrasonic signal in the process of the crystallization of metal melts may serve as a means of monitoring the formation of the structure of an ingot while it still is in liquid-solid state, which is of major practical and theoretical interest. Orig. art. has: 3 figures.

SUB CODE: 20, 13, 11/ SUBM DATE: 31Jan66/ ORIG REF: 003/ OTH REF: 001

Card 3/3 gd

PASHKOV, Viktor Filippovich, tokar'; FILIPPOV, S.M., red.; SHVRYUKOV, P.A., tekhn.red.

[Constantly improve your skill] Postoianno sovershenstvovat' svoe masterstvo. Kurskoe knizhnoe izd-vo, 1958. 22 p.
(MIRA 12:6)

1. Kurskiy mekhanicheskiy zavod Ministerstva sel'skogo khozyaystva RSFSR (for Pashkov).

(Lathes)

AUTHOR: Filippov, S.M. SOV/130-58-10-1/18

TITLE: The Iron and Steel Industry of the USSR is Growing (Chernaya metallurgiya SSSR na pod"yeme).

PERIODICAL: Metallurg, 1958, Nr.10, pp.1-3 (USSR)

ABSTRACT: The author mentions the rapid growth of the Soviet ferrous metallurgical industry and mentions that in the first half or 7 months of 1958 most production targets have been exceeded and several large blast furnaces completed ahead of schedule. He gives a breakdown of production (Table 1) into pipe iron, steel, rolled products, steel tubes and iron ore, by republics as absolute values for 7 months of 1957 and in relation to the planned values. He shows (Table 2) that in the first half of 1958 the average value of the coefficient of utilization of blast-furnace volume was 0.77 (0.79 in 1957), the best republic being the RSFSR (0.72) and the best works the Magnitogorsk metallurgical combine (0.61); the table shows improvements over 1957 in the coefficient and also in time-off-blast values. In open-hearth operation (Table 3) the

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The Iron and Steel Industry of the USSR is Growing.

average daily steel production per m^2 of bottom area was 7.56 (7.32 in 1957), the RSFSR with 7.74 being the best republic and the Nizniy Tagil combine (9.19) the best works; the table shows improvements over 1958 in these figures and also in furnace idle time. In rolled products the greatest excess over the target values (2.8%) was obtained by the Ukrainian SSR; a number of enterprises failed to produce the appropriate balance between the products, and the author discusses such failures and some similar failures in tube production. Labour productivity in the second quarter of 1958 (Table 4) has on the whole increased appreciably over the values for the last quarter of 1957 in spite of the reduction in working hours. The author contrasts Soviet production increases with increases in some capitalist countries and suggests that the Soviet decentralization of the organization of the steel industry and reduction of the working day have proved successful. There are 4 tables.

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SOV/130-58-10-1/18

The Iron and Steel Industry of the USSR is Growing.

ASSOCIATION: Gosplan of the USSR

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SOV/130-58-12-2/21

AUTHOR: Filippov, S.M.

TITLE: Fulfilling the Decision of the Twentieth Congress of the CPSU (Vypolnyaya resheniya XX S''yezda KPSS)

PERIODICAL: Metallurg, 1958, Nr 12, pp 2 - 5 (USSR)

ABSTRACT: The author considers Soviet achievements in iron and steel production in the light of decisions taken at the twentieth meeting of the Communist Party of the Soviet Union. He gives Soviet annual production figures for pig iron, steel, rolled products, steel tubes and iron ore for 1955-58 (Table 1) and some corresponding data for other countries (Table 2) and states that the USSR in 1957 accounted for 17.5% of world steel production. In pig-iron production new capacity played an important part in compensating for temporary raw-material deterioration in 1957, the average size of furnaces increased from 639 m^3 in 1951 to 715 m^3 in 1955 and 844 m^3 in 1958; the proportions of sinter in the burden and of fluxed sinter in the sinter have increased; high top pressure operation has been widely adopted as have high blast temperatures and moisture-contents. These measures have led to significant improvements in efficiency between 1955 and 1958 for the

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Fulfilling the Decision of the Twentieth Meeting of the CPSU

USSR (Table 3) and for the leading works (Table 4). The author mentions that a value of 0.575 was achieved for the coefficient of utilization of working volume on Nr 3 blast furnace of Magnitogorsk. In open-hearth practice the period 1955-58 has also seen considerable improvements for the country as a whole (Table 3) and the leading works (Table 5), a daily steel production per m^2 of bottom area of 9.03 tonnes being quoted for the "Zaporozhstal'" works. Both in blast-furnace and open-hearth practice the Makeyevka metallurgical works is lagging and the author makes constructive suggestions. He states that in 2½ years labour productivity has increased by over 12% and gives data (Table 6) on per capita pig-iron and steel production in the USSR and USA for 1913, 1950, 1955 and 1957.

There are 6 tables.

ASSOCIATION: Gosplan SSSR (Gosplan of the USSR)

SOV/130-59-2-1/17

AUTHOR: Filippov, S.M.

TITLE: Entering the First Year of the Seven-Year Plan (Vstupaya v pervyy god semiletki)

PERIODICAL: Metallurg, 1959, Nr 2, pp 1-3 (USSR)

ABSTRACT: The author gives the 1958 production figures for iron ore, pig-iron, steel, rolled products and tubes and relates them to those of the previous year. He notes that 1958 production targets were not reached in some of the smaller republics. Stating that improved efficiency as well as additional capacity had contributed to growth of output in 1958, the author discusses, giving figures for works, some of the measures which had contributed to the improvement of the average coefficient of utilisation of blast furnace volume from 0.79 to 0.77 and the average coke rate per tonne of steelmaking iron from 817 to 786 kg. He treats similarly steelmaking where the average production of steel per m^2 of open-hearth bottom area improved from 7.32 tonnes in 1957 to 7.56 for eleven months of 1958 and briefly mentions improvements in rolling practice. He examines capital construction in the iron and steel

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Entering the First Year of the Seven-Year Plan

industry in 1958, which was 30% greater than in 1957. The 1958 plan for building seven blast-furnaces (total capacity 4.9 million tonnes, including two of 1 million tonnes each) was successfully completed. On the other hand, some plans were not fulfilled, e.g. that for rolling mill construction, due to delays in equipment delivery and mine-construction also lagged. For 1959 production increases of over 3 million tonnes of pig iron, over 4 million tonnes of steel, over 3 million tonnes of rolled products and over half a million tonnes of tubes are planned. For the achievement of these targets, stricter adherence to quarterly plans, efforts to improve efficiency and to enlist young people in the labour force should be stressed. In blast-furnace practice ore preparation will be improved and top-pressure and blast-temperature increased. In open-hearth practice more and better use will be made of oxygen and compressed air and charge preparation (especially scrap) will be improved. Converter shops will aim to achieve more economical operation and improve refractories for oxygen-blown

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converters. In rolling and tube-making lightened sections are to be increasingly produced and plant modernisation will continue. Over the whole industry better exchange of information is to be organised to make available knowledge of the best practice. Although most of the new capacities will be provided at existing works the construction of the new Zapadno-Sibirskiy (West Siberian) and Karagandinskiy (Karaganda) works is to be continued on a large scale.

ASSOCIATION: Gosplan SSSR (Gosplan of the USSR)

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S/130/60/000/011/011/011
A006/A001

AUTHOR: Filippov, S. M.

TITLE: The Use of Analytical Computers in the Planning and Analysis of Production Indices in Ferrous Metallurgy

PERIODICAL: Metallurg, 1960, No. 11, pp. 36-38

TEXT: A scientific Conference was organized in June 1960 at the Moscow inzhenerno-ekonomicheskiy institut (Economical Engineering Institute) imeni Sergo Ordzhonikidze devoted to problems of improved planning, control and analysis of production using computers and mathematical methods in the main shops of ferrous metallurgy. Ya. P. Gerchuk, Candidate of Economical Sciences of the Moskovskiy Institut stali (Moscow Steel Institute) treated in a report the use of linear programming in planning optimum components, equipment operation, transportation and lay-out of materials. Linear programming can be performed most efficiently using high-speed electronic computers. The planning of rolling production using perforation computers is divided into three consecutive stages: 1. Treating, summarization and classification of orders for the current quarter of the year and the month, and calculation of rolling mill charges. 2. Establishing the

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The Use of Analytical Computers in the Planning and Analysis of Production Indices in Ferrous Metallurgy

optimum sequence of forwarding the orders into production; 3. Stock-taking and checking the fulfillment of the plan. The scientific-research laboratory of economics and organization of Mosgorsovnarkhoz production attached to the Moscow Economical-Engineering Institute, developed a project on the mechanized treatment of operational plans applied to section mills of the "Serp i Molot" Plant, using 45-digit computers. The results obtained on improved planning, checking and analysis, using perforation computers, are now being introduced to the steelmaking shops of the plant and can be recommended to other metallurgical enterprises. Investigations were also made to select optimum conditions for coordinating the delays of delivery, according to graphs of metallurgical enterprises, with the production delays of the machine-building plants. This problem can be solved by linear programming. The calculation methods determined were applied to the cold-pressing shop of the Chelyabinsk Tractor Plant according to the time of delivery of the sheet material from the Magnitogorsk Metallurgical Combine. Analytical computers may also be used for the technical and economical analysis of prime costs in metallurgical production. For this purpose it is necessary 1. to develop standards for the use of equipment; labor; material, fuel and electric