Transformations in eutectic alloys copper-aluminum.
VI. P. L. Gruzin and G. Kurdyumov. *J. Tech.
Phys.* (U.S.S.R.) 10, 1080-4 (1940).--The transforma-
tion $\beta' \to \beta_1$ in heated eutectic Cu-Al alloys was investi-
gated by the method of Sykes (measurement of true spe-
cific heat). The thermal-capacity curves, obtained for
the alloys with the concns. of Al from 11.85 to 12.9%,
show a max. corresponding to the absorption of heat at
the $\beta' \to \beta_1$ transformation point. The measured energy
of transformation was 4.2-4.5 cal./g. The transformation
$\beta' \to \beta_1$ covers the temp. interval analogous to that in the
transformation of steels. (The width of the interval
reaches 100°.) The energy of eutectic transformation
$\alpha-\gamma \to \beta$ was found to be 6 cal./g. VII. G. Kurdyumov
and V. Miretskii. *Ibid.* 1685-90.--For the investigation
of $\beta_1 \rightleftarrows \beta'$ transformation of solid solns. in Cu-Al alloys,
a photographic method was developed permitting making
photographs in a few sec. The heating and cooling proc-
esses in the monocryst. alloys contg. 12.4, 12.7 and 13.09%
Al were photographed. This permitted direct observa-
tion of structural charges corresponding to the $\beta \rightleftarrows \beta_1 \rightleftarrows$
β' transformation, and study of the phenomena of reversi-
bility and temp. hysteresis for the $\beta_1 \rightleftarrows \beta'$ transformation.
Roksalana Gamow

CA

9

PACKAGES AND PROPERTIES

Thermal effects in the high-temperature annealing of hardened steel. R. A. Abramovich, P. L. Gruzin, G. V. Kurdyumov and R. I. Entin. *J. Tech. Phys.* (U.S.S.R.) 11, 1083-6(1941).—In order to collect exptl. data on the condition of Fe and carbides in troostite and sorbite, heat capacities were detd. and their changes on heating of steels which were annealed after hardening at 375°, and of cold-deformed steels. In the range 100–700° the heat capacity of cold-worked steels does not differ from that of the heat-treated steels. On heating hardened steels that were previously annealed at 375°, there was found a thermal effect in the range of 500-600°, the magnitude of which is about 1 cal/g. Several explanations for this effect are presented.

G. M. Kosolapoff

A S A I S L A   METALLURGICAL LITERATURE CLASSIFICATION

GRUZIN, P. L.

USSR/Metals - Diffusion   1 Sep 51

"The Influence of Carbon on the Self-Diffusion of
Iron," P. L. Gruzin, Yu. V. Kornev, G. V. Kurdyumov,
Corr Mem, Acad Sci USSR, Inst of Metal Sci and Phys
of Metals, Cen Sci Res Inst of Ferrous Metallurgy

"Dok Ak Nauk SSSR" Vol LXXX, No 1, pp 49-51

Preliminary data touching on the influence of carbon.
on the self-diffusion of gamma-iron was obtained
during investigations of the self-diffusion of pure
iron. It was shown that the addn of carbon strongly
influences the parameters governing the self-diffu-
sion of iron. Current article subjects this problem

to a special study. Concludes that the addn of car-
bon in iron decreases the energy of the bond of the
austenite lattice. Submitted 12 July 51.

221T45

221T45

GRUZIN, P. L.

USSR/Engineering - Refractories, Testing, Radioactive Indicators   Oct 52

"Application of the Method of Radioactive Indicators for Investigation of Diffusion in Refractories," L. A. Shwartsman, O. A. Pechenev, P. L. Gruzin, Inst of Metallography and Phys of Metals, TsNIIChM

"Ogneupory" No 10, pp 465-469

Studies character of motion in refractories of one of slag components, iron oxides, at temps when this substance is already solidified. Method of radioactive indicators, used in experiments, established that process of penetration of solid oxides in refractories at high temps is described by equation of diffusion. Coefficients of diffusion were determined in magnesite, chrome-magnesite, and dinas bricks at various temps. Used radioactive isotope Fe59. Measured radiation intensity with counters for beta-particles and gamma-quanta.

PA 244T72

GRUZIN, P. L.

"Using Artificial Radioactive Indicators for Studying Diffusion and Self-Diffusion Processes in Alloys: Selh Diffusion of Cobalt," Dokl. AN SSSR, 86, No.2, 1952

J. of the Iron & Steel
Inst: Feb 1954

Corrosion

The Use of Artificial Radioactive Isotopes for the Study of Diffusion and Self-Diffusion in Alloys. Self-Diffusion in γ Iron. P. L. Gruzin (*Izvestiya Akademii Nauk S.S.S.R.*, *Otdelenie Tekhnicheskikh Nauk*, 1953, (3), 383-392). [In Russian]. A method of determining coefficients of diffusion and self-diffusion, based on the use of radioactive isotopes, which can be used for any solid suitable for mechanical working is described. More exact results were obtained when using γ-radiating isotopes. The temperature dependence of the coefficient of self-diffusion of γ iron in the 960–1250° C. range was determined.—V. o.

P. L. GRUZIN

Journal of the Iron and Steel Inst.
June 1954
Metallography

The Influence of Carbon on the Self-Diffusion of Iron in the Iron-Nickel System. P. L. Gruzin and E. V. Kuznetsov. (*Doklady Akademii Nauk. S.S.S.R.,* 1953, 93, (5), 809–812). [In Russian]. The influence of carbon on the self-diffusion of iron in Fe-Ni alloys was studied, using radioactive Fe₅₅, in the temperature ranges 800–1300 C. and 1050–1330° C. for alloys containing 20% and 25% of nickel respectively. The time of diffusion heating was such that the diffusion layer was 40–50 times thicker than the electroplated layer of radioactive iron. The dependence of the coefficients of self-diffusion of iron on the carbon content of the iron-nickel alloys are represented by the formulæ : (1) for alloys containing 20% of nickel

$$D_{\text{Fe-Ni-C}} = 18 \cdot 10^{-0.02p} e^{-\frac{75000 - 6000p}{RT}};$$

and (2) for alloys containing 25% of nickel

$$D_{\text{Fe-Ni-C}} = 71 \cdot 10^{-0.05p} e^{-\frac{70000 - 5000p}{RT}};$$

where p is the carbon content in at.-%, R a gas constant, and T the temperature (° K.) It is concluded that carbon lowers the bond energy of atoms in solid solutions of iron and nickel.

GRUZIN, P.L.; KUZNETSOV, Ye.V.; KURDYUMOV, G.V., akademik.

    Effect of intra-granular structure of austenite on the autodiffusion
    of iron. Dokl.AN SSSR 93 no.6:1021-1023 D '53.   (MLRA 6:12)

    1. Institut metallovedeniya i fiziki metallov TsNIIChM.
       (Iron--Metallography) (Austenite)

Geuzin, P. L.

Determination of diffusion coefficients in solid bodies by the method of radioactive isotopes. P. L. Gruzin and D. F. Litvin. *Doklady Akad. Nauk S.S.S.R.* 94, 41—(1954); cf. *C.A.* 48, 1223c.—The method was based on the fact that β-particles are more strongly absorbed than γ-rays, and therefore the relative intensities of the 2 radiations changed as a layer of radioactive isotopes diffused into the body of a specimen. The method was tested on tech. Fe by using Co^{60} as the diffusing substance. Fe specimens 3 × 12 × 25 mm. were homogenized at 1050–1250° and then covered with a 1-μ layer of radioactive Co. Counts were made before and after diffusion with and without a 1-mm. Al filter. The diffusion anneal was done in a quartz tube evacuated to 10^{-3} mm. Hg and with temps. controlled to ±5°. The back side was cleaned after diffusion to avoid surface-diffusion effects. Data were obtained for γ-Fe at 3 temps. in the range 1100–1200° and for α-Fe at 5 temps. in the range 700–900°. The D values were: $D_\alpha = 0.2$ exp. $(-54,000/RT)$; $D_\gamma = 300$ exp. $(-87,000/RT)$. These agreed only moderately well with the results of a sectioning method. The present method had shortcomings, but it had such advantages as being independent of partial loss of the radioactive substance. A. G. Guy

3

1mm

Rmf 9m

GRUZIN, P.L.

*Diffusion of Cobalt, Chromium, and Tungsten in Iron and Steel. P. L. Gruzin (*Doklady Akad. Nauk S.S.S.R.*, 1954, 94, (in Russian). The temp.-dependence of the diffusion coeff., D, of Co, Cr, and W in α and γ phases of tech. Fe (0·08% C) and steel of eutectoid compn. (0·82% C) was studied in the range 700°–1250° C. by the method of radioactive isotopes (using Co^{60}, Cr^{51}, W^{185}). The log D against $1/T$ curves for tech. Fe showed a break in the 1000°–1100° C. range, in the γ-phase field. The increase of the diffusion rate in austenite below 1050° C. was explained by the complex structure of the austenite grains (at that temp.), in which the grain boundaries of crystals of the transformed ferrite, pearlite, and ferrite-pearlite mixture are still discernible. The diffusion parameters D_0 and Q in the equation $D = D_0 e^{-Q/RT}$ were calculated for Co, Cr, and W in the ferrite of tech. Fe and in the austenite of tech. Fe and steel. The diffusion activation energy of Co, Cr, and W in austenite was much lower for steel than for tech. Fe, indicating that the presence of dissolved C loosened the bonds between the atoms of these elements in the austenite lattice. The differences between D for Co, Cr, and W in austenite were small; in ferrite the rate of diffusion of Co was 10–20 times that of Cr, with W occupying an intermediate position.—S. K. L.

Inst. Metal. + Physics z Metals, Ts NIIChM.

Evaluations: {
B-77863 - 18 Aug 54
B-78524 - 8 Sep 54
B-81524 - 28 Dec 54

GRUZIN, P L.

USSR/Physics - Technical physics

Card 1/1   Pub. 22 - 16/40

Authors   : Gruzin, P. L.; Noskov, B. M.; and Shirokov, V. I.

Title   : Effect of Mn on the self-diffusion of Fe

Periodical : Dok. AN SSSR 99/2, 247-250, Nov 11, 1954

Abstract   : Eight Fe-Mn alloys were investigated to determine the effect of Mn on the self-diffusion of the Fe in austenite. The thermal dependence of the self-diffusion coefficients of Fe in the gamma-phase of Fe-Mn alloys was investigated by the method of radioactive indicators through the utilization of the artificially-radioactive Fe^{59} isotope. The self-diffusion coefficients were calculated on the basis of data obtained by measuring the integral radioactivity of the sample. It was found that the bond between the atoms of the basic alloy during the addition of the second element increases. The energy of activation of Fe self-diffusion at an Mn content of 8% was established as greater than the activation energy of pure iron self-diffusion. Seven references; 6-USSR and 1-USA (1938-1954). Tables; graphs.

Institution : Central Scientific Research Institute of Ferrous Metals, Institute of Metallurgy and Physics and State University, Institute of Chemistry, Gorkiy

Presented by: Academician G. V. Kudryumov, June 5, 1954

11228   AEC-cr2928   27
SELF DIFFUSION IN TANTALUM. P. L. Gruzin and V. I.
Meshkov. Translated from Voprosy Fiz. metall. I Metal-
loved. Akad. Nauk Ukrain. S.S.R. 570(1953). 9p.
The self-diffusion coefficients in Ta were determined at
1200, 1250, and 1300°C using Ta[182] as tracer. Radioactive
Ta was deposited on one of the surfaces of a nonradio-
active Ta specimen which was in the form of a parallelo-
piped. Two samples, with their active faces toward each
other, were sealed in quartz ampoules and given diffusion
anneals of 170 to 329 hr, depending on the temperature.
The self-diffusion coefficients were measured by cutting
layers and measuring the remaining integral activity of the
specimens. (L.T.W.)

VINTAYKIN, Ye.Z.; GRUZIN, P.L., kand.fiz.-mat.nauk; KLYACHKO, Yu.A., prof., doktor
khim.nauk; SHOTOV, A.P.

Alloy phase analysis by the method of radioactive tracers. Probl.
metalloved. i fiz. met. no.4:269-276 '55.   (MIRA 11:4)
        (Alloys--Metallography) (Radioisotopes--Industrial applications)

GRUZIN, P.L.,kand.fiz.-mat.nauk

Cobalt, chromium, and tungsten diffusion in iron and steel. Probl.
metalloved. i fiz. met. no.4:475-485 '55.   (MIRA 11:4)
        (Diffusion) (Iron alloys)

GRUZIN, P.L.

USSR/Crystals.   B-5

Abs Jour   : Referat Zhur - Khimiya, No 6, 1957, 18298

Author   : P.L. Gruzin, D.F. Litvin.
Title   : To The Question of Diffusion Study by the Method of
               Radioactive Isotopes.

Orig Pub   : Problemy metalloved. i fiz. metallov, sb. 4, 1955, 486-
               493.

Abstract   : A variant of the absorption method of radiometric analy-
               sis was developed. At the measurement of the sample acti-
               vity before and after the diffusion annealing, the ratio
               of the intensities of β - and γ - components of radiation
               in case of mixed radiators, or the ratio of the intensi-
               ties of two β spectrum parts in case of pure β- radiators
               is determined by this method. The solution of the diffu-
               sion equations is modified in order to apply them to
               this method. The relative error of the determination of
               the diffusion factor is 25%. The experiments were succes-
                                                                     sful

Card 1/2   - 64 -

USSR/Crystals.   B-5

Abs Jour   : Referat Zhur - Khimiya, No 6, 1957, 18298

               in reducing the error to from 10 to 15%.
               The sensitivity of this method is greater than that of
               other modifications of the absorption method. The use
               of this method in the region of low temperatures is the
               most rational. The diffusion factor of Co in Fe deter-
               mined by this method agrees well with data obtained
               with other methods.

Card 2/2   - 65 -

GRUZIN, P.L., kand.fiz.-mat.nauk; KUZNETSOV, Ye.V.; KURDYUMOV, G.V., akademik

Effect of the intergranular structure of austenite on the self-
diffusion of iron. Probl. metalloved. i fiz. met. no.4:494-497 '55.
(Diffusion) (Iron alloys--Metallography)   (MIRA 11:4)
(Austenite)

GRUZIN, P.L.,kand.fiz.-mat.nauk; NOSKOV, B.M.,kand.fiz.-mat.nauk; SHIROKOV,
        V.I.,kand.fiz.-mat.nauk.

    Effect of manganese on the self-diffusion of iron. Probl. metalloved.
    i fiz. met. no.4:503-508 '55.   (MIRA 11:4)
            (Diffusion) (Iron) (Manganese)

CRUZIN, P. L.

Effect of alloying upon the self-diffusion of cobalt. P. L. Gruzin and I. M. Noskov. Problemy Metalloved. i Fiz. Metal. Sbornik No. 4, 500–16(1955); Referat. Zhur., Met. 1956, No. 6844.—The coeffs. of self-diffusion D of Co in Co alloy contg.: (1) Cr 3.58, (2) Cr 7.09, (3) Ni 4.10, (4) Ni 7.9, (5) Ni 20.17, (6) Cr 0.21, Ni 26.38, (7) Cu 18.32, Ni 95.03, (8) Fe 20.8, and (9) Fe 15.10, Ti 3.76% were detd. at 1100–1350° by the method of integral residues (cf. C.A. 47, 2007a) by means of the γ-activity of Co⁶⁰. The alloys after being cast were homogenized at 1050° for 20–25 hrs. in a H atm. and rolled into sheets. The curve of log D as a function of 1/T shows that at 1150° and above only vol. diffusion occurs; at temps. below 1150° mixed diffusion occurs. At 1150° for the alloys in the above order D is 0.57, 56.3, 839.9, 124.0, 0.155, 6.3, 0.4, 0.54, and 0.008 sq. cm./sec. energies of activation of self-diffusion are 65.8, 79.3, 87.4, 81.2, 69.5, 72.1, 64.2, 65.0, and 51.2 kcal./g.-atom. This shows a considerable change in bond energy of the lattice on addn. of alloy components.   Alexis N. Pestun

GRUZIN, P.L.,kand.fiz.-mat.nauk; KOSTOGONOV, V.G.; PLATONOV, P.A.

Using an artificial C^{14} isotope in studying the diffusion of carbon
in steel. Probl. metalloved. i fiz. met. no.4:517-523 '55.
        (Carbon--Isotopes) (Steel--Analysis)   (MIRA 11:4)

GRUZIN, P.L.,kand.fiz.-mat.nauk; MESHKOV, V.I.

Self-diffusion of tantalum. Probl. metalloved. i fiz. met. no.4:570-573
'55.   (MIRA 11:4)
        (Diffusion) (Tantalum)

VINTAYKIN,Ye.Z.; GRUZIN,P.L.; FEDOROV,S.N.

Determining sublimation temperatures by means of the mass-
spectrograph. Zav.lab.21 no.7:835-837 '55. (MIRA 8:10)

1. TSentral'nyy nauchno-issledovatel'skiy institut chernoy
metallurgii.
    (Sublimation (Chemistry)) (Mass spectrometry)

GRUZIN, P. L.

USSR/Physics - Metallurgy

Card 1/1   Pub. 22 - 17/50

Authors   : Gruzin, P. L.

Title   : Effect of chrome on the self-diffusion of iron

Periodical : DOK. AN SSSR 100/1, 65-67, Jan. 1, 1955

Abstract   : Experiments were conducted to determine the effect of chrome on the self-
              diffusion of iron. The results indicate that the presence of chrome in
              iron increases the intermolecular couplings in the crystallic lattice and
              diminishes the velocities of the iron atoms. This, then increases the self-
              induction of iron. Four USSR references (1948-1953). Graphs; tables.

Institution : Institute of Metalography and Physics of Metals of TsNIIChM (Central
              Scientific Research Institute of Ferrous Metals

Presented by: Academician G. V. Kurdyumov, May 26, 1954

GRUZIN, P. L.

USSR/ Physics - Diffusion

Card 1/2   Pub. 22 - 10/47

Authors   :   Gruzin, P. L.; Kostogonov, V. G.; and Platonov, P. A.

Title   :   Application of the carbon isotope C^{14} for the study of carbon diffusion in steel

Periodical :   Dok. AN SSSR, 100/6, 1069-1072, Feb 21, 1955

Abstract   :   The development of a method for measuring the diffusion coefficient in metals by means of the radioactive C^{14} isotope is reported. The new method has shown greater sensitivity than all other available methods and requires no special assumptions regarding the mechanism of diffusion or knowledge of the structural diagram.

Institution :   Central Scientific Research Institute of Ferrous Metallurgy, Institute of Metallurgy and Physics of Metals

Presented by : Academician G. V. Kurdyumov, June 22, 1954

Periodical :   Dok. AN SSSR. 100/6, 1069-1072, Feb 21, 1955

Card   2/2   Pub. 22 - 10/47

Abstract   :   The method was found highly suitable for the study of the effect of
alloying elements on the carbon diffusion in ferrite and austenite.
Some practical experiments carried out by means of the radioactive iso-
tope method are described. Nine references: 4 USA and 5 USSR
(1937-1953). Graphs.

GRUZIN, P.L.

Chromium diffusion in its nickel solid solution. P. L. Gruzin and G. B. Fedorov (Eng.-Phys. Inst., Moscow). Doklady Akad. Nauk S.S.S.R. 105, 207-7(1955).—Cr diffusion was studied in (1) 99.8% Ni, (2) Ni-Cr alloys, (3) Ni-Cr-Ti-Al, and (4) Ni-Cr-Ti-low Al alloys. The isotope was plated on the sample surface; 2 samples were clamped together face to face and diffusionally annealed for 5-8 hrs. at 875° and 1250°. The radioactivity was measured in thin layers taken off by machining the samples. In all the samples except No. 3, Cr diffused in the single-phase range; in No. 3, at 875°, 2 phases were present, whereas at higher ranges in No. 3, Cr also diffused in 1 phase. In all single phases the diffusion values fall on a straight line on the log D-T diagram. The diffusion coeffs. were evaluated for 700, 800, 900, and 1000°. In a 20%-Cr alloy the diffusion coeff. is 0.1 to 0.2 that in pure Ni in the 700-900° range, which corresponds to a rise in activity energy from 48 to 58 kcal./g. The Ti addn. further raises the activity coeff., i.e. increases the bond strength in the lattice. The calcd. m.p. of the alloys were very close to the exptl., and were, in the 4 samples, resp.: 1455°, 1425°, 1370°, and 1330°, which explains the experimentally observed rise in the activation energy of Cr diffusion in the alloys of lower m.p.

W. M. Sternberg

Gruzin, P.L.

3785. INVESTIGATION OF WEAR OF REFRACTORY LININGS OF METALLURGICAL FURNACES USING RADIOACTIVE ISOTOPES. Gruzin, P.L. and Zemsky, S.B. (Zavod. Lab. (Fact. Lab., Moscow), 1956, (2), 169). To follow the wear of the shaft lining of a blast furnace, Co^{60} was placed at intervals along the radius, and a counter outside the furnace registered the total radiation; the counter showed when the lining had worn back to such an extent that a radioactive pellet was removed. The source is placed in alumina ampoules, closed at one end; the other end is smeared with refractory paste, to reduce evaporation. At working temperatures of 1100° evaporation of cobalt from closed ampoules is negligible. To study wear on the lining of a mixer and of the roof, sides and hearth of an open hearth furnace, holes were made in chrome-magnesite bricks and radioactive iron powder was inserted. For measurements under production conditions, five radiation sources were placed 50 mm apart in the brick. This method cannot be used for the hearth of a blast furnace, the wear in which can be measured by impregnating the hearth with solutions of radioactive isotopes and watching for evidence of radioactivity in the pig iron and slag. Experience shows that the hearth lining wears quickly at first — the top courses last from a day to a month — and short-lived isotopes such as

P^{32}, Ir^{192} were therefore used. In the lower courses, however, long life isotopes such as Co^{60} are needed. The results are shown graphically. To avoid errors, isotopes with different spectra should be placed in the adjoining sections. Isotopes having a stable radiation with an average energy of $0.4 - 0.5$ Mev, are most suitable. Radioactive isotopes are at present placed along the axis of the hearth. Isotopes are put into bricks during construction or repair of the furnace. The ampoules for carbon brickwork are made from graphite, those for the firebrick lining from iron.

B.Curran.R.A.

E-6

USSR / Diffusion. Sintering.

Abs Jour   : Ref Zhir - Fizika, No 4, 1957, No 9339

Author   : Arkharov, V.I., Gerasimov, A.F., Gruzin, P.L.
Inst   : Ural'University USSR
Title   : Investigation of the Phenomenon of Internal Adsorption on
              the Boundary of an Aluminum Silver Alloy with Oxide Film,
              Using the Radioactive Isotope Method.

Orig Pub   : Fiz. metallov i metallovedeniye, 1956, 2, No 2, 294-302

Abstract   : Plates of the alloy Al -- 0.29% Ag, containing a small a-
              mount of radioactive isotope Ag^{110} were subjected to a
              six-hour exposure at 550° in vacuum (10^{-2} -- 10^{-3} mm mer-
              cury) to obtain a thin (50 -- 100 A) oxide film, and to
              rapid cooling. After this, successive layers 500 -- 600 A
              thick were etched away from the specimen (the thickness of
              the removed layer was estimated from the decrease in weight
              of the specimen), and each layer was etched away in a dif-

Card   : 1/2

USSR / Diffusion. Sintering.   E-6

Abs Jour   : Ref Zhur - Fizika, No 4, 1957, No 9339

Abstract   : ferent vessel. · Such treatment was carried out cyclically
              18 times until there was accumulated in all the vessels a
              sufficient· amount of etching products, and after which the
              etching products were evaporated and their activity measu-
              red. It turned out that the first (surface) layer is some-
              what poorer in silver, compared with the average contents
              of the silver in the alloy, which can be explained by the
              floating away of the silver atoms into the specimens as a
              result of the oxidation of the surface. The second and 3rd
              layers have considerably more silver compared with its ave-
              rage contents in the alloy. This enrichment cannot be at-
              tributed to selective oxidation of the alloy and must be a-
              scribed to the internal adsorption of silver in the transi-
              tion zone between the oxide and metal. The thickness of
              the transition zone, according to the described experiments,
              is estimated to be 1,600 -- 1,800 A.

Card   : 2/2

·P. L.

USSR / Diffusion. Sintering.   E-6

Abs Jour   : Ref Zhur - Fizika, No 4, 1957, No 9328

Author   : Gruzin, P.L., Tyutyunnik, A.D.
Inst   : Institute of Metal: Research and Metal Physics, Central
              Scientific Research Institute for Ferrous Metallurgy.
Title   : Concerning the Diffusion Mobility of Atoms During the Mel-
              ting and Crystallization of Metals.

Orig Pub   : Fiz. metallov i metallovedeniye, 1956, 3, No 1, 70-75

Abstract   : Certain problems concerning the role of diffusion in mel-
              ting and recrystallization of metal are considered. An ana-
              lysis of the available data on self-diffusion leads to the
              conclusion that the melting processes and the recrystalli-
              zation of various metals are characterized by definite le-
              vels of diffusion mobility. The threshold levels of the
              diffusion mobility are determined by a coefficient of the
              order 10^{-22} cm^2 sec^{-1} in recrystallization and 10^{-8} cm^2

Card   : 1/2

USSR / Diffusion. Sintering.

E-6

Abs Jour   : Ref Zhur - Fizika, No 4, 1957, No 9328

Abstract   : sec^{-1} in the melting of pure metals. .The crystallization
of solid solutions takes place at higher threshold levels
of diffusion mobility ($D \sim 10^{-13}$ cm^2 sec^{-1}). It can be as-
sumed that other single-type processes that take place in
solid bodies and that are connected with diffusion also ha-
ve approximately equal threshold levels of diffusion mobi-
lity.

Card   : 2/2

GRUZIN, P.L.

Study of refractory lining wear in metallurgical furnaces by the radioactive tracer technique. P. L. Gruzin and S. V. Zemskii. Zavodskaya Lab. 22, 109-11(1956).—The detn. of blast-furnace, mixer, and open-hearth lining wear by the radioactive tracer technique, as practiced in Russia, is described. The techniques depend on the specific furnace construction, the lining thickness, etc., and the preferred radioactive isotopes are Co^{60} and Fe^{59}, the former in the blast-furnace shaft with a relatively thin lining (1350 mm.), by measuring the radiation through the shell and in the metal. A large increase in the latter invariably indicates a breaking off of the lining. In the blast furnace well lining, Ir^{192} and W^{185} are recommended. The selection of the proper isotope is dictated by the length of the service period of the furnace, by the lining thickness, by safety to the operating personnel, etc.   W. M. Sternberg.

SAKHARUK, P.A.; KHAZANOVA, T.P.; GRUZIN, P.L.; TYUTYUNNIK, A.D.

Using radioisotopes to investigate the dephosphorization process of pyrochloric concentrates. TSvet. met. 29 no.7:7-9 Jl '56.
(MLRA 9:10)

(Pyrochlore) (Radioisotopes--Industrial applications)

BABIKOVA, Yu.F.; GRUZIN, P.L., professor, doktor fiziko-matematicheskikh
nauk, nauchnyy rukovoditel'.

[Using radioactive indicators in the study of the mobility of
atoms in solid solutions; abstract of a dissertation for the
degree of candidate of physical and mathematical sciences]
Izuchenie podvizhnosti atomov v tverdykh rastvorakh metodom
radioaktivnykh indikatorov; avtoreferat dissertatsii na
soiskanie uchenoi stepeni kandidata fiziko-matematicheskikh nauk.
Moskva, M-vo vysshego obrazovaniia SSSR, 1957. 15 p.   (MIRA 11:12)
    (Solutions, Solid)   (Carbon--Isotopes) (Mass transfer)

GRUZIN, P L

137-58-5-10592

Translation from: Referativnyy zhurnal, Metallurgiya. 1958, Nr 5. p 246 (USSR)

AUTHORS: Gruzin, P. L., Kurdyumov, G. V., Tyutyunik, A. D., Entin, R. I.

TITLE: On the Role of Diffusive Displacements of Atoms in High-temp-
erature Strength (O roli diffuzionnykh peremeshcheniy atomov v
zharoprochnosti)

PERIODICAL: V sb.: Issled. po zharoprochn. splavam. Vol 2. Moscow,
AN SSSR, 1957, pp 3-8

ABSTRACT: Some results of investigations of diffusion (D) in metals and
alloys relative to the problem of high-temperature strength (H)
are examined. It is noted that the special features of the be-
havior of metals at high temperatures under load are conditioned
by the existence of rather frequent diffusive shifts of atoms (A)
in the crystal lattice of the phases constituting the alloy. There-
fore, along with the shear mechanism of plastic deformation, a
diffusion mechanism becomes active. The number of atomic dis-
placements, increasing with temperature, tends to limit the
temperature zone in which hardened alloy phases may be em-
ployed, owing to the reduction in the resistance to plastic de-
formation due to the shear mechanism. The relatively higher A

Card 1/2

On the Role of Diffusive (cont.)

137-58-5-10592

mobility at the grain boundary or the intra-grain interface, as against that within the body, means that the grain boundaries constitute the weak spot in the resistance of a metal to deformation and failure at high temperatures. A reduction in the mobility of the A is required to increase the level of H. It is demonstrated that an identical level of mobility of the A can be attained at different temperatures with different metals. The temperature at which a given level of diffusive mobility of A is attained is determined primarily by the energy of activation. In some metals the level of mobility of the A is also significantly shifted by the change in the magnitude of the factor D_0 preceding the exponent in the expression for the relationship between the coefficient of diffusion (CD) and the temperature. Accumulated experimental data show that a variation in the CD may occur owing to changes in either parameter of the temperature dependence of the CD. At elevated energies of activation (due to alloying), there is usually an increase in the multiplier D_0, with the result that at temperatures that are high for the given alloy base metal there is little change in the CD, while at low temperatures they may change by a full order of magnitude or even more. Addition to the alloy of elements that strengthen the bond in the solid solution causes a shift toward higher temperatures for the onset of the diffusive ductility mechanism.
1. Metals--Diffusion   2. Alloys--Diffusion   3. Metals--Temperature
Card 2/2   4. Metals--Mechanical properties

137-58-4-6317

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 4, p 1 (USSR)

AUTHOR: Gruzin, P. L.

TITLE: Making Use of the Achievements of Nuclear Physics in Metallurgy
            (Ispol'zovaniye dostizheniy yadrenoy fiziki v metallurgii)

PERIODICAL: V sb.: Primeneniye radioaktivn. izotopov v chernoy metallurgii.
            Chelyabinsk, Knigoizdat, 1957, pp 19-31

ABSTRACT: The use of isotopes and nuclear radiations in metallurgy, in-
            strument and machine manufacture, and the study and control of
            metallurgical processes.

            1. Metallurgy--USSR   2. Isotopes--Applications   P. N
            3. Instrumentation--Development

Card 1/1

Translation from: Referativnyy zhurnal, Metallurgiya, 1957, Nr 12, p 358 (USSR)

AUTHORS: Gruzin, P. L.,   Zemskiy, S. V.

TITLE: Inspection of Refractory   Lining by Means of Radioactive
            Isotopes (Primeneniye radioaktivnykh izotopov dlya kontroiya
            sluzhby ogneupornoy kladki)

PERIODICAL: V sb.: Primeneniye radioaktivn. izotopov v chernoy metallurgii
             Chelyabinsk, Knigoizdat, 1957, pp 32-48

ABSTRACT: Methods of inspection for wear in the lining of open-hearth
             and blast furnaces are examined.

                                                              L V

             1. Refractory materials-Inspection   2. Isotopes (Radioactive)-
                 Applications   3. Furnaces-Maintenance

Card 1/1

GRUZIN, P.L.

137-1958-1-280

Translation from Referativnyy zhurnal. Metallurgiya, 1958. Nr 1, p 43 (USSR)

AUTHORS: Gruzin, P.L., Zemskiy, S.V., Trekalo, S.K., Afanas'yev, V.N.

TITLE: A Study of the Motion of Charge Components in Blast Furnaces
          (Izucheniye dvizheniya shikhtovykh materialov v domennykh pechakh)

PERIODICAL: V sb.: Primeneniye radioaktivn. izotopov v chernoy metallurgii.
             Chelyabinsk. Knigoizdat. 1957, pp 59-66

ABSTRACT: Radioactive isotopes Fe^{59} and Co^{60} were used to determine
            the rate of motion of the charge at various distances from the wall
            of a blast furnace. Photon counters mounted either outside the
            furnace or in its lining (fixed counters) or introduced within it by
            A.A. Melikyan's method (mobile counters) were used to trace the
            progress of the radioactive isotopes through the various levels of
            the furnace. Data obtained by the investigation show that the time
            during which the materials remain within a $330 m^3$ furnace from
            the stock line to the tuyere belt is 3 hrs. 40 min. for the clinker
            in the middle of the furnace and 4 hrs. 45 min. at the periphery,
            while for coke it is 4 hrs. 50 min. both at the center and at the
            periphery.
Card 1/1   M.O.

1. Blast furnaces--Performance   2. Iron isotopes (Radioactive)
--Applications   3. Cobalt isotopes (Radioactive)--Applications

USSR/Physical Chemistry - Crystals.   B-5

Abs Jour   : Referat Zhur - Khimiya, No 1, 1958, 232

Author   : P.L. Gruzin, Yu.A. Polikarpov, G.B. Fedorov.
Inst   :
Title   : Study of Diffusion of Carbon in Nickel and Its Alloys
              Using Radioactive Isotope C^{14}.

Orig Pub   : Fiz. metallov i metallovedeniye, 1957, 4, No 1, 94-102

Abstract   : The method of the study of the diffusion of C in metals
              using C^{14} was developed. The tagged C was applied to
              the metal surface by short-time cementation. Parallel
              layers were machined off after the diffusion annealing.
              The total radioactivity I of the remaining portion of
              the specimen was measured after the removal of each layer,
              and graphs of the dependence of I on the thickness of the
              removed layers x, and of the dependence of ln I on x^2 we-
              re plotted. The diffusion factor D was determined by the
              equation $D = (\alpha/\beta - 1) / 4 \alpha t$, where β is the slant of

Card 1/2

USSR/Physical Chemistry - Crystals.   B-5

Abs Jour   : Ref Zhur - Khimiya, No 1, 1958, 232

            the line $\ln I = f(x^2)$, and $\propto$ is the slant of a line of
            the same kind plotted for the thin surface layer of the
            specimen after cementation. It was found for the diffu-
            sion of C in Ni at 500 to 900° that the pre-exponential
            factor D_O 0.1 $cm^2 sec^{-2}$ and the activation energy $Q =$
            33 kcal per g-atom. The alloying of nickel with Cr, Co
            or Mo (1 to 5%) results in a small increase of D_O and Q,
            D remaining practically constant, which agrees with the
            known peculiatities of the arrangement of C in metal lat-
            tices. D for C is 10^5 to 10^6 times greater than D for
            metal in metal. The importance of obtained results for
            metallurgy is discussed.

Card 2/2

AUTHORS: Babikova, Yu. F., and Gruzin, P. L.   126-2-10/35

TITLE: Study of the electrolytic transfer of carbon in steel
         by means of radioactive tracers. (Izucheniye elektro-
         liticheskogo perenosa ugleroda v stali metodom radio-
         aktivnykh indikatorov).

PERIODICAL: Fizika Metallov i Metallovedeniye, 1957, Vol.5, No.2,
         pp. 255-260 (USSR)

ABSTRACT: Literary data are available on investigations of electro-
         diffusion of carbon into austenite. Attempts by
         Guterman, V. M. (Ref.5) to establish electrolytic
         transfer of carbon into ferrite were unsuccessful.
         Diffusion data published by Gruzin, P. L. (Ref.6) indicate
         that the mobility of carbon atoms in ferrite is greater
         than in austenite. Therefore, it could be expected
         that electro-diffusion of carbon should take place in
         ferrite and that it could be detected if a proper
         technique is used. In this work the main object of
         investigation was α-iron. The specimens consisted of
         iron foils whereby the iron contained the following:
         0.03% C; 0.04% Mn; 0.009% S; 0.13% Si; 0.005% P. The
         specimens consisted of 5 to 8 mm wide, 0.08 to 0.15 mm
Card 1/3 thick and 50 mm long strips which were copper-plated

126-2-10/35

Study of the electrolytic transfer of carbon in steel by means of radioactive tracers.

throughout their entire length, except for a central section 1 to 5 mm long intended for case hardening with radioactive carbon. The case hardening was effected in special copper containers placed into evacuated quartz tubes using charcoal and $BaCO_3$ with radioactive C^{14} as the carburizing agent. Fig.2, shows a photo of the general view of the set-up for electro-diffusion annealing; Fig.3 shows a photo of the vacuum part of the apparatus for electro-diffusion annealing, which was carried out in molten salts at the temperatures 550 to $800^\circ C$. The graph, Fig.1, shows the distribution of the radio-active carbon along the length of the specimen after case hardening; the graph, Fig.4 shows the distribution of the radio-activity on the cathode and the anode sections of the specimen, before and after heating, at a temperature of $600^\circ C$ for ten minutes. Fig.5 shows the distribution of radio-activity at the ends of the specimen before and after diffusion annealing at $700^\circ C$ for fifty minutes. Table 1 gives the number of carbon transfers for the ferrite for the temperatures 800, 700, 600 and $530^\circ C$, whilst Table 2 gives the values of carbon cathion charges

Card 2/3

126-2-10/35

Study of the electrolytic transfer of carbon in steel by means of radioactive tracers.

       for the ferrite for the same temperatures. The here described method of determining the carbon transfer number in alloys, based on utilising C^{14}, permits detection of the transfer of carbon in steels under the effect of the electrical field and to determine the degree of ionisation of its atoms. It was established that the carbon atoms in the ferrite are in the form of cathions and the cathion charge of the carbon is approximately equal to four elementary units of the electric charge.
There are 5 figures, 2 tables and 10 references, 7 of which are Slavic.

SUBMITTED: March 7, 1957.

ASSOCIATION: Institute of Metal Technology and Metal Physics
TsNIIChM. (Institut Metallovedeniya i Fiziki Metallov
TsNIIChM)
Moscow Physico-Engineering Institute. .
(Moskovskiy Inzhenerno-fizicheskiy Institut).

AVAILABLE: Library of Congress.
Card 3/3

GRUZIN, P. L.

Radioactive indicators for the study of processes of dephosphorizing pyrochlore concentrates. E. A. Slavianik, T. P. Khazanova, P. L. Gruzin, and A. D. Tyutyunnik. Tsvetnye Metal. 29, No. 7, 7-9 (1957).—Radioactive P dissolved in HNO_3 and neutralized with NaOH was added (a) to metallic Zn which had been treated with a soln. of apatite in 10% HCl, (b) to pyrochlore concentrate contg. 17% ZnO_3, and (c) to pyrochlore contg. 0.7% ZrO_2. In all cases about 65% of the activity was lost after the 3rd washing with hot, 90°, water. On the other hand, 30-35% of the activity remained after 7 washings. Thus, while much of the P was adsorbed and could be removed by washing, some remained as an insol. phosphate of Zr. I. B.

20-114-6-23/54

AUTHORS: Bardin, I. P., Member of the Academy, Gruzin, P. L., Zemskiy,S.V.

TITLE: An Investigation of the Blast Furnace Process by Means of
             Isotopes (Izucheniye domennogo protsessa metodom izotopov)

PERIODICAL: Doklady Akademii Nauk SSSR,1957,Vol.114,Nr 6,pp.1220-1223(USSR)

ABSTRACT: The present paper gives the results of various experiments
             made by the Central Scientific Research Institute for Sider-
             urgy and by metallurgical factories on the motion of the
             charge materials, the wear of the fire-proof lining and the
             elaboration of a method for studying the motion of gases in
             the blast furnace by means of isotopes. Under the influence
             of the air blast the pieces of coke perform a spherical cir-
             culation. With the aid of radioactive isotopes the motion of
             the parts of the charge in the blast furnaces can be studied
             by fundamentally new methods. A piece of the charge is labelled
             by an artificially radioactive isotope and its motion follow-
             ed by radiation detectors. The simplest method for labelling
             the charge materials consists in the boring of holes in the
             pieces of coke and lime and the fixing of certain quantities

Card 1/2   of radioactive isotopes in these holes. Another very suitable

20-114-6-23/54

An Investigation of the Blast Furnace Process by Means of Isotopes

method is based on the activation of the grains of the charge
material in the nuclear reactors.
At present two methods are used for studying the motion of
the charge. By the first method the total duration of stay
of the charge in the furnace is determined; details on this
are given. The second method requires a special equipment of
the furnace with investigation holes which are arranged in
a vertical. By these methods the authors performed a number
of investigations of the motion of charges in furnaces with
various volumes.
Several conclusions: The various components of the charge of
the blast furnace have various speeds. In the axial part of
the blast furnace the coke and the agglomerate are more rapid-
ly displaced than on the perphery. Of great influence are the
construction of the blast furnace, the cooling system and the
forcing of the blast furnace process. There are 2 figures,
1 table,and 6 references, 5 of which are Slavic.

SUBMITTED: March 12, 1957

Card 2/2

/8.7500

81501

SOV/137-59-9-10629

Translation from: Referativnyy zhurnal, Metallurgiya, 1959, Nr 5, p 166 (USSR)

AUTHORS: Gruzin, P.L., Polikarpov, Yu.A., Fedorov, G.B., Shumilov, M.A.

TITLE: Investigations Into Carbon Diffusion In Alloys With the Use of
           the C^{14} Radioactive Isotope

PERIODICAL: V sb.: Metallurgiya i metallovedeniye, Moscow, AS USSR, 1958,
            pp 246 - 252

ABSTRACT: The authors investigated the diffusion of C in ferrite (alloyed
            with Ni, Mo, Cr, Mn) Si in austenite (alloyed with Si) and in Ni
            (alloyed with Cr, Co, Mo). The diffusion coefficient D was deter-
            mined by the method of removing the layers and measuring the
            integral radioactivity of the remaining section of the specimen.
            Introduction of Si into the ferrite increased the pre-exponential
            multiplier D_0 and also the activation energy Q. The same effect
            was exerted by alloying with Ni, while Mo and Cr produced the
            greatest effect. Thus if the Mo content was 2.58%, D_0 increased
            from 0.2 to 20.0 cm^2/sec, and Q from 24.6 to 33.5 kcal/g-atom.
Card 1/2   The introduction of 0.93% Cr gave D = 16.4 cm^2/sec and Q =

81501

SOV/137-59-5-10629

Investigations Into Carbon Diffusion in Alloys With the Use of the C^{14} Radio-active Isotope

33.6 kcal/g-atom. Alloying of nickel with 0.74% and 4.65% Cr, 5.25% Co and 2.94% Mo, caused in any case an increase in Q due to the stronger bonds of C atoms was in the crystalline lattice of Ni. The same effect on the C diffusion in γ Fe was produced by an addition of Cr and Mo. The addition of Co reduced the value of Q for C diffusion in γ Fe. There was almost no difference in the rates of C diffusion in Ni and γ Fe. At all temperatures, D of C was 10^5 - 10^{10} times higher than D of the metal. The rates of C diffusion in the ferrite and austenite were very different. This explains some peculiarities in the process of stepped case-hardening of steel. The first case-hardening stage is conducted in the γ -phase range. At the second stage, case-hardening is con-ducted in the α phase range, since diffusion takes place at a higher rate.

I.D.

Card 2/2

SMITH, P. I. (and N. G. Bogdanova, G. I. Yermolayev, I. D. Mikulinskiy)

"APPLICATION OF RADIOACTIVE ISOTOPES FOR THE INVESTIGATION OF METALLURGICAL PROCESSES".

by N. G. Bogdanova, P. L. Gruzin, G. I. Yermolayev and I. D. Mikulinskiy.

Report presented at 2nd UN Atoms-for-Peace Conference, Geneva, 9-13 Sept. 1958.

GRUZIN, P. L. (Prof.)

"Employment of Isotopes and Nuclear Radiation in Research and Industry,"

report distributed at the International Seminar on Peaceful Uses of Atomic
Energy, and the Youth, Moscow, Aug 1958.

BABIKOVA, Yu.F.; GRUZIN, P.L.

    Diffusion in nickel-base solid solutions. Issl. po zharopr. splav.
    3:109-112 '58.   (MIRA 11:11)
      (Diffusion)   (Solutions, Solid)   (Nickel alloys)

SOV/137 ?? ? 4054

Translation from: Referativnyy zhurnal. Metallurgiya, 1959, Nr 2, p 248 (USSR)

AUTHORS: Gruzin, P. L., Babikova, Yu. F., Borisov, Ye. V. Zemskiy, S. V.
Peregudov, N. P., Polikarpov, Yu. A., Tirkina, A. N. Federov, G. B.
Shumilov, M. A.

TITLE: Study of the Mobility of Carbon Atoms in Steel and Alloys Using C^{14}
Isotope (Izucheniye podvizhnosti atomov ugleroda v stali splavakh
pri pomoshchi izotopa C^{14})

PERIODICAL: Sb. tr. In-t metalloved. i fiz. metallov Tsentr. n.-i. in-ta chernoy
metallurgii. 1958, Vol 5, pp 127-365

ABSTRACT: The authors examine methods for investigating the diffusion elec
trolytic transfer, and distribution of C in Fe, Ni and some of their
alloys. Data were obtained by the direct (autoradiographic) method
on the effect of Cr, Ni, Mo. and Si on the diffusion of C in ferrite; Ni
and Si have appreciably less effect on the diffusion of C than the carbide-
forming Cr and Mo. It was established that the diffusion mobility
level changes very little when the Fe and Ni are highly alloyed; it is
displaced only when another base is used, as it happens in Fe Cr and

Card 1/2   under these conditions the mobility level of C approaches that of the

SOV/137-59-2-4054

Study of the Mobility of Carbon Atoms in Steel and Alloys Using C^{14} Isotope

alloying elements. It was experimentally verified that the C in Fe and Ni is in the cation state. It was established that the cation charge can change depending upon the character of the alloying element. Bibliography: 27 references.

M. G.

Card 2/2

SOV/137-58-8-16757

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 8, p 75 (USSR)

AUTHORS: Gruzin, P.L., Zemskiy, S.V., Tyutyunnik, A.D.

TITLE: Diffusion in Titanium and Alloys Based Thereon and the Sintering Process (Diffuziya v titane i splavakh na yego osnove i protsess spekaniya)

PERIODICAL: Sb. tr. In-t metalloved. i fiz. metallov Tsentr. n.-i. in-ta chernoy metallurgii, 1958, Vol 5, pp 366-382

ABSTRACT: Processes of diffusion in powder Ti (porosity $<2\%$) and alloys thereof with 10% Cr or W (porosity $< 5\%$) are investigated by Cr, Fe, and W isotopes in the $700-1250^{\circ}C$ interval. The temperature dependence of the value of D is determined on the basis of a layer-by-layer analysis of the integral radioactivity of the β (W isotope) and γ radiation. It is established that this dependence is of the same exponential character as that of compact metals. Ti differs from other refractory metals by a higher level of diffusive mobility. D and D_0 rise with increase in porosity. The D values may be employed to solve problems of rational duration of homogenation of powder alloys and to
Card 1/2   calculate the density of Ti in powder form sintered at various

SOV/137-58-8-16757

Diffusion in Titanium and Alloys Based Thereon and the Sintering Process

temperatures in the course of a given period. The conclusion is arrived at
that the sintering of metallic Ti powder proceeds primarily by diffusion.

A.N.

1. Titanium--Diffusion   2. Titanium alloys--Diffusion
3. Radioisotopes--Applications   4. Diffusion--
Temperature factors

Card 2/2

GRUZIN, P.L.; KONONYUK, I.F.; PAVLYUCHENKO, M.M.; POLIKARPOV, Yu.A.

Using the method of radioisotopes in studying the diffusion
of sulfur in iron. Inzh.-fiz. zhur. no. 6:64-67 Je '58.
(MIRA 11:7)

1. Institut metallovedeniya i fiziki metallov Tsentral'nogo nauchno-
issledovatel'skogo instituta chernoy metallurgii, Moskva i
Belorusskiy gosudarstvennyy universitet im. V.I.Lenina, Minsk.
(Radioisotopes--Industrial applications)
(Sulfur--Isotopes)
(Iron--Metallography)

24(8)   PHASE I BOOK EXPLOITATION   SOV/2117

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

Eksperimental'naya tekhnika i metody issledovaniy pri vysokikh tem-
    peraturakh; 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. Bankviteer.

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 pro-
    duction of pure metals   5) pyrometry, and 6) general questions.
    For more specific coverage, see Table of Contents.

                          VI. GENERAL QUESTIONS

Kholodov, A.I., and O.V. Musorin. Instrument for Measuring the
Rate of Teeming of Steel   675

Bogdanova, N.O., P.L. Gruzin, O.I. Yermolayev, and I. D.
Mikulinskiy. A Study of the Motion of Metal and the Distribu-
tion of Alloying Elements in Open-hearth Furnaces   682

Card 27/32

G Ku z i n, P.C.

21(3,4); 17(10)   PHASE I BOOK EXPLOITATION   SOV/3394

Neischerpayemyy (The Inexhaustible) Moscow, Atomizdat, 1959. 149 p.
   Errata slip inserted. 10,000 copies printed.

Compiler: V. P. Parkhit'ko; General Ed.: A. K. Krasin, Doctor of Physical and
   Mathematical Sciences, Professor; Ed.: N. M. Pchelintseva; Tech. Ed.: N. A.
   Vlasova.

PURPOSE: This book is intended for the layman interested in the peaceful use of
   atomic energy.

COVERAGE: This book contains several reports by leading Soviet scientists,
   specializing in the peaceful uses of atomic energy, at the international
   seminar on "Youth and Peaceful Use of Atomic Energy," held in August, 1958,
   under the auspices of the Committee on Youth Organizations of the USSR.

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The Inexhaustible

SOV/3394

Card 2/3

GRITZIN, P.L.

PHASE I BOOK EXPLOITATION SOV/2713

International Conference on the Peaceful Uses of Atomic Energy. 2nd, Geneva, 1958

Mirnoye ispol'zovaniye atomnoy energii; poluchentye i primeneniye izotopov (Reports of Soviet Scientists; Production and Application of Isotopes) Moscow, Atomizdat, 1959. 368 p. (Series: Its: Trudy, vol. 6) 8,000 copies printed.

Eds. (Title page): G.V. Kurdyumov, Academician, and I.I. Novikov, Corresponding Member; Ed. (Inside book): L.D. Andreyenko; Tech. Ed.: Z.D. Andreyenko.

PURPOSE: This book is intended for scientists, engineers, physicists, and biologists engaged in the production and application of atomic energy to peaceful uses; for professors and graduate and comprehensive students of higher technical schools where nuclear science is taught; and for the general public interested in atomic science and technology.

COVERAGE: This is volume 6 of a 6-volume set of reports delivered by Soviet scientists at the Second International Conference on the Peaceful Uses of Atomic Energy held in Geneva from September 1 to 13, 1958. Volume 6 contains 32 reports on: 1) modern methods for the production of stable and active isotopes and their labeled compounds, 2) various applications with the aid of isotopes in the field of chemistry, metallurgy, machine building, and agriculture, and 3) dosimetry of radiation. The volume was edited by: S.V. Lorievich, Candidate of Medical Sciences; Ya.D. Prrukov, Candidate of Chemical Sciences; and V.T. Soloy, Candidate of Medical Sciences. See Sov/2031 for titles of volumes of the set. References appear at the end of the articles.

Tsarevsky, O.M., and V.S. Dedov. Means of Developing Remote Control Methods in the Radiochemical Laboratories of the AS USSR (Report No. 2926)

4. Malkov, M.P., A.G. Zeldovich, A.B. Fradkov, and I.B. Danilov. Commercial Production of Deuterium by the Low-temperature Distillation Method (Report No. 2923)

5. Sredinskii, I.G., R.Ya. Kucherov, and Y.K. Technayn. Separation of Isotopes by Diffusion in a Steam Flow (Report No. 2666)

6. Zolotarev, V.S., A.I. Il'in, and Ye.G. Kumar. Separation of Isotopes on Electromagnetic Units in the Soviet Union (Report No. 2305)

7. Alakasyev, B.A., S.P. Bulygin, V.S. Zolotarev, B.V. Putin, Ye.S. Garmortor, and G.Ya. Schcherbin. Separation of Isotopes of Rare-earth Elements by the Electromagnetic Method (Report No. 2217)

8. Morozov, P.M., B.N. Makov, M.S. Iofta, B.G. Brechart, and G.M. Frolkin. Ion Source for the Separation of Stable Isotopes (Report No. 2303)

9. Kozlin, M.Y., and P.M. Morozov. Electric Field Effect in Ion Beams on Stable Isotope Separation by the Electromagnetic Method (Report No. 2304)

10. Boclanov, N.G., P.L. Gruzin, G.I. Tarnology, and I.D. Nikulakiy. Use of Radioactive Isotopes in Metallurgical Research (Report No. 2218)

11. Shamatovskiy, S.E., V.A. Yamshikovskiy, and I.M. Shiar. The Theory and Practice of Relay-type Instruments Based on Radioactive Isotopes (Report No. 2232)

12. Zaslayevskiy, Yu.S., G.I. Shor, and R.N. Suverevora. Studying the Mechanism of Protection of Rubbing Surfaces Against Wear Due to Corrosion (Report No. 2196)

13. Emoryetsev, S.V., and L.M. Matarsk. The Fe170, Eu155, and Co114 as Sources of Radiation for Checking Thin-walled Products (Report No. 2235)

14. Brub, B.I., A.S. Zaryelov, and G.I. Lapyrin. Studying the Raddistribution of Elements in Metal Alloys and Weld Compounds by Autoradiographic and Radiometric Methods (Report No. 2256)

15. Gruzin, P.L., A.I. Yevstyukhin, V.S. Yemel'yanov, G.G. Ryabova, B.G. Fedorov. Studying the Diffusion and Distribution of Elements in Alloys of Zirconium and Titanium Base by the Radioactive Isotope Method (Report No. 2826)

GRUZIN, P. L.

PHASE I BOOK EXPLOITATION   SOV/3559

Akademiya nauk SSSR. Institut metallurgii. Nauchnyy sovet po problems zharoprochnykh splavov

Issledovaniya po zharoprochnym splavam, t. 5 (Investigations of Heat-Resistant Alloys, Vol 5) Moscow, Izd-vo AN SSSR, 1959. 423 p. Errata slip inserted. 2,000 copies printed.

Ed. of Publishing House: V.A. Klimov; Tech. Ed.: I.P. Kuz'min; Editorial Board: I.P. Bardin, Academician, O.V. Kurdyumov, Academician, N.V. Ageyev, Corresponding Member, USSR Academy of Sciences (Resp. Ed.), I.A. Oding, I.M. Pavlov, and I.F. Zudin, Candidate of Technical Sciences.

PURPOSE: This book is intended for metallurgical engineers, research workers in metallurgy, and may also be of interest to students of advanced courses in metallurgy.

COVERAGE: This book, consisting of a number of papers, deals with the properties of heat-resisting metals and alloys. Each of the papers is devoted to the study of the factors which affect the properties and behavior of metals. The effects of various elements such as Cr, Mo, and V on the heat-resisting properties of various alloys are studied. Deformability and workability of certain metals as related to the thermal conditions are the object of another study described. The problems of hydrogen embrittlement, diffusion and the deposition of ceramic coatings on metal surfaces by means of electrophoresis are examined. One paper describes the apparatus and methods used for growing monocrystals of metals. Boron-base metals are critically examined and evaluated. Results are given of studies of interstitial bonds and the behavior of atoms in metal. Tests of turbine and compressor blades are described. No personalities are mentioned. References accompany most of the articles.

BABIKOVA, Yu.F.; GRUZIN, P.L.

Use of the radioactive isotope C^{14} to study the electrolytic transfer of carbon in metals and alloys. Met.i metalloved.chist. met. no.1:200-212 '59.   (MIRA 12:10)
        (Electrolysis) (Carbon--Isotopes)

28551
S/137/61/000/009/026/087
A060/A101

I₈ 75₿0

AUTHORS: Borisov, Ye.V., Gruzin, P.L., Pavlinov, L.V., Fedorov, G.B.

TITLE: Self-diffusion of molybdenum and diffusion of tungsten in molybdenum

PERIODICAL: Referativnyy zhurnal. Metallurgiya, no. 9, 1961, 3, abstract 9Zh11
("Metallurgiya i metallovedenie chist. metallov", no. 1, Moscow,
1959, 213 - 218)

TEXT: The self-diffusion of Mo and the diffusion of W in Mo were studied
in the interval 1,800-2,175°C by the use of radioactive isotopes Mo^{69} and W^{185}.
The annealing time was from a few hours up to tens of hours. Samples of Mo ob-
tained by arc-smelting in vacuum were subjected to preliminary annealing at 1,500
°C for a period of 20 hrs in a H_2 atmosphere. To determine the diffusion coeffi-
cient the method of measuring the total activity of the sample remainder was us-
ed. The following temperature dependence was obtained for the diffusion coeffi-
cient for Mo self-diffusion: $D = 4 \exp (-115,000/RT) \ cm^2/sec$. For diffusion of
W in Mo it was found that $D = 5 \cdot 10^{-4} \exp (-78,000/RT) \ cm^2/sec$.

[Abstracter's note: Complete translation]

A. Rusakov

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28552
S/137/61/000/009/027/087
A060/A101

18.7560

AUTHORS: Gruzin, P.L., Fedorov, G.B.

TITLE: Diffusion in heat-resistant cobalt-base alloys

PERIODICAL: Referativnyy zhurnal. Metallurgiya, no.9, 1961, 3-4, abstract 9Zh17
             (V sb. "Metallurgiya i metalloved. chist. metallov", no. 1, Moscow,
             1959, 219 - 223)

TEXT: The diffusion of Co-Cu-W-Mo alloy ВК 36 (VK36) under deformation was
studied. The diffusion of both the elements entering in the base of the alloy
(Co) and of those used for heat-proofing (C and Mo) was investigated. To investi-
gate the influence of C and Mo upon the diffusion constant, an alloy with a mini-
mum C content (0.025%) was prepared, and also a similar alloy without Mo. After
casting the alloys were subjected to a preliminary compression to break down the
dendritic structure. Diffusion annealing in H_2 at 1,100°C for 50 hrs was then
carried out. Thereupon the ingots were forged into bars from which the specimens
were prepared. Before the diffusion annealing a thin layer of the radioactive
element (Co^{60}, Cr^{51}, W^{185}) was applied to one of the sides of the specimen. Dif-
fusion annealing proceeded at 850-1,250°C in a tubular furnace. The diffusion co-

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Diffusion in heat-resistant cobalt-base alloys

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S/137/61/000/009/027/087
A060/A101

efficients were measured by determining the total activity of the remaining portion of the sample after parallel layers were removed from it. The study of Co self-diffusion in the alloys investigated has shown that an addition of C reduces somewhat the activation energy and increases the self-diffusion coefficient. The admixture of Mo raises the activation energy and reduces the self-diffusion coefficient of Co. The increased tendency towards carbide formation determines the highest activation energy of Cr in an alloy with the maximum Cr content. Thus, the presence of Cr in these alloys raises the activation energy somewhat and reduces the diffusion coefficient of Cr. The retardation of Cr diffusion is the essential factor improving the heat-resistance properties of the VK36 alloy.

A. Rusakov

[Abstracter's note: Complete translation]

Card 2/2

SOV/133-59-4-2/32

AUTHORS: Gruzin, P.L., Doctor of Phys.-Mathematical Sciences,
             Professor,   Afanas'yev, V.N., Engineer, and Zemskiy,S.V.

TITLE: Investigation and Control of the Blast Furnace Process
             using Radioactive Isotopes and Radiations
             (Issledovaniye i kontrol' domennogo protsessa s
             pomoshch'yu radioaktivnykh izotopov i izlucheniy)

PERIODICAL: Stal', 1959, Nr 4, pp 291-297 (USSR)

ABSTRACT: A brief review of the application of radioactive sources
             in the USSR for the investigation and control of the
             blast furnace process is given. The following
             applications are briefly discussed: the determination of
             the rate of descent and residence time of burden
             materials in a blast furnace; control of the rate of
             wear of the blast furnace lining; studies of the
             movement of gases in a blast furnace (in this respect a
             method of utilising inert gases with subsequent
             application of a mass-spectroscope for the analysis of
             the top gas instead of radon, developed by TsNIIChM is
             mentioned); control of stock level and of the quality
Card 1/2   of coke and sinter charged to skips (the latter relates

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Investigation and Control of the Blast Furnace Process Using
Radioactive Isotopes and Radiations

> to an indirect indication of the size distribution of
> sinter and coke based on the absorption of γ radiation
> of the layer of the above materials in the weighing
> hopper). It is concluded that a further effort should
> be made in applying radiometric methods for research
> and control purposes with special attention to
> utilising isotopes with a short radioactive life.
> There are 6 figures and 27 references of which 22 are
> Soviet, 4 English and 1 German.

ASSOCIATION: TsNIIChM

Card 2/2

GRUZIN, P.L.

SOV/89-7-2-18/24

21 (0), 24 (0)
AUTHOR: Tygunov, G. A.

TITLE: Scientific Conference of the MIFI (Nauchnaya konferentsiya MIFI)

PERIODICAL: Atomnaya energiya, 1959, vol 7, Nr 2, pp 176-177 (USSR)

ABSTRACT: The early scientific meeting was held from 27 April to 15 May
            1949 in the Moskovskiy inzhenerno-fizicheskiy institut (Moscow
            Physical Engineering Institute). More than 600 participants from
            100 different institutes attended the 2 plenary and 18 sectional
            conferences. A total of 145 lectures were held. The following
            lectures are specially mentioned: M. K. Romanovskiy on ...

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Card 2/3

Card 3/3

ALIYAROVA, Z.A.; GRUZIN, P.L.; ZEMSKIY, S.V.

Studying the distribution of an admixture of sulfur in selenium
by autoradiography. Dokl.AN Azerb.SSR 15 no.6:467-471 '59.
(MIRA 12:9)

1. Predstavleno akademikom AN Azerbaydzhanskoy SSR Z.I.Khalilovym.
(Sulfur--Analysis) (Selenium--Analysis)
(Autoradiography)

GRUZIN, P.L., doktor fiz.-mat. nauk, otv. red.; BRYANTSEVA, V.P., inzh., ved. red.; SHKOVSKAYA,I.Yu., inzh., ved. red.; SINITSYN, V.I., inzh., nauchnyy red.; LADONINA, L.V., tekhn. red.

[Use of radioactive isotopes and nuclear radiations in hydraulic engineering and construction] Primenenie radioaktivnykh izotopov i iadernykh izluchenii v gidrotekhnike i stroitel'stve. Moskva, (Peredovoi nauchno-tekhnicheskii i proizvodstvennyi opyt. Tema 19) No.14. 1960. 35 p.   (MIRA 15:3)

1. Moscow. Institut tekhniko-ekonomicheskoy informatsii.
   (Construction industry)   (Hydraulic engineering)
   (Radioactive substances—Industrial applications)

18.7500

AUTHORS: Gruzin, P. L., Meshkov, A. P., Mashkov, V. T.,
               Polikarpov, Iu. A.

TITLE: Study of the Dependence of Self-diffusion Coefficient
               of Iron in Steel on Temperature

PERIODICAL: Investiga vysshikh uchebnykh zavedeniy. Chernaya
               metallurgiya, 1960, Nr 1, pp 164-170 (USSR)

ABSTRACT: Previous experiments of P. L. Gruzin proved that the
               diffusion coefficients for Mo, C, and Co in Armco iron
               and steel with 0.3% C, obey the rule of exponential
               dependence at 1,100 to 1,250°C, but exhibit deviations
               from the rule below 1,100°C. The authors checked and
               specified more precisely the coefficient deviations
               in the case of self-diffusion of Fe and tried to deter-
               mine the extent to which the self-diffusion coefficient
               for Fe depends on the size of austenite grains. Steel
               U7 containing 0.75% C, i.e., close to that at eutectic
               point, was selected for this purpose, since it is the
Card 1/4   best suitable steel for the study of self-diffusion at

Study of the Dependence of Self-Diffusion
Coefficient of Iron in Steel on Temperature

the lowest possible temperatures. The self-diffusion
coefficients were determined according to the radio-
activity of different layers caused by the diffusion
of radioactive Fe-55 isotope. This had been deposited
electrolytically prior to a high-temperature treatment
for grain growth (or without such treatment) and

subsequent annealing at 800 to 1,300°C for 20 to 200
hr. The grain size of austenite was measured in
parallel specimens having exposed their grain boun-
daries by evaporation (thermal etching) in vacuum for
5 to 12 hr. The experiments proved that self-diffusion
coefficient D for Fe depends on temperature as illustra-
ted in Fig. 2 and is defined by

$$ D = 2 \cdot 10^{-2} exp\left(-\frac{52000}{RT}\right) \ cm^2.sec^{-1} $$

If the treatment fails to make austenite equigranular,
for instance at low temperatures, the equation does not
hold. Figure illustrates this case on the right side,
where fine grained austenite shows anomalously high
diffusion coefficient at low temperatures. This
is the combined effect of: (a) increase in grain
amplitude above some critical value in proportion with the
decreasing grain size; (b) increase in activation with

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Study of the Dependence of Self-Diffusion
Coefficient of Iron in Steel on Temperature   SOV/148-60-1-20/34

Fig. 2. Self-diffusion coeffi-
cient as a function of tempera-
ture. (Nrs 1 to 7 denote
relative grain sizes, 7 being
the smallest). _____ speci-
mens which have undergone a
high-temperature treatment
for grain growth; ---- speci-
mens without such treatment.
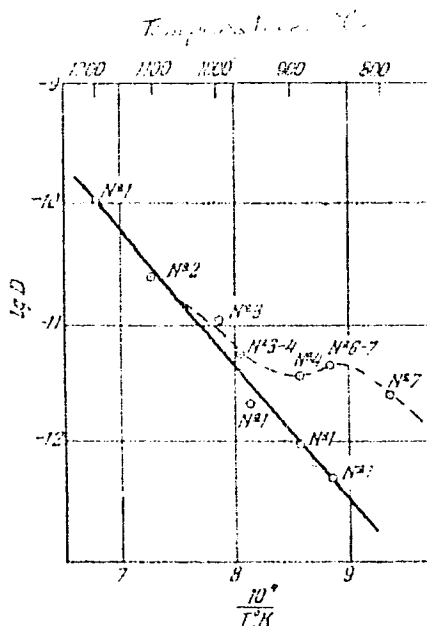
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Study of the Dependence of Self-Diffusion
Coefficient of Iron in Steel on Temperature   SOV/148-60-1-29/34

seem to be incomplete or instable at lower tempera-
tures of annealing. In conclusion, further experiments
are recommended in which steels: (1) of identical
composition but with different tendency to grain
growth; and (2) undergoing no phase transformations,
should be used. Such experiments would permit one
to establish diffusion coefficients depending on
grain size and phase transformations separately,
instead of both factors combined. There are 2 fig-
ures; 1 table; and 4 references, 3 Soviet, 1 U.S.
The U.S. reference is: H. W. Mead, C. T. Birchenal,
J. of Metals, 1956, 8, Nr 10, 1336.

ASSOCIATION: Moscow Machine Construction Evening Institute and
the Central Scientific Research Institute of
Ferrous Metallurgy (Moskovskiy vecherniy mashino-
stroitel'nyy institut i TsNIIChM)

SUBMITTED: November 4, 1958

Card 4/4

RYABOVA, G.G.; BABIKOVA, Yu.F.; GRUZIN, P.L.

Distribution and electrodiffusion of tin in zirconium alloys.
Met. i metalloved. chist. met. no. 2:115-127 '60. (MIRA 13:12)
(Zirconium alloys--Metallography)
(Diffusion)

188100   1160 1418 1138

28061 S/137/6.../...
A056/A...

AUTHORS: Babikova, Yu. F., Gruzin, P. L.

TITLE: Electrodiffusion of carbon in zirconium

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 4, 1961, ...
(V sb. "Metallurgiya i metallovedeniye chistykh metal... ... 2, M.
Atomizdat, 1960, 128-133)

TEXT: The author gives the data of the study of carbon ... in
zirconium under the action of an electric field. The samples were ma... ...
of Zr-foils. In the central part of the samples was produced a ... ... 0.3 - 3
mm length, containing a radioactive isotope of the element the transfer of wh...
was studied. This zone is, for high temperatures, a source of di... ...
transfer. For the study of the C-transfer, the zone was formed ... ...
pin point welding of a Zr-wire containing the radioactive isotope ... A... ...
formation of the radioactive zone on the sample the distribution ... radio... ...
on both sides of the zone, constituting the origin of the reading, was d... ...
The electrodiffusive annealing of the samples was conducted in a special ...
under a vacuum of ~ 10^{-5} mm/Hg, at 900, 1,000, 1,100 and 1,200 ... during 7, 4, ...

Card 1/2

Electrodiffusion of carbon in zirconium

29061

and 4 hours respectively. The samples were heated by a d... ...produ...
density. After annealing a redistribution of radioactivity was ...mi...d in
the cathodic and anodic sections of the samples. I... e... sam...
C to the cathode was displayed. This point... o... the ia.. that C i... p...
Zr-crystal lattice in ionized state in the form of cation... ...mpa...
temperature-dependence obtained of the C-transfer ...rb... wi...
unalloyed austenite shows that the el...romobility of ... i ... ...
Fs by more than an order of magnitude. One suppose... that ...
great (possibly < 1). The transiti... n...e... ... 300 and 1,... ...
high value in comparison with that which ...ld be ...p...d ... the data fo...
1,100 and 1,200°C. Such anomaly of dependence of ... temp...a ...
is explained by the influence of the stru...ure factor - temp...ra...
at high temperature. The results obtained prove that the di...
possibly its transfer are chiefly of a boundary nature. ...i... is ...onfirmed
by the data of autoradiography.

A. ...

[Abstracter's note: Complete translation.]

Card 2/2

18 7500

29032
S/081/61/000/018/002/027
B104/B101

AUTHORS: Gruzin, P. L., Ryabova, G. G.

TITLE: Study of the influence of the structure factor on diffusion
in zirconium and its alloys

PERIODICAL: Referativnyy zhurnal. Khimiya, no. 18, 1961, 31, abstract
18B196 (Sb. "Metallurgiya i metallovedeniye chistykh
metallov". M., Atomizdat, no. 2, 1960, 134-140)

TEXT: The influence of the structure factor on self-diffusion of Zr and
diffusion of Sn in zirconium alloys was studied. The alloys were smelted
down in an arc furnace and subjected to a homogenizing annealing for
10 hr. The self-diffusion coefficient and the diffusion coefficient were
determined by using Zr^{95} and $Sn^{113,123}$ isotopes, and the method of
removing layers, and by measuring the radioactivity of the rest. In
order to study the influence of the structure factor on self-diffusion in
β-Zr, some of the specimens were annealed by the conventional method. The
other specimens were heated to 1200°C, and kept at this temperature for

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29032
S/081/61/000/018/002/027
B104/B101

Study of the influence of the...

20 minutes. Subsequently, the specimens were cooled to the temperature of
diffusion annealing and kept at this temperature. The self-diffusion
parameters were found to depend on the structure state. This dependence
is the greater, the lower the temperature. The influence of the
structure (hardening and annealing) on Sn diffusion in Zr-Sn alloys in
the range of α-solutions (0.5; 1, and 2% Sn) was studied. In all cases,
the diffusion coefficient of Sn in specimens with martensite structure
was greater than in annealed specimens. With an increase of the Sn con-
tent in the alloys and with a temperature drop, the difference between
the diffusion coefficients increased for both structure states.
[Abstracter's note: Complete translation.]

Card 2/2

GRUZIN, P.L.; POLIKARPOV, Yu.A.

Studying the effect of structural facotrs on diffusion in
steels and alloys by means of radioactive isotopes. Met.
i metalloved. chist. met. no. 2:259-275 '60.   (MIRA 13:12)
        (Steel alloys--Metallography)
    (Radioisotopes--Industrail applications)

GRUZIN, P.L.; YEVSTYUKHIN, A.I.; ZEMSKIY, S.V.; NIKISHANOV, V.V.

Investigating the redistribution of sulfur during the zonal
melting of chromium in arc furnaces. Met. i metalloved.
chist. met. no. 2:276-279 '60.   (MIRA 13:12)
        (Chromium--Metallography)   (Suflur--Isotopes)

S/129/60/000/010/002/009
E193/E483

AUTHOR: Gruzin, P.L., Doctor of Physico-Mathematical Sciences,
              Professor

TITLE: Certain Laws Relating to Diffusion and Distribution of
              Elements in Alloys

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov,
              1960, No.10, pp.5-13 + 3 plates

TEXT: In a general review of the present state of knowledge of
diffusion processes in metallic materials, the following subjects
are discussed: (1) Application of the auto-radiographic method
in studies of diffusion phenomena with particular reference to
work carried out by V.M.Golikov, V.T.Borisov and B.Ya.Lyubov,
who have derived an expression for the kinetic curve of integral
radio-activity of diffusion test pieces.   (2) The exponential
character of the temperature-dependence of the self-diffusion
coefficients of practically all metals above their recrystallization
temperature, as illustrated by graphs reproduced in Fig.1 and 2.
(3) The relationship between the diffusion characteristics and
other properties of metals such as the melting point and
recrystallization temperature, and the effect of alloying
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E193/E483

Certain Laws Relating to Diffusion and Distribution of Elements in
Alloys

additions on this relationship.   (4) The anomalous temperature-
dependence of the self-diffusion coefficients of iron, titanium
and zirconium, with particular reference to the effect of the
structural factor on diffusion processes.   (5) The findings of
Yu.F.Babikova, A.D.Tyutyunnik, G.G.Ryabova and the present author,
who have studied localized concentration of the alloying additions
in titanium and zirconium.[1]   (6) The effect of alloying additions
on diffusion processes in iron,[1] nickel,[1] chromium and various other
metals, studied by L.M.Mirski, S.Z.Bokshteyn and S.T.Kishkin.
(7) The effect of phase transformations on the diffusion process,
and the anomalous variation of the coefficient of diffusion of
cobalt and iron in steel U8 at temperatures below 1100°C (Fig.7
and 9), as studied by A.P.Gulyayev, Yu.A.Polikarpov, Yu.D.Zharov,
V.G.Martinson and the present author.   (8) The effect of other
alloying elements (titanium, boron) on diffusion of cobalt in
steel U8.   (9) The effect of the structural factor (grain size
and the degree of fragmentation of grains) on self-diffusion in
austenite, as studied by Ye.Z.Vitaykin, V.D.Sadovskiy, V.M.Golikov,

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E193/E483

Certain Laws Relating to Diffusion and Distribution of Elements in Alloys

V.T.Borisov and G.V.Shcherbedinskiy.   (10) The effect of various alloying additions (silicon, molybdenum, nickel, chromium, cobalt) on diffusion of carbon in steels;   (compare Table 2, giving the magnitude of the pre-exponential factor D_0 and activation energy Q and Fig.10 and 11, showing the temperature-dependence of the coefficient of diffusion of carbon in various steels, as studied by M.Ye.Blanter, S.Z.Bokshteyn, S.V.Zemskiy, F.R.Florensova, Ye.M.Morozova and the present author).
(11) The findings of Yu.A.Polikarpov and the present author on the effect of the structural factor on diffusion of carbon in the Fe-Ni-Mn alloys.   (12) The results of an investigation, carried out by Yu.F.Babikova and the present author, of the state of the carbon atoms in iron, nickel, zirconium and some other alloys, according to which carbon atoms are present in ferrite and nickel in the form of cations.   (13) The effect of alloying additions (silicon, chromium) on the degree of ionization of carbon in nickel and iron.   (14) Electron transfer from

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S/129/60/000/010/002/009
E193/E483

Certain Laws Relating to Diffusion and Distribution of Elements in
Alloys

carbon in titanium and zirconium.   There are 12 figures and
2 tables.

ASSOCIATION: TsNIIChM

Card 4/4

FEDOROV, G.B.; BABIKOVA, Yu.F.; GRUZIN, P.L.; ZHOMOV, F.I.; RYABOVA, G.G.

Radioactive-tracer techniques in the study of the mobility, in-
teratomic interaction, and distribution of elements in zirconium
and its alloys. Izv.vys.ucheb.zav.;khim. i khim.tekh. 3 no.3:
395-401 '60.   (MIRA 14:9)

1. Moskovskiy inzhenerno-fizicheskiy institut, kafedra metallurgii
i metallovedeniya.
          (Zirconium alloys)   (Radioactive tracers)

18.7000,21.1200

77220
SOV/89-8-1-14/29

AUTHORS: Gruzin, P. L., Ryabova, G. G., Fedorov, G. B.

TITLE: Iron Distribution in Microvolumes of Zirconium Alloys.
              Letter to the Editor

PERIODICAL: Atomnaya energiya, 1960, Vol 8, Nr 1, pp 58-59 (USSR)

ABSTRACT: The use of zirconium in nuclear power reactors is very
              much reduced because of its poor strength and stability
              against corrosion. Although it is a well established
              fact that small impurities of different elements can
              decrease or increase its stability, little is known about
              the mechanism of these influences. Investigation of
              element distributions in alloys could, therefore, be very
              helpful, and the authors undertook to study the distribu-
              tion of iron, which causes an extreme reduction of
              stability against corrosion especially in iodine contain-
              ing zirconium. They used zirconium alloy with 0.15 weight

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Iron Distribution in Microvolumes of   77220
Zirconium Alloys. Letter to the Editor   SOV/89-8-1-14/29

% of iron and zircalloy type alloys (on the iodine
zirconium basis) containing (in weight %): 1.1 lead,
0.1 iron, 0.1 chromium, and 0.05 nickel, and investi-
gated the distribution of iron by means of contact
autoradiography. Powdered radioactive isotope Fe^{59}
was introduced into the alloy melted by means of an
arc in the atmosphere of argon. Selfradiograms were
taken on the MR type NIKFI plates by means of the
1.295 mev γ-ray and the 0.46 mev γ-ray of Fe^{59}.
To insure sufficient resolution, sample thickness
was of the order of a few tenths of a micron, which
supplied a 5 to 10,000 imp/min·cm² intensity of radia-
tion. Exposure time depended on the particular setup.
The authors found that the iron distribution in the cast
zirconium alloy was nonhomogeneous even after various
thermomechanical treatments. Largest part of the iron
remains concentrated on the boundaries between blocks
obtained during the $\beta \rightarrow \alpha$ phase transition, and another
Card 2/5   part remains in the solid solution having not enough

Iron Distribution in Microvolumes of   77...
Zirconium Alloys.   Letter to the Editor   507

time to separate out of the alloy during its fast
cooling. Similar iron distribution was recorded in
cast zircalloy-2. A cold 5-10% deformation produced
almost the same picture as in cast alloys. Annealing
of cold deformed alloys achieved a transfer of iron
from solid solution to the α-phase boundaries.
Forging hot alloys in air at temperatures between
650 and 750° C results in a strong parallelization
of their structure but the iron inhomogeneity
remains. Thermal treatments of cast and hot-forged
alloys occurred inside quartz tubing evacuated to
approximately 10^{-4} mm Hg. Tempering the alloys
from various temperatures from β-regions, the iron
distributions stayed similar to those in cast alloys
This follows from the fact, pointed out by Hayes and
others, that at high temperatures (in the β-region) iron is
in solid solution and fast cooling leads only to its par-
tial separation on the boundaries developed during the
$\beta \to \alpha$ transition. Slow cooling in ovens from the

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Iron Distribution in Microvolumes of
Zirconium Alloys.   Letter to the Editor

SOV...

β-region temperatures leads to a more complete
separation of iron along the boundaries and sub-
boundaries of the α-phase. A sample of cast, un-
forged zirconium-iron alloy tempered at its eutectoid
temperature of 800° C showed almost complete separa-
tion of iron from the solution in the form of the
intermetallide ZrFe$_2$, distributed along the boundaries
and inside the grains of the α-phase of zirconium.
Annealing zirconium—iron alloy in the α-region at
600° C (20 h) and 500° C (40 h) after tempering at
1200 and 500° C preserved the inhomogeneity of the
iron distribution. In zircalloy-2 the redistribution
of iron proceeds at a slower rate than in pure zirconium.
This is probably due to the presence of which is tempered
with a distribution pattern similar to that of iron
according to preliminary data. One can assume that the
higher resistance to corrosion of the alloys as compared
compared with zirconium-lead alloys is due to the fact
that lead distributes uniformly in zirconium, increasing

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Iron Distribution in Microvolumes of   77220
Zirconium Alloys.   Letter to the Editor   SOV/89-8-1-14/29

          thereby the resistivity of the solid solution (rep-
          resenting the basis of the alloy), while Fe, Cr, and
          Ni concentrate on the boundaries of grains and blocks,
          slowing down the corrosion at the boundaries. There
          are 8 figures; and 7 references, 5 Soviet, 2 U.S.
          The U.S. references are: B. Lustman, F. Kerze,
          The Metallurgy of Zirconium, London, McGraw-Hill
          Book Co., 1955, p 608; E. Hayes, A. Roberson, W.
          O'Brien, Trans. Amer. Soc. Metals, 43, 888 (1951).

SUBMITTED: August 5, 1959

Card 5/5

S/089/60/009/003/011/014
B006/B063

AUTHORS: Gruzin, P. L., Babikova, Yu. F.

TITLE: Application of Radioactive Isotopes and Nuclear Radiations
                in Metallurgy

PERIODICAL: Atomnaya energiya, 1960, Vol. 9, No. 3, pp. 223 - 225

TEXT: The present article gives a survey of the Soviet plants at which
radioisotopes and nuclear radiation sources are successfully used as well
as of the various fields of application. Radioisotopes and nuclear
radiation were first used in metallurgy in 1948-49. Among the various
fields of application are to be mentioned the use of isotopes as
indicators (tracer technique), nuclear radiation as a power source, and
the use of isotopes for the control and automation of technological
processes. The Novo-Tul'skiy metallurgicheskiy zavod (Novo-Tula Metallur-
gical Plant) and the Kuznetskiy metallurgicheskiy kombinat (Kuznetsk
Metallurgical Plant) were the first to use radioisotopes. One of the
principal problems in the production of pig-iron was to find new methods
for an increase in the efficiency of blast furnaces and the automation of

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individual units. In this connection, radioisotopes were used for control
purposes, especially for the determination of the most favorable condi-
tions. The plant imeni Dzerzhinskiy achieved great success with the use of
a radiometric instrument that checks the charge level in blast furnaces.
This plant in conjunction with the Tsentral'nyy nauchno-issledovatel'skiy
institut chernoy metallurgii (Central Scientific Research Institute of
Ferrous Metallurgy) developed and tested a method of checking the charge
material. Analogous work was carried out at the Kuznetsk Metallurgical
Kombinat. Further work has been carried out for the control of the enrich-
ment of iron ore and the sintering of agglomerates. The Kuznetsk
Metallurgical Kombinat developed a radiometer that is suited for deter-
mining the density of agglomerates. The Kuznetsk Metallurgical Kombinat,
the plants imeni Dzerzhinskiy, "Azovstal'", Makeyevskiy metallurgicheskiy
zavod (Makeyevka Metallurgical Plant), and others employ radiometric
methods to check the wear and tear of the fireclay lining of blast-
furnaces. The annual amount saved by radiometric control at the Plant
imeni Dzerzhinskiy and at the Institut ekonomiki AN SSSR (Institute of
Economics of the AS USSR) was calculated to be some million rubles. The
Magnitogorskiy metallurgicheskiy kombinat im. Il'icha (Magnitogorsk

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Metallurgical Kombinat imeni Il'ich) is also mentioned in this connection.
Radioisotopes are also much used in steel production. Slag formation in
open-hearth furnaces was investigated at the Magnitogorsk Metallurgical
Kombinat by a radiometric method. Similar investigations were performed
at the "Azovstal'" Plant and the Stalinskiy metallurgicheskiy zavod
(Stalino Metallurgical Plant). The two last-mentioned plants and the
"Zaporozhstal'" Plant use radioisotopes to determine the melting rate and
to check the weight of liquid steel during the melting process in open-
hearth furnaces. The nature of non-metallic inclusions in steel was
examined with the help of radioisotopes at the plants of the Kuznetsk and
and Magnitogorsk Metallurgical Kombinats as well as at the kombinat im.
Serova (Kombinat imeni Serov), the Stalino and Chelyabinsk Plants, the
plants "Serp i molot", "Dneprospetsstal'", "Elektrostal'", and at various
institutes. The Kuznetsk and Makeyevka Metallurgical Kombinats and the
"Azovstal'" Plant devised a method of checking the wear and tear of the
fireclay lining of open-hearth furnaces. Radiometric examinations of the
flow of metal during the rolling process were carried out at the Kuznetsk
Metallurgical Kombinat and the Stalino Metallurgical Plant. Iron and tin
radioisotopes were used to develop a new tinning technique which was

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tested by the Novo-Moskovskiy zavod (Novo-Moskovsk Plant) and the
"Zaporozhstal'" Plant. The Central Scientific Research Institute of
Ferrous Metallurgy designed a radiometric level-meter for liquid metal.
Such level-meters and level-regulators are in use at the Khartsyzskiy
trubnyy zavod (Khartsyzsk Tube Mill), the Kalinin Plant imeni May 1, the
Sinarskiy trubnyy zavod (Sinara Tube Mill), and the Mogilevskiy
metallurgicheskiy zavod (Mogilev Metallurgical Plant). The Leningradskiy
staleprokatnyy zavod (Leningrad Steel Rolling Mill) and the Izhorskiy
zavod (Izhora Plant), for example, made considerable savings by using
radiometric thickness gauges and controllers for rolled stock. The non-
ferrous metallurgical industry also makes use of radioisotopes for control
purposes, such as, e.g., the Yuzhno-Ural'skiy nikelevyy kombinat (South
Ural Nickel Kombinat). The Volkhovskiy alyuminiyevyy zavod (Volkhov
Aluminum Plant) and the Dneprovskiy titano-magniyevyy zavod (Dnepr
Titanium - Magnesium Plant) use radioactive densimeters for automation
purposes. The use of radioisotopes for the production of high-purity
metals was tested by the plants "Ukrtsink" and Novosibirskiy olovozavod
(Novosibirsk Tin Plant).

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A160/A101

AUTHORS: Babikova, Yu. F., Ryabova, G. G., Gruzin, P. L.

TITLE: The distribution of carbon admixture in zirconium and titanium

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 7, 1962, 72, abstract 7I477
                (In collection: "Metallurgiya i metalloved. chist. metallov". no. 3,
                Moscow, Gosatomizdat, 1961, 28 - 33)

TEXT: The method of contact autoradiography was used in the work. Radio-
active $BaCO_3$ salt was introduced in a hole drilled in a Ti or Zr ingot. The hole
was plugged with a stopper from a corresponding metal and the ingot remelted in
an arc furnace. The content of C^{14} in Zr was $< 0.005\%$, and the total content of
C in commercial Ti ($C^{12} - C^{14}$) was $< 0.2\%$. In the martensitic structure of Zr and
Ti, C distributes along the boundaries of the β-phase grains and along the interior
boundaries developed as a result of martensitic conversion. In the slowly-cooled
β-zone of Zr, C distributes along the boundaries and subboundaries. In Ti, a si-
milar thermal treatment leads to the formation of a δ dispersion phase rich with
C. After the annealing, the distribution of C in Zr and Ti in the α-zone ($800°C$,
$\sim$20 hours) becomes uniform, which is apparently caused by a high mobility of C
atoms. The considerable non-uniformity in the distribution of C in Zr and Ti,

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cooled from the β^--zone, is connected with the martensitic nature of the $\alpha \rightleftarrows \beta$-con-version. During the conversion, a large number of blocks arise inside the initial grain, due to the shear processes. Along their boundaries, an accumulation of ad-mixtures, and especially of C, takes place. The non-uniform distribution of the admixtures in the solid solution leads to the fact that their effect on the pro-perties proves to be non-proportional to their mean concentration in the metal.

P. Novik

[Abstracter's note: Complete translation]

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S/755/61/000/003/010/027

AUTHORS: Ryabova, G. G., Gruzin, P. L.

TITLE: Study of the distribution of various elements in zirconium and its
          alloys by means of radioautography.

SOURCE: Moscow. Inzhenerno-fizicheskiy institut. Metallurgiya i metallove-
          deniye chistykh metallov.   no.3.   1961, 96-119.

TEXT: The paper describes a series of tests in which contact radioautography
(RA) was employed to investigate the distribution (D) of Sn, W, Fe, Ni, Cr, Nb, and
C in Zr and some of its alloys. It was found that the character of the D of Fe, Ni,
Cr, Nb, and C is substantially affected by the existence of a polymorphic transfor-
mation (PT) in Zr, which leads to the formation of subgranular concentrational non-
uniformities in the D of these elements, but not in that of Sn and W. It is shown
that certain other factors, such as deformation and heat treatment, affect the D of
the various admixtures. A brief state-of-the-art survey on the effect of various
impurities on the properties of Zr and its alloys is based primarily on 3 references:
(1) "The metallurgy of Zr," (B. Lustman, F. Kerze, Jr., eds. McGraw-Hill, 1955;
For. Lit. Publ. House, Moscow, 1959); (2) "Materials of the U.S. AEC," v.III - Nu-
clear Reactors, For. Lit. Publ. House, Moscow, 1956); (3) Ambartsumyan, R.S.,

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et al. (In Trans. 2d Intern'l Conf. on the Peaceful Uses of Atomic Energy, Geneva,
1958, v.3, Atomizdat, 1959). The test alloys were smelted in the MIFI-9-3 arc
furnace in an atmosphere of purified Ar. Radioactive isotopes were introduced
into the melt. The D of the various elements was studied after casting and follow-
ing various work and heat treatments performed with all necessary precautions
against the admittance of gases and other impurities to the alloys. RA was per-
formed either with ordinary specimens or with thin (10-100 μ) specimens, depending
on the radiation intensity of the isotope, which ranged from 2,000-30,000 pulses/
cm^2·min. NIKFI MK and MR film was used. Exposures ranged from 2 to 20 days.
Sn: Some of the test results with Zr alloys and Zircalloy-type alloys containing
0.3-2.0 wt·% Sn were previously published by the senior authoress et al., in no.2 of
the present sbornik, 1960, 128, and by G. B. Fedorov, et al. in Izv. vyssh. uchebn.
zav. SSSR, "Khimiya i khim. tekhnologiya," no.3, 1960, 295. The dendritic
liquation of Sn in cast specimens, increasing with Sn concentration and more pro-
nounced in the Zircalloy-type alloy, is noted. Heating and holding at β-phase T's
eliminated this nonuniform D and yielded a homogeneous solid solution. Hot forging
at 800-850°C intensified the dendritic liquation of Sn. A 19-hr 620°C anneal of
cold-worked alloys did likewise, despite recrystallization. W: The W concentrated
in the interdendritic regions. Hot forging as well as cold-working with subsequent
12-hr 700° anneal preserved the intracrystalline liquation of the W despite complete

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