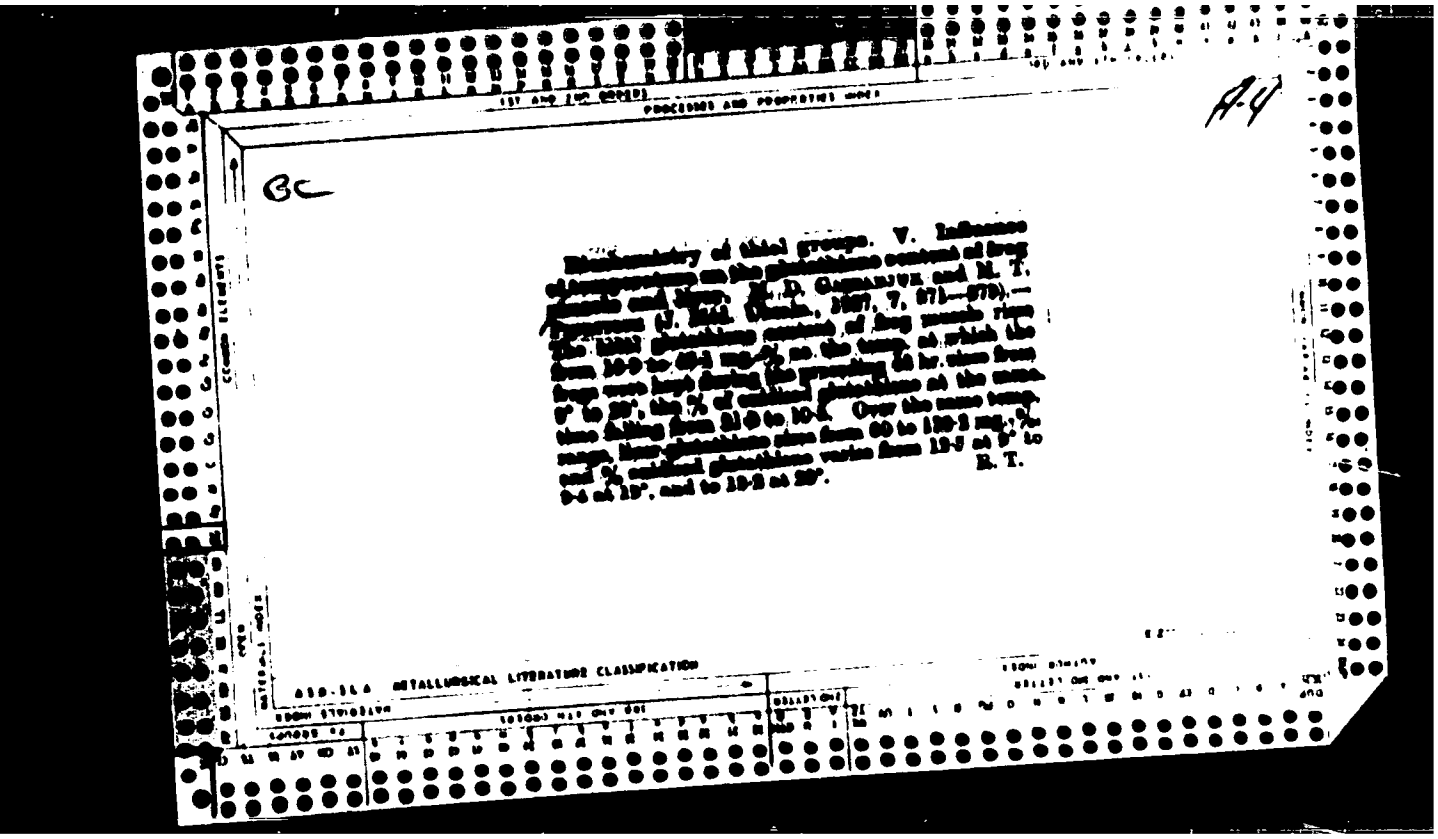
LIPKAN, N.F. [Lipkan, M.F.]; PINDICH, M.T. [Pindych, M.T.]

Nucleic acid content of tissues of animals irradiated and treated with an antiradiation complex. Ukr. biokhim. zhur. 35 no.1:114-119 '63. (MIRA 17:11)

1. Department of Medical Radiology of the Kiyev Postgraduate Institute for Physicians.

PINDICH, S.P.; RABINOVICH, A., redaktor; STEPANOVA, N., tekhnicheskiy redaktor

[Repair of tractor engines; the experience of agricultural repair enterprises] Remont traktornykh dvigatelei; iz opyta sel'skokhoziaistvennykh remontnykh predpriiatii. Minsk, Gos. izd-vo BSSR, 1956. (MLRA 9:12)
141 p.
(Tractors--Engines--Repairing)



PINDOR, A.

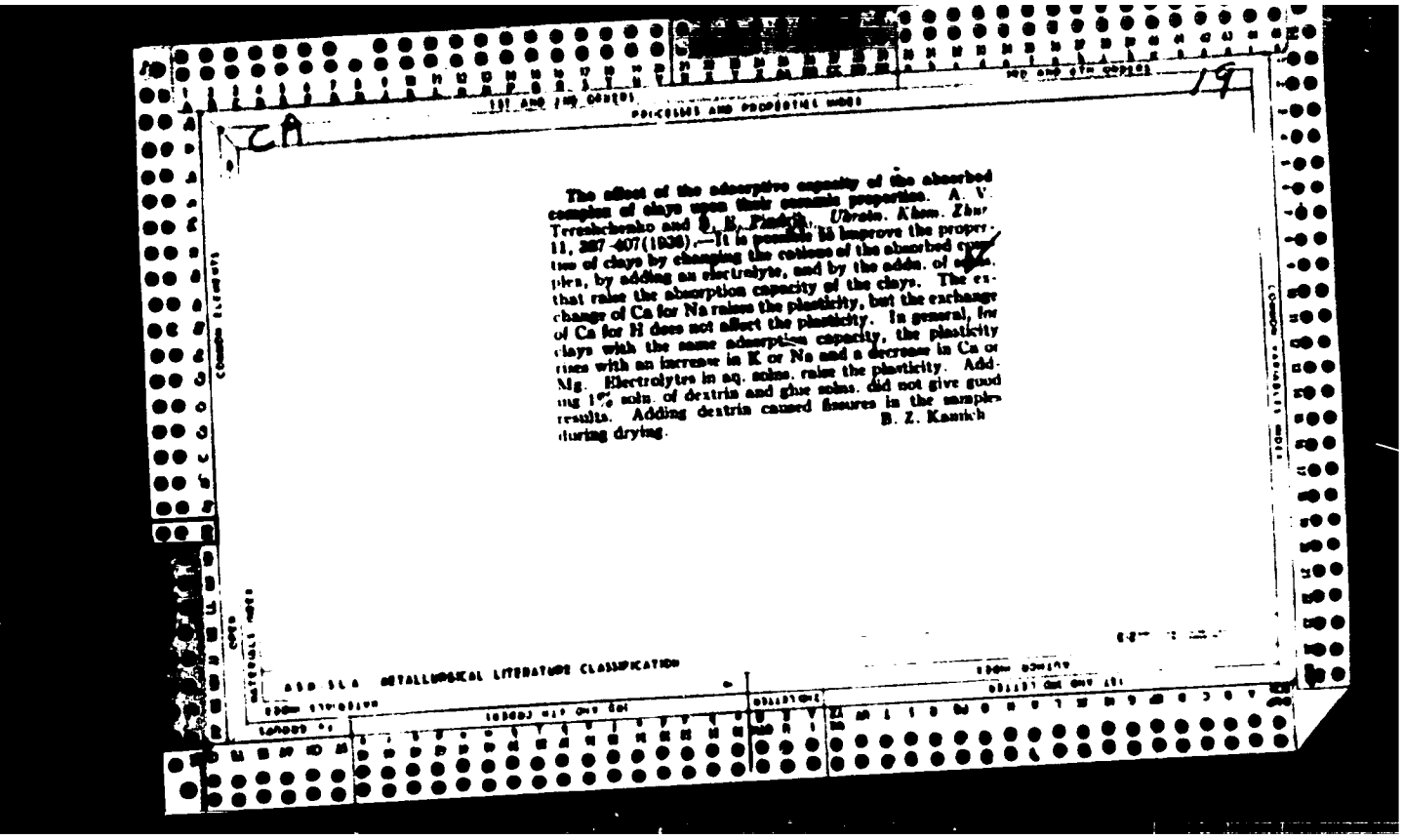
Annular distributions in the reaction $\bar{p} + p \rightarrow \pi^{-} + e$.
Bul Ac Pol mat 12 no. 1: 61-65 '64.

1. Institute of Theoretical Physics, University, Warsaw.
Presented by L. Infeld.

Toobin, G. B., and Fiedrik, B. B. Pyrophyllite as
refractory materials. Ogneupory, 6, 710-13 (1939).
Experiments showed that pyrophyllite had to undergo a
special treatment to produce high grade semiacid refrac-
tory materials. Pyrophyllite products containing a 15%
addition of refractory clay showed satisfactory physico-
chemical properties; they are best suited for iron and steel
casting because of their resistance to slag attack.

APPROVED FOR RELEASE: 06/15/2000 CIA-RDP86-00513R001340920002-0"

Taubin, G. B., and Pindrik, B. E. Quartzites from the Ovruch deposits. Ogneupory, 4, [illegible] (1936). Crystalline quartzites of Ovruch are excellent raw materials for the manufacture of silica brick. The composition and physicochemical properties of these quartzites, however, are rather variable. The chief impurities are pegmatite, talc, rutile, and zircon.



The effect of the adsorptive capacity of the absorbed complex of clays upon their ceramic properties. A. V. Terentchenko and B. K. Pinskii. *Ukrain. Khem. Zhur.* 11, 387-407(1936).—It is possible to improve the properties of clays by changing the cations of the absorbed complex, by adding an electrolyte, and by the addn. of colloids that raise the absorption capacity of the clays. The exchange of Ca for Na raises the plasticity, but the exchange of Ca for H does not affect the plasticity. In general, for clays with the same adsorption capacity, the plasticity rises with an increase in K or Na and a decrease in Ca or Mg. Electrolytes in aq. solns. raise the plasticity. Adding 1% soln. of dextrin and glue solns. did not give good results. Adding dextrin caused fissures in the samples during drying.

B. Z. Kanitch

Pottery

BCS

[illegible]. Porous ceramics for the dispersion of gases in liquids. I. S. Kaynarskiy and B. L. Pozhnin (Steklo i Keram., 8, No. 6, 16, 1951). A detailed account is given of the manufacture of porous ceramics for the aeration of water, with quartz sand as a filler, [illegible] coke as a combustible admixture, soda-lime glass with bentonite as a ceramic bond, and sulphite lye, etc., as temporary bond. It is shown that the use of equal grains, in size and shape, of the filler and combustible is effective in obtaining porous ceramics with a uniform open texture. The efficiency of porous ceramics can be altered over a wide range: from 50 to 180 m.³/m.²/hr. By changing the grading of the filler and combustible, bond comp., and proportions of components used, it is possible to obtain porous ceramics for various uses such as sound insulation, flotation machines, etc. (4 figs., 3 tables.)

E-

USSR / Diffusion. Sintering.

Abs Jour : Ref Zhur - Fizika, N [illegible], 19[illegible], No [illegible]

Author : Pines, B.Ya.
Title : On the Sintering of Multiphase Bodies. I. The Coalescence of Heterogeneous Grains.

Orig Pub : Zh. tekhn. fiziki, 19[illegible], 2[illegible], N [illegible], 2086-2094

Abstract : The character of sinter'n of multiphase bodies should depend on the relations between the coefficient of surface tension of the components σ_A and σ_B and the coeffi ient of interphase surface tension σ_{AB}. The coalescence of different character, depending on the sign of the inequality

[illegible]

the coalescence will consist of "filling" of the isthmus between the grains and the coming together of their centers by self-diffusion of atoms of both kinds ("visc us

Card : 1/2

E-6

USSR / Diffusion. Sintering.

Abs Jour : Ref Zhur - Fizika, No 4, 1957, No [illegible]

Abstract : flow" of substance of both components). When the components are mutually insoluble (there is no hetero-diffusion), the process should stop at a certain distance between particle centers. In the case [illegible] the coalescence should begin with the surface hetero-diffusion, leading to the covering of the surface with the substance having the smallest [illegible]. This will be followed by a development of the change in the form by self-diffusion of the substance with the minimum [illegible]. Upon formation of new intermetallic phases in the system, the phenomena can become more complicated.

Card : 2/2

Pines, B. Ya.

B-

USSR , Diffusion. Sinter n .

Abs Jour : Ref Zhur - Fizika, N 4, 19[illegible] , N [illegible].

Author : Pines, B. Ya., Sudnitsin, N.I.
Title : On the Sintering of Multiphase Bodies. II. The Sintering of Compressed Powder Mixtures. Contraction as a Function of Concentration.

Orig Pub : Zh. tekhn. fiziki, 1956, 26, N [illegible], 2100 - 210 .

Abstract : The shrinkage upon sintering of a compressed mixture of powders is non-additive and in the case of random distribution of grains of the components, the shrinking depends on the bulk concentration of in accordance with the formula: [illegible] where η_1 and η_2 are the values of the shrinkage (in sintering under the same conditions) of the pure components, and η_{12} is a constant characterizing the relative reduction in the distance between the centers of grains of different mate-

Card : 1/2

E-

USSR / Diffusion. Sintering.

Abs Jour : Ref Zhur - Fizika, No 4, 19[illegible], No 9341

Abstract : rials. In mixtures of powders of metals that show mutual diffusion (for example copper and nickel), reduced shrinkage is obtained in sintering, owing to the newly-formed porosity (in the grains of copper, in the case of the Cu-Ni system) in connection with the inequality of the partial coefficients of hetero-diffusion.

Card : 2 2

PINES B.YA

CARD 1 / 2 PA - 1102

SUBJECT USSR / PHYSICS
AUTHOR PINES, B.YA
TITLE On the Computation of the Most Simple Equilibrium Diagrams of Three-Component Alloys.
PERIODICAL Zurn techn.fiz, 26, fasc. 9, 2108-2118 (1956)
Issued: 10 / 1956 reviewed: 11 / 1956

The present work demonstrates generalized computations of the most simple equilibrium diagrams for three-component alloys. These computations were carried out on the basis of the same assumptions and simplifications as was the case in previous works (ZETF, 13, fasc. 11-12, 411 (1943), ISFHA 16, fasc. 1, 64 (1948), ZTH 21, fasc 9, 629 (1949), DAN SSSR, 72, fasc. 3 (1950), ZFH 1, 1948 for two-component alloys. These assumptions were the following:

1. The potential energy of the alloy U is considered to be the sum of reciprocal potential energies U_{ik} of the atoms located in the closest proximity to one another, in which case the value of U_{ik} should, for the given pair of atoms, be independent of the reciprocal potential energy of the individual atom with respect to the other adjoining neighbors, and also independent of the amount of interatomic distance

2. On the occasion of the determination of entropy only BOLTZMANN'S summand of "mixing entropy" is taken into account as well as the "additive summand" of the entropy for the given phase, which is independent of concentration and of the nature of the substance

The effect of "correlation" is neglected. Satisfactory numerical agreement between computed and experimental results can be attained only in those systems for which the assumptions mentioned hold good

General equations for a two-, three-, and four-phase equilibrium in the three-component system are derived

The same equations are then explicitly given. In addition, the approximated equations for the free energy of the solutions, which had formerly been used for the purpose of computing the diagrams of two-component systems, were utilized as functions of concentration

In conclusion, the most simple "symmetrical" solutions of the equations which correspond to two- and three-phase equilibrium on the occasion of the decomposition of the solutions without phase transition are analyzed

INSTITUTION:

PINES, B Ya

JARD 1 / 2 PA - 1565

SUBJECT USSR / PHYSICS
AUTHOR PINES, B. JA , SIRENKO, A F.
TITLE Some Rules Governing the Mechanic Properties of Samples Produced by the Baking of Metal Powders
II. Tests at Increased Temperatures.
PERIODICAL Zurn. techn. fis, 26, fasc.10, 2378-2386 (1956)
Issued: 11 / 1956

The first report (B.JA PINES, N I.SUCHININ, Zurn techn fis,26, 7 (1956)) showed that the mechanic strength of porous "metallic ceramic" samples (obtained by pressing and annealing metal powders at one and the same temperature) depends linearly on porosity
The present work describes breaking strength tests carried out at temperatures of up to 900° C in a H_2 atmosphere with samples of compressed powder which had previously been annealed for different lengths of time at a temperature of 1000° C. On this occasion load velocity was modified by 100 times its original amount. For samples of equal porosity which were tested at ~ 900° C the linear connection between the logarithm of load velocity and the value for strength resulting from the dependence of "life" on stress was confirmed
Samples with different porosity show a linear decrease of the strength p with a growing porosity η also when tested at high temperatures (with load velocity remaining constant), so that it is possible to determine the value for strength which is extrapolated for a growing porosity The aforementioned linear connection

Pines, B. Ya.

1
1-4E2e

A Critique of the Paper by G. K. Williamson and E. R. Smallman: "The Use of Fourier Analysis in the Interpretation of X-Ray Line-Broadening for Cold-Worked Iron and Molybdenum." B. Ya. Pines (*Zhur. Tekhn. Fiziki*, 1956, 26, 110). 2387-2388).—(In Russian). See W. and S., *Acta Cryst.*, 1954, 7, 574; *M.A.*, 12, 945. P. points out inconsistencies and gives reasons for rejecting the conclusions.

—A. F. B.

PA - 2001

AUTHOR: PINES, B.Ya., ČAJKOVSKIJ, L.F.

TITLE: The X-Ray Method for the Determination of the Coefficients of Heterodiffusion in Alloys forming Solid Supplementary Solutions.

PERIODICAL: Doklady Akademii Nauk SSSR, 1956, Vol 111, Nr 6, pp 1234-1237 (U.S.S.R.)

Received: 2 / 1957 Reviewed: 3 / 1957

ABSTRACT: The determination of the dependency of concentration of the diffusion coefficient D necessitates the explanation of the distribution of concentrations in the sample. This problem can be solved successfully in a system in which the lattice constant shows a noticeable dependence on concentration. Such dependence mostly exists in the case of metal alloys which form supplementary solutions. By realizing a one-dimensional distribution of concentration for reasons of simplicity, the problem can be solved in the following manner: on to a plane massive plate of the component I a plane layer of the component II of the thickness $l < 1/\mu$ is applied. In this connection μ denotes the absorption coefficient of the X-ray radiation used. It is possible to obtain an X-ray picture with the interference lines of both components from such a sample. If both components have a homogeneous lattice with a different lattice constant, two lines with equal reflection indices can be observed in each case in the X-ray picture. If the composed plate is heated to such temperatures as are sufficient for diffusion, a certain distribution $c = c(x)$ of concentrations over the depth occurs in the plate as a consequence of diffusion and an equivalent change of the lattice constant a occurs corresponding to depth. From the linear depend-

CARD 1 / 2

PHASE I BOOK EXPLOITATION 605

Pines, Boris Yakovlevich

Lektsii po strukturnomu analizu (Lectures on Structural Analysis) 2d ed., rev. Khar'kov, Izd-vo Khar'kovskogo gos. univ-ta, 1957. 454 p. 10,000 copies printed.

Resp. Ed.: Bublik, A. I., Docent, Candidate of Physical and Mathematical Sciences; Ed. of Publishing House: Tret'yakova, A. N. Tech. Ed.: Trofimenko, A. S.

PURPOSE: This handbook was approved by the Ministry of Higher Education as a manual for university students majoring in physics.

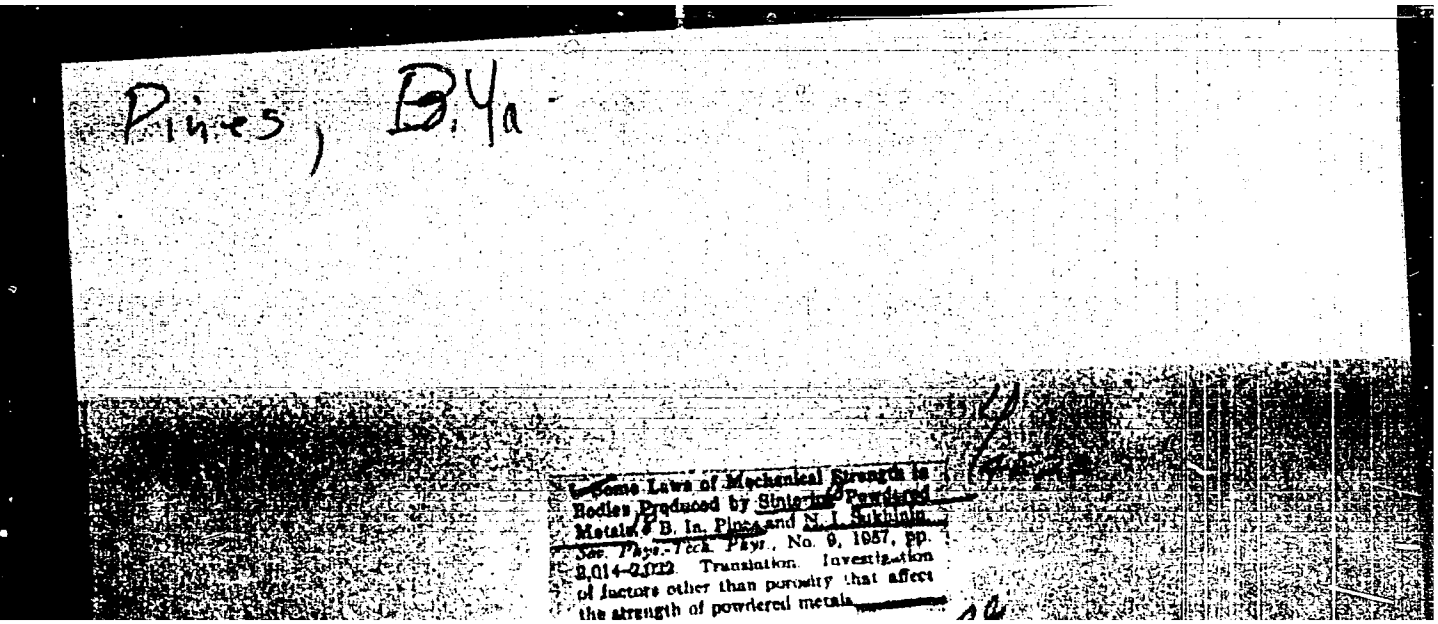
COVERAGE: This book, the second revised edition, is brought up to date by the inclusion of new subject matter, e.g.: electronographic methods, harmonic synthesis of structures, non-equilibrium states in real crystals. The practical aspects of X-ray crystallography in metallography are also considered. The author stresses the contributions of Soviet scientists who represent schools and trends in the field of structural analysis, e.g.: N. V. Belov,

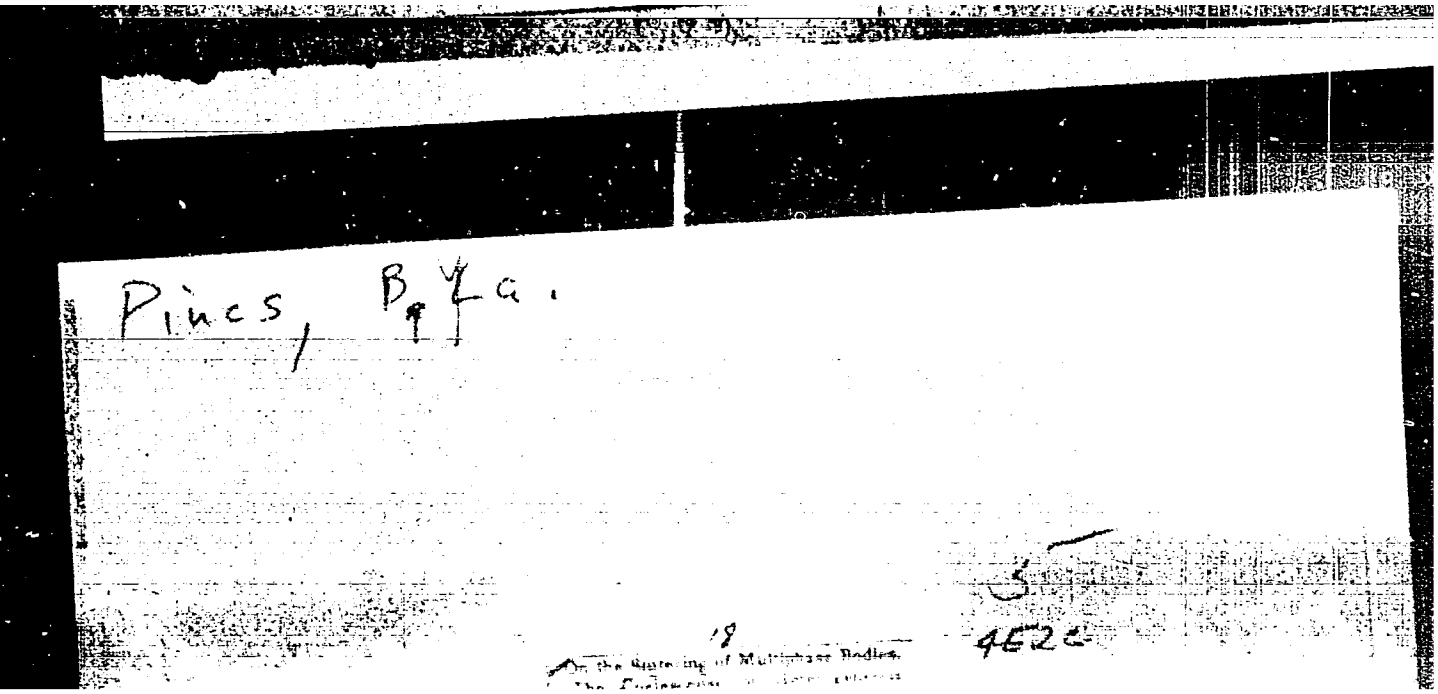
Card 1/9

Lecture on Structural Analysis

Academician; G. V. Kudrymov, Academician; G. B. Bokiy, Professor; A. I. Kitaygorodskiy, Professor; G. S. Zhdanov, Professor ; Z. G. Pinsker, Professor. Acknowledgment is given to T. A. Karpinskaya for the preparation of the text of this book, based on lectures given by the author. There are 289 figures, 16 tables, and 143 references, 85 of which are Soviet, 42 English, 16 German, and 1 French.

TABLE OF CONTENTS:





57-6-34, 36

AUTHOR: Lines, B.Ya.

TITLE: A Note of the Calculation of the Simplest Equilibrium Diagrams of Ternary Alloys. II Some Solutions of General Equations for the Case of Disintegration of Solutions Associated with the Phase Transition (K raschetu prosteyshikh diagr[illegible]mmovesiya troynykh splavov. II Nekotoryye resheniya obshchikh uravneniy dlya sluchaya raspada rastvorov, idushchego s fazovym pere[illegible]o..

PERICDICAL: Zhurnal Tekhn. Fiz. 1957, Vol 27, Nr 8, pp 1806-[illegible] (USSR)

ABSTRACT: The solutions of the equations for a bi-phase state of equilibrium in a ternary system are investigated which correspond to that case where an unlimited solubility is given for three double systems with the same components in every phase. Special solutions of equations of a phase equilibrium for a ternary alloy are investigated for that case where the disintegration of the solution is connected with a phase transition. The phases in which all three components are situated are equal. The [illegible] ternary diagram are made clear for that case where in three binary systems with the same components an unlimited solubility in each of the two phases is given. There are 4 figures and [illegible] Slavic references.

Card 1/2

57-8-31/36

A Note of the Calculation of the Simplest Equilibrium Diagrams of Ternary Alloys. II. Some Solutions of General Equations for the Case of Disintegration of Solutions Associated with the Phase Transition.

ASSOCIATION: State University im. A.M.Gor'kiy, Khar'kov (Gosudarstvennyy universitet im. A.M.Gor'kogo, Khar'kov).

SUBMITTED: November 24, 1956

AVAILABLE: Library of Congress

Card 2/2

57-6-32/36

AUTHORS Pines, B.Ya. Sirenko, A.F. Sukhinin N.I.

TITLE Sintering of Non-Single-Phase Bodies. III. Sintering of Mixtures Containing Low-melting Components. (Spekaniye neodnofaznykh tel. III. Spekaniye smesey, soderzhashchikh legkoplavkiye komponenty.)

PERIODICAL Zhurnal Tekhn. Fiz., 1957, Vol. 27, Nr 8, pp. 1893-1903 (USSR)

ABSTRACT The authors show that the contraction of pressed material of a single-component (copper-)powder essentially depends on the initial porosity caused by the pressure of compression, or more exactly by the presence of the closed gas-filled pores. With the increase of pressure the contraction magnitude becomes smaller and furtheron its sign changes, i.e. the contraction is replaced by an "increase", the measurements of the pressed material becoming greater after sintering. The dependence of contraction on the pressure increases and becomes more complicated in the case of the sintering of powder-mixtures of copper with lowmelting additions of Pb, Sn, Bi, Cd. The additions promote the formation of closed pores which can lead to an "anomalous" decrease of contraction and also to "increase". The comparing investigations in vacuum and gas at atmospheric pressure, as well as an investigation of the sintering of

CARD 1/2

57-8-12/36

Sintering of Non-Single-Phase Bodies. III. Sintering of Mixtures Containing Lowmelting Components.

samples of different initial porosity showed that the anomaly of sintering pressed material of Cu-powder with low-melting additions depends on the formation of an increased number of closed pores with additions being present. In the case of the sintering of piled powder mixtures all contraction anomalies disappear and the direct influence of the low-melting additions become evident, namely the acceleration of sintering. Furthermore a great acceleration of the re-crystallization of samples takes place if these additions are present.
(With 12 illustrations, 1 table and 5 Slavic references)

ASSOCIATION: Khar'kov State University im. A. M. Gor'kiy.
(Khar'kovskiy gosudarstvennyy universitet im.A.M. Gor'kogo.)

SUBMITTED: September 27, 1956.
AVAILABLE: Library of Congress.

CARD 2/2

57-8-33/36

AUTHORS Pines, B.Ya., Sirenko, A.F., Sukhinin, N.I.

TITLE Some Regularities of Mechanical Strength of Bodies Prepared by Sintering of Metal Powders. III. The Case of Powder Mixtures Containing Low-melting Components. (Nekotoryye zakonomernosti mekhanicheskoy prochnosti u tel, poluchennykh spekaniyem poroshkov metallov. III. Sluchay, kogda smesi poroshkov soderzhat legkoplavkiye komponenty.)

PERIODICAL Zhurnal Tekhn. Fiz., 1957, Vol.27, Nr 8, pp. 1904-1911 (USSR)

ABSTRACT The authors show that the mechanical strength p of single-phase-powderpressed pieces which were burned of a powder of plastic metal (Cu) and at high temperature (1000°C) decreases with the increase of porosity within wide limits (0-40%) in such a way as would have to be expected in the case of a reduction of cross-sectional area. Here p depends only on the final porosity but not on the initial porosity of the pressed material. In the case of pieces pressed of Cu-powder mixture with low-melting components (like Pb and Sb) at 1000° an anomalous dependence of the real strength limit on the porosity η is observed. The dependent strength limit p' (in relation to the initial sample cross-section) changes with η in a normal way. These anomalies disappear in the case of weakly pressed samples and of samples with

CARD 1/2

Pines, B. Ya.

AUTHOR: Pines, B. Ya.,

TITLE: On Diffusional Creeping of Solids (O diffuzionnoy polzuchesti tverdykh tel)

PERIODICAL: Zhurnal Tekhn. Fiz., 1957, Vol.27, Nr 10, pp. 2314-2320 (USSR)

ABSTRACT: It is shown that the diffusional creeping of all solids takes place in all kinds of stress states with the exception of general compression or general tension. It is shown that in the case of existence of the gradient of one of the main normal stresses as well as in the case of existence of the gradient of a general pressure a current of "directed self diffusion" of the atoms which corresponds to the creeping is bound to occur. It is noticed that the first viscosity coefficient which characterizes the creeping in the mere shear (or for a "incompressible" body) has in the case of solids the same order of magnitude as the second viscosity coefficient and is expressed by an equation of the same kind as the second viscosity coefficient which in special corresponds to the effect of the directed self-diffusion which is influenced by the pressure gradient. There are 4 Slavic references.

Card 1/2

On Diffusional Creeping of Solids. 57-10-17/22

ASSOCIATION: **Khar'kov State University** imeni A. M. Gor'kiy (Khar'kovskiy gosudarstvennyy universitet im. A. M. Gorkogo)

SUBMITTED: March 7, 1957

AVAILABLE: Library of Congress

Card 2/2

PINES, B.

Collection of translated articles: "Progress in Metal Physics."
Usp.fiz.nauk 62 no.4:539-540 Ag '57. (MIRA 10:10)
(Physical metallurgy)

L 00664-67 EWT(m)/EWP(t)/ETI IJP(c) JD

ACC NR: AP6018340 SOURCE CODE: UR/0030/66/013/001/0225/0231

AUTHOR: Pines, B. Ya.; Nguyen Xuan Chanh

ORG: State University, Kharkov

TITLE: Strength and structure of thin vacuum-evaporated metal films

SOURCE: Physica status solidi, v. 13, no. 1, 1966, 225-231

TOPIC TAGS: metal film, electron diffraction, [redacted]

ABSTRACT: The structure and substructure of thin Al, Ag, Ge, and Ni films, 100—700-Å thick, have been investigated with the use of an electron microscope and electron diffraction techniques. The results obtained were compared with a previous determination by the same authors showing the relationship between thickness and strength of films (Fiz. Metallov i Metallovedeniye 19, 739 (1965). The structure and substructure of Au, Ag, and Ge films of uniform thickness (200—300 Å) were changed by different heat treatments following the measurement of their strength. The origin of the higher strength

Card 1/2

L 00664-67

ACC NR: AP6018340

of the films was discussed on the basis of the results obtained. The authors were assisted by N. D. Beznosyk in the experimental work. Orig. art. has: 7 figures. [Based on authors' abstract]
[NT]

SUB CODE: 11/ SUBM DATE: 21Oct65/ ORIG REF: 002/ OTH REF: 004

Card 2/2 vlr

PINES, B.Ya.; SIRENKO, A.F.

Temperature dependence of the mechanical strength and durability of powdered metals under load. Fiz. tver. tela 1 no.2:275-283 F '58. (MIRA 12:5)
(Cermets--Testing)

PINES, B.Ya.; SIRENKO, A.F.; SUKHININ, N.I.

Regularity of mechanical strength in solids prepared by the sintering of metal powders. Issl. po zharopr. splav. 3:326-338 '58. (MIRA 11:11)

(Powder metallurgy) (Strength of materials)

AUTHOR: Pines, B. Ya.

78-3-3-7/47

TITLE: Discussion of Lectures (Obsuzhdeniye dokladov

PERIODICAL: Zhurnal Neorganicheskoy Khimii, 1958, Vol. 3, Nr 3, pp. 601-602 (USSR)

ABSTRACT: The lecturer takes an attitude to a lecture by I.I. Kornilov in the first plenary meeting and says that these explanations had been very interesting. It turned that in a polycomponent alloy there is great solubility of various metals. The information that in a polycomponent system there can be observed a two-phase, three-phase and four-phase equilibrium was not surprising as this corresponds to the phase rules by Gibbs. A certain interaction between the number of components, the phases and the degree of freedom is not to be understood that way that with such a great number of components there must inevitably also be a great number of phases. I.I. Kornilov believed that it would be possible to represent graphically the equilibrium of a polycomponent system on a diagram of a three-component system. This seems to be based on a misunderstanding on behalf of the lecturer He says that the phase diagrams represented by Kornilov in fact

Card 1/2

Discussion of Lectures

78-3-3-7/47

do not represent diagrams of n-component systems but only their three-dimensional sections. They correspond to a certain interaction of the concentration of components, or represent ternary diagrams of equilibrium between the intermetal compounds containing 6-7 elements, which, however, are no components of the system. This is supposed to be a warning that the simplified explanation is not justified and that it does not give any complete description of the whole n-component system.

ASSOCIATION: Khar'kovskiy gosuniversitet (Khar'kov State University)

Card 2/2

AUTHOR: Pines, B. Ya.

TITLE: Approximate Thermodynamic Calculations of Simple Equilibrium Diagrams of Ternary and Polycomponent Alloys (Priblizhennyy termodinamicheskiy raschet prosteyshikh diagramm ravnovesiya troynykh i boleye mnogokomponentnykh splavov)

PERIODICAL: Zhurnal Neorganicheskoy Khimii 1958 Vol. 3 Nr 3 pp. 611-629 (USSR)

ABSTRACT: The equations for the calculation of ternary diagrams consisting of two, three and four phase-equilibria were set up The equation for two phase-equilibria is as follows:

$$f'_{x_2} = g'_{y_2} \; ; \; f'_{x_3} = g'_{y_3} \; ; \; f - x_2 f'_{x_2} - x_3 f'_{x_3} = g - y_2 g'_{y_2} - y_3 g'_{y_3}$$

The equations for three phase-equilibria is as follows:

$$f'_{x_2} = g'_{y_2} = i'_{z_2} \; ; \; f'_{x_3} = g'_{y_3} = i'_{z_3} \; ; \; f - x_2 f'_{x_2} - x_3 f'_{x_3} =$$

$$= g - y_2 g'_{y_2} - y_3 g'_{y_3} = i - z_2 i'_{z_2} - z_3 i'_{z_3}$$

Card 1/3

78-3 3 14/47

Approximate Thermodynamic Calculations of Simple Equilibrium Diagrams of Ternary and Polycomponent Alloys

The equation for four-equilibria is as follows:

$$f'_{x_2} - g'_{y_2} - i'_{z_2} - k_{u_2}; \quad f'_{x_3} - g'_{y_3} - i_{z_3} - k_{u_3};$$

$$f - x_2 f'_{x_2} - x_3 f_{x_3} - g \quad y_2 g_{y_2} - y_3 g_{y_3} - i \quad z_2 i_{y_2} \quad z_3 i_{z_3} -$$

$$- k \quad u_2 k_{u_2} \quad u_3 k_{u_3}$$

By these equations the following simple diagrams can be calculated:

1) When the decomposition of the solution takes place without any phase transition, i.e. when in the two-phase equilibrium two equal phases exist;

2) At the presence of the same phase transition in all three components and of unlimited solubility in higher and lower temperature phases;

3) When diagrams with eutectic lines and points occur. The agreement between calculated and experimental values was found. Equations for r-phase equilibria and n component

Card 2/3

78-3 3 14/47

Approximate Thermodynamic Calculations of Simple Equilibrium Diagrams of Ternary and Polycomponent Alloys

alloys were set up with any significance for r and n. There are 8 figures and 14 references 12 of which are Soviet.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A. M. Gor'kogo (Khar'kov State University imeni A. M. Gor'kiy)

SUBMITTED: June 25, 1957

Card 3/3

SOV/70-3-4-9/26

AUTHORS: Pines, B.Ya. and Grebennik, I.P.

TITLE: A New Crystal Phase in Thin Films of Fe-Ni Alloys (Novaya kristallicheskaya faza v tonkikh plenkakh splavov Fe-Ni)

PERIODICAL: Kristallografiya, 1958, Vol 3, Nr 4, pp 461-466 (USSR)

ABSTRACT: In an electron diffraction examination, a new phase was discovered in thin Fe-Ni films which had been heated to 650 °C. Electronograms obtained at temperatures between -40 ° and 650 °C showed lines of the unknown phase which could be indexed on an orthorhombic cell with a = 3.42, b = 5.9 and c = 5.06 KX . The structure appears pseudo-hexagonal and it is suggested that it has a NiAs cell containing 9 Ni and Fe atoms. Rough intensity measurements give some support for this hypothesis. The observed lines occur with d values (in KX) of 2.96, 2.54, 2.52, 1.92, 1.613, 1.48, 1.47, 1.269, 1.019 and 0.918. Their intensities are w, m, vw, vvs, w, m, m, m, w, w, respectively.

Card 1/2

A New Crystal Phase in Thin Films of Fe-Si Alloys SOV/[illegible]

There are 7 figures, 3 tables and 5 references, 4 of which are Soviet and 1 English.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A.M. Gor'kogo (Khar'kov State University imeni A.M.Gor'kiy)

SUBMITTED: October 11, 1958.

Card 2/2

AUTHORS: Pines, B. Ya. and Sirenko, A. F. SOV/126-6-[illegible]-9/24

TITLE: The Sintering of Ternary Metal Powder Mixtures (O spekanii troynykh smesey metallicheskikh poroshkov)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol 6, Nr [illegible], pp 201-207 (USSR)

ABSTRACT: Ternary mixtures are examined, and shown to exhibit the same square-law variation of shrinkage and yield point with component concentration as is shown by binary mixtures. Moreover, it is shown that the relevant constants in the laws can be derived from values for the corresponding three binary mixtures, by which they are completely defined, provided no complicating features, such as fusion of one of the components, or diffusion of one into another, occur. Fig.1 shows isothermal shrinkage curves for binary mixtures in the Ni-Cu-Fe system for brief, 15 mins and 3 hour heating to 1000°C respectively. Fig.2 shows the same for two ternary mixtures in this system (3.5 hours at 1000°C). Fig.3 reproduces Fig.1, but for the yield point, and Figs.4 and 5 Figs. in the same way. Fig.6 shows some data for the

Card 1/2

The Sintering of Ternary Metal Powder Mixtures SOV/124-6-[illegible]-9/14

extension to rupture.
There are 6 figures and 4 references, all of which are Soviet.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet imeni A.M.Gorkiy (Khar'kov State University imeni A.M.Gorkiy)

SUBMITTED: November 27, 1956

Card 2/2 1. Metal powders--Sintering 2. Sintering--Test results

AUTHOR: Pines, B. Ya. SOV/126-6-2-3[illegible]

TITLE: Still More on the Sintering Theories (Eshche o teoriyakh spekaniya)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol 6, No 2, pp 375-381 (USSR)

ABSTRACT: This is a reply to the criticism of earlier work of Pines and his team by V. A. Ivensen (preceding contribution pp 370-375 of the same issue). The author sums up as follows. On the basis of a detailed analysis he claims to show that the statements made by V. A. Ivensen on the diffusion theory of sintering and the theory of viscous flow proposed by Frenkel' contradict the real contents of the theory and that he wrongly interprets the conclusions which follow from these theories. It is shown that, contrary to the statement of V.A.Ivensen, the diffusion mechanism is fully effective also during the period of existence of inter-communicating porosities. Explanation of the high speeds of densification during the process of elimination of lattice distortions by the formation of additional vacancies does not contradict the assumption

Card 1/3 that the speed of flow of the substance is determined by

Still More on the Sintering Theories S/126/[illegible]

the gradient of the concentration vacancies. In a non-uniformly stressed crystalline body there is not only a non-uniform concentration of the vacancies but also vacancies occur which correspond to atom transfers causing "flow of substance". The theory of Frenkel' is not a "semi-phenomenological" one but substantially it is the existing diffusion theory; the so-called "diffusion" theory represents the result of developments and is a variant of the theory of Frenkel' as has already been indicated in literature (Ref.4). The contradiction of the theory of Frenkel' (supplemented by the conception of the "generation of vacancies") by the diffusion theory [illegible] is not valid. At present there is only one theory of sintering of single-phase bodies, the founder of which is Ya. I. Frenkel'. Further development of this theory led to the "diffusion variant". Although this theory cannot be considered perfect and requires improvement, agreement between this and established facts

Card 2/3

Still More on the Sintering Theories SOV/126-6-[illegible]/24

shows undoubtedly that the basic assumptions of this theory are correct.
There are 10 references, all of which are Soviet.

SUBMITTED: December 26, 1956.

Card 3/3 1. Sintering--Theory

AUTHORS: Pines, B.Ya. and Barutkin, I.". SOV/126-6-5-11/43

TITLE: X-ray Investigation of the Structure of the Ferromagnetic Alloys Fe-Mo and Fe-Mo-Co (Rentgenograficheskoye issledovaniye struktury ferromagnitnykh splavov Fe-Mo i Fe-Mo-Co)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol. , Nr 5, pp 832 - 837 (USSR)

ABSTRACT: A harmonic analysis was [illegible] of the shape of the blurred X-ray diffraction lines for the purpose of determining the magnitude of the micro-stresses and the degree of dispersion of the paramagnetic inclusions in Fe-Mo (79% Fe, 21% Mo) and Fe-Mo-Co (74% Fe, 16% Mo and 10% Co) alloys after various heat treatments. This method was used by the author in earlier work (Refs [illegible]) for studying the structural changes in cold-worked metals and during tempering of hardened steel. In the work described in this paper the method was used for elucidating the causes of changes in the coercive force H_c resulting from heat treatment. The specimens consisted of [illegible] mm dia, 15 mm high cylinders. The heat treatment regimes and the magnetic characteristics of some of the investigated

Card1/3

specimens are entered in a table, p 834. The structural characteristics are compared with the magnetic properties of the specimens. On the basis of the obtained results the following conclusions are arrived at: 1) changes in the coercive force in Fe-Mo and Fe-Mo-Co alloys during heat treatment are accompanied by changes in the "shape" of the X-ray interference lines; 2) blurring of the X-ray diffraction lines, corresponding to the ferromagnetic solid solutions of the alloys Fe-Mo and Fe-Mo-Co, is due to micro-deformations of the crystal lattice (micro-stresses), 3) the high coercive force in the Fe-Mo alloys is due to the presence in these alloys of considerable micro-stresses (up to 80 kg/mm^2), which [illegible] ferromagnetic solid solution as a result of [illegible] the Fe$_2$Mo phase during tempering; 4) dependence of the coercive force on the magnitude of the micro-stresses in Fe-Mo alloys is in agreement with what can be anticipated in accordance with the "stress theory"; 5) the coercive force in Fe-Mo alloys is due to micro-stresses in the ferromagnetic solid solution and to finely dispersed inclusions of the θ phase;

X-ray investigation of the Structure of the Ferromagnetic Alloys Fe-Mo and Fe-Mo-Co SOV/126-[illegible]-11/43

6) in the case of Fe-Mo-Co alloys high coercive force values are obtained if high internal stresses, of the order of 60 kg/mm^2 are combined with a high volume concentration of finely dispersed paramagnetic inclusions; c) in the first approximation, the dependence of the coercive force on the magnitude of the microstresses and the volume concentration of finely dispersed inclusions, derived from the "stress" and "inclusion" theory for Fe-Mo-Co alloys is in agreement with the obtained experimental data. There are [illegible] figures and [illegible] tables, 2 of which are English and 8 Soviet.

ASSOCIATION: Khar'kovskiy gosudarstvennyy [illegible]institut imeni A.M. Gor'kogo (Khar'kov State University imeni A.M. Gor'kiy)

SUBMITTED: May 1[illegible], 195[illegible]

Card 3/3

SOV/126-6-6-13/25

AUTHORS: Pines, B. Ya. and Barutkin, I. N.

TITLE: X-Ray Crystallographic Determination of Dispersion of Structural Components and of Magnitude of Microstresses in Cu-Ni-Fe Alloys with High Coercive Forces (Rentgenograficheskoye opredeleniye dispersnosti strukturnykh sostavlyayushchikh i velichiny mikronapryazheniy u vysokokoertsitivnykh splavov Cu-Ni-Fe)

PERIODICAL: Fizika metallov i metallovedeniye, 1958, Vol 6, Nr 6, pp 1053-1060 (USSR)

ABSTRACT: Cu-Ni-Fe alloys with high coercive forces H_c are mixtures of two face-centred cubic phases γ_1 and γ_2 which differ strongly in their magnetic properties. Neuman et al and Livshits et al (Refs. 2, 3) have shown that the maximum value of H_c is obtained in Cu-Ni-Fe alloys only at a certain definite stage of decomposition of the solid solution into phases γ_1 and γ_2. The paper reports an X-ray crystallographic study of the structure of such Cu-Ni-Fe alloys and its relationship with the magnetic properties. The following

Card 1/5

X-Ray Crystallographic Determination of Dispersion of Structural Components and of Magnitude of Microstresses in Cu-Ni-Fe Alloys with High Coercive Forces

three alloys were studied:
1) 53% Cu, 23% Ni, 24% Fe;
2) 61% Cu, 22% Ni, 17% Fe;
3) 50% Cu, 25% Ni, 25% Fe.
The method of harmonic analysis of the "form" of X-ray diffraction lines was used to find the degree of dispersion of the structural components and the magnitude of microstresses in these three alloys. If the photometric curves, representing the "form" of the diffraction lines, are expanded into Fourier series it is possible to find the reason for the diffuseness of these lines. The X-ray patterns were obtained by means of a camera with a 114 mm dia drum. A sharp-focus X-ray tube with an iron anticathode was used. A nickel standard was employed to calibrate the "instrumental" line width. The diffraction patterns were obtained immediately after thermal treatment. This thermal treatment was carried out in an electric furnace in an atmosphere of hydrogen. Samples were hardened by quenching from 1075°C (after 2 hours at that temperature) Some of the samples were subsequently tempered and dipped in oil. Magnetic measurements were made by the

X-Ray Crystallographic Determination of Dispersion of Structural Components and of Magnitude of Microstresses in Cu-Ni-Fe Alloys with High Coercive Forces

"neck" method The maximum magnetizing field used in measurements was 4200 oersted. Saturation occurred in every sample at fields of this order. X-ray diffraction patterns of samples of the alloy Nr 1 are shown in Fig.1 and some of the curves used in the analysis of these patterns are given in Figs 2-4. Table 1 gives the values of the coercive force and the lattice constants a_0, as well as the ratios of the intensities of the (2,2) lines of the phases γ_1 and γ_2 in the alloy Nr 1. Fig.5 gives the dependence of H_c on the mean dimensions of "coherent regions" in Cu-Ni-Fe alloys Nrs 1 and 2 The following conclusions are drawn by the authors from their results.

A) Change in the coercive force of the Cu-Ni-Fe alloys studied is accompanied by a change in the width of the X-ray diffraction lines.

B) At the initial stage of tempering, the diffraction lines

X-Ray Crystallographic Determination of Dispersion of Structural Components and of Magnitude of Microstresses in Cu-Ni-Fe Alloys with High Coercive Forces

become diffuse, which signifies the appearance of highly disperse "coherent regions" (100-150 Å in size), which form the nuclei of the γ_1 and γ_2 phases.

C) Further tempering produces a separation of γ_1 and γ_2 phases out of the solid solution and this is accompanied by splitting of each diffraction line into two. Microstresses increase at this stage.

D) The maximum values of H_c are reached when the separation between the γ_1 and γ_2 phases is greatest; γ_1 and γ_2 crystallites are then about 200 Å in size.

E) Further tempering produces then coagulation of the γ_1 and γ_2 crystallites and H_c falls. Microstresses also become smaller

F) It is suggested that reversal of magnetization in Cu-Ni-Fe alloys with high coercive forces occurs by rotation due to high dispersion and magnetic isolation of the structure

SOV/126-6-6-13/25

X-Ray Crystallographic Determination of Dispersion of Structural Components and of Magnitude of Microstresses in Cu-Ni-Fe Alloys with High Coercive Forces

of components. There are 5 figures, 2 tables and 14 references; 7 of the references are Soviet, 4 English, German and 1 international

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet imeni A. M. Gor'kogo (Khar'kov State University imeni A. M. Gor'kiy)

SUBMITTED: May 17, 1957

Card 5/5

1/1 14

AUTHOR:

TITLE:

PERIODICAL:

ABSTRACT:

Card 1/2

On the [illegible]

[illegible] In [illegible]

ASSOCIATION: Khar'kov State University imeni A. M. Gor'kiy

SUBMITTED: [illegible]

AVAILABLE: [illegible]

Card 2/2

AUTHORS: Pines, B. Ya., Smushkov, I. V. 57-28-3-30/33

TITLE: The X-Ray Determination of the Heterodiffusion Coefficients in Alloys With Components Considerably Differing in X-Ray Absorption (Rentgenograficheskoye opredeleniye koeffitsiyentov geterodiffuzii v splavakh komponent s rezko razlichayush chimsya pogloshcheniyem rentgenovskikh luchey)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 3, pp. 661-667 (USSR)

ABSTRACT: The method described in references 1 and 2 is here applied to the case of metal alloys with different absorption coefficients and different scattering power, and is further developed. The computation of a "mirror image" of the radiograph of a sample of binary alloys is investigated. In the case where the alloy components differ with regard to the X-ray absorption coefficients μ and the "reflective" power the alloy has a variable concentration with respect to depth. Equation (4) is derived. It represents the relation between the intensity dI of the X-rays which are reflected by the layer with the concentration

Card 1/2

The X-Ray Determination of the Heterodiffusion Coefficients in Alloys With Components Considerably Differing in X-Ray Absorption

57-28-3-30/33

c and the depth x in which this layer is located. This equation can only be solved according to the method of successive approximations. It is shown that the zero-th approximation cannot be selected very far from the actual distribution curve of cx. Beside the function c(x) of the concentration distribution the gradient values of the $\frac{dc(x)}{dx}$ -concentrations in the interior of the sample are directly obtained, without differentiating the c = c(x) - curve. With the aid of the quantities thus determined the heterodiffusion-coefficients in dependence on the concentration can be determined. At the end an example for the computation of the c(x)-function of a Cr-Mo-alloy is given.
There are 6 figures, 1 table and 2 Soviet references.

ASSOCIATION: Gosudarstvennyy universitet im. A. M. Gor'kogo, Khar'kov (Khar'kov, State University imeni A. M. Gor'kiy)

SUBMITTED: April 1, 1957

Card 2/2 1. Alloys--Diffusion 2. X-rays--Absorption 3. Alloys--Absorptive properties

AUTHORS: Pines, B. Ya., Smushkov, I. V. 57-28-3-31/33

TITLE: X-Ray Determination of Heterodiffusion Coefficients in Cr-Mo and Ni-W Systems (Rentgenograficheskoye opredeleniye koeffitsiyentov geterodiffuzii v sistemakh Cr-Mo i Ni-W)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 19[illegible], Vol. [illegible], Nr [illegible], pp. [illegible] (USSR)

ABSTRACT: The method of X-ray analysis for the determination of heterodiffusion coefficients D was applied here to the case of the Cr-Mo and Ni-W systems. The solid molybdenum and wolfram samples were covered with thin chromium or nickel films and subjected to a diffusion-annealing at different temperatures. After the annealing the samples were investigated by X-ray analysis, the X-ray spectrographs were evaluated photometrically and the photometric curves were computed according to the formulae given in ref. 1. In the Cr-Mo system data on the dependence of the diffusion coefficients on the concentration were obtained at 4 temperatures. The concentration dependence of the activation energy Q (c) and of the factor in front of the exponential function $D_o(c)$ were computed and

Card 1/2

X-Ray Determination of Heterodiffusion Coefficients in Cr- [illegible] 7-58-3-31/33
and Ni-W Systems

the latter was compared to the value computed according to the formula from ref. 7. After the concentration dependence $D_o = D_o(c)$, the energy of mixture in the solid phase was determined for the Cr-Mo system and by means of this [illegible] start the computed equilibrium diagram of Cr- [illegible] was set up. The melting points of the Cr-Mo alloys determined by experiments coincide well with its liquidus curve. In the case of the Ni-W system the D values were compared in dependence on c, $D = D(c)$ at 4 temperatures, [illegible] $Q(c)$ and $D_o(c)$ were computed and the energy of [illegible] in the solid phase was determined. As to its order of magnitude the latter agrees with the values obtained from the Ni-W phase diagram. It was observed that the [illegible] in the Ni-W system becomes zero at a concentration corresponding approximately to the limit of solubility. There are [illegible] and 11 references, 10 of which are Soviet.

SUBMITTED: April 1, 1958

Card 2/2

1. Chromium-molybdenum-nickel-titanium systems--Diffusion
2. Chromium-molybdenum-nickel-titanium systems--X-ray analysis

AUTHORS: Pines, B. Ya., Sirenko, A. F. SOV/

TITLE: Self-Diffusion and Heterodiffusion in Inhomogeneous Porous Bodies (Samodiffuziya i geterodiffuziya v neodnorodnykh poristykh telakh)
II. The Direct and the Inverse Frenkel' Effect (II. pryamoy i obratnyy effekt Frenkelya)

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1958, Nr 8, pp [illegible] (USSR)

ABSTRACT: The Kirkendall effect (displacement of the neutral marks at the boundary of interdiffusing metals) is caused by the inequality of the partial diffusion coefficients. This effect does not predetermine the occurence of an additional porosity during diffusion. This is determined by the vacancy mechanism of diffusion. This effect was mentioned by Frenkel. Fisher a long time ago. Therefore, it is only fair to call it Frenkel effect. It can, however, also be interpreted by a self-diffusion of vacancies, which is due to the inequality of the partial coefficients of heterodiffusion. Apart from the direct Frenkel effect an inverse Frenkel effect must be expected. This effect

Card 1/2

Self-Diffusion and Heterodiffusion in Inhomogeneous Porous Bodies. II. The Direct and the Inverse Frenkel' Effect

is represented by a heterogeneity of concentration (produced by means of a rising diffusion), when the partial self diffusion in the alloy is inhomogeneous. The inverse Frenkel effect was found experimentally in the sintering of samples of grains consisting of Cu-Ni-, Fe-Ni- and α-brass alloys. The quantitative investigation of this effect is being continued. The results of this study will be published later.
There are 2 figures, 1 table, and 5 references, 3 of which are Soviet.

ASSOCIATION: Gosudarstvennyy universitet im. A. M. Gor'kogo, Khar'kov
(State University imeni A. M. Gor'kiy, Khar'kov)

SUBMITTED: June 28, 1957

23(0)

AUTHORS: Pines, B.Ya., Sirenko, A.F., Mel'nik, L.S. SOV/57-28-10-25/40

TITLE: On the Resolving Power of the So-Called High-Dispersion X-Ray Photography (O razreshayushchey sposobnosti tak nazyvayemoy vysokodispersionnogo rentgenografirovaniya)

PERIODICAL: Zhurnal tekhnicheskoy fiziki, Vol 28, Nr 10, pp [illegible] USSR

ABSTRACT: This is a comparison of the resolving power of a reversal photograph as dependent upon the distance between the film and the sample. It was found that no increase in the resolving power of X-ray photographs is achieved even if the distance between film and sample is varied between 90 - 750 mm. An increase of D exceeding 100 to 150 mm is proved not to be expedient. This is due to the circumstance that when the resolving power of the photograph at great D is maintained, the negative influence of X-ray dispersion in air becomes more pronounced (leading to an increase of background in the X-ray photographs, and in a longer exposure of the photographs). There are 3 figures, 1 table, and 6 references, 6 of which are Soviet.

Card 1/2

On the Resolving Power of the So-Called High-Dispersion X-Ray Photography

SOV/57-28-10-[illegible]

SUBMITTED: November 1[illegible]

Card 2/2

SOV/58-59-8-18049

Translated from: Referativnyy Zhurnal Fizika, 1959, Nr 8, p 148 (USSR)

AUTHORS: Barutkin, I.N., Pines, B.Ya.

TITLE: The Structure and Coercive Force of Some Ferromagnetic Alloys

PERIODICAL: Uch. zap. Khar'kovsk. un-t, 1958, Vol 98, Tr. Fiz. otd. fiz.-matem. fak., Nr 7, pp 233-250

ABSTRACT: By means of the X-ray method, which permits the study of microstress and microdispersion by means of the form of the smeared lines of the X-ray photographs, a study was conducted of the structure of several high-coercive alloys (Fe-Mo, Fe-Mo-Co, Cu-Ni-Fe and Fe-Ni-Al-Cu) during heat treatment, in connection with the variation of their magnetic properties. The correlation between elements of structure and H_c was investigated. It was possible in the case of each concrete alloy to determine the cause of the development of a high-coercive state. Thus, in the case of the Fe-Mo alloy, H_c is explained by the presence of microstresses (up to 80 kg/mm^2) which originate in the separation of the Fe_3Mo_2 phase during annealing, and in the case of the Fe-Mo-Co alloy, the highest values of

Card 1/2

SOV/58-59-8-18049

The Structure and Coercive Force of Some Ferromagnetic Alloys

H_c are attained by combining the greatest internal stresses (60 kg/mm^2) with the least volumetric concentration of fine-dispersed non-magnetic impurities. The connection of H_c with structural variations was established for various stages of decomposition under various conditions of heat treatment.

A. V. Zalesskiy

Card 2/2

Pines, B. Ya.

18(7) PHASE I BOOK EXPLOITATION SOV/3355

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

Issledovaniya po zharoprochnym splavam. t. IV (Studies on Heat-Resistant Alloys, vol. 4), Moscow, Izd-vo AN SSSR, 1959. 400 p. Errata slip inserted. 2,200 copies printed.

Ed. of Publishing House: V. A. Klimov; Tech. Ed.: A. P. Guseva; Editorial Board: I. P. Bardin, Academician; G. V. Kurdyumov, Academician; N. V. Ageyev, Corresponding Member, USSR Academy of Sciences; I. A. Oding, I. M. Pavlov, and I. F. Zudin, Candidate of Technical Sciences

PURPOSE: This book is intended for metallurgists concerned with the structural metallurgy of alloys

COVERAGE: This is a collection of specialized studies of various problems in the structural metallurgy of heat-resistant alloys. [illegible] concerned with [illegible] Various [illegible] specified conditions are studied [illegible] by a number of references [illegible] Contents. The articles are accompanied by a number of references [illegible] and non-Soviet.

Card 10/12

Pines, B. Ya.

24(6) PHASE I BOOK EXPLOITATION SOV 2355

Akademiya nauk SSSR

Nekotoryye problemy prochnosti tverdogo tela; sbornik statey (Some Problems in the Strength of Solids; Collection of Articles) Moscow, Izd-vo AN SSSR, 1959. 386 p. Errata slip inserted. 2,000 copies printed.

Ed. of Publishing House: V. I. Aver'yanov; Tech. Ed.: R. S. Pevzner; Editorial Board: A.F. Ioffe, Academician; G. V. Kurdyumov, Academician; S. N. Zhurkov, Corresponding Member, USSR Academy of Sciences; B. P. Konstantinov, Corresponding Member, USSR Academy of Sciences; F. F. Vitman, Doctor of Physical and Mathematical Sciences, Professor (Resp. Ed.); L. A. Glikman, Doctor of Technical Sciences, Professor; S. A. Kiatin, Doctor of Physical and Mathematical Sciences; V. A. Stepanov, Doctor of Technical Sciences; Ya. B. Fridman, Doctor of Technical Sciences, Professor; B. S. Ioffe, Candidate of Technical Sciences (Deputy Resp. Ed.).

PURPOSE: This book is intended for construction engineers, technologists, physicists and other persons interested in the strength of materials.

COVERAGE: This collection of articles was compiled by the Otdeleniye fiziko-matematicheskikh nauk AN SSSR (Department of Physical and Mathematical Sciences) and the Fiziko-tekhnicheskiy institut AN SSSR (Institute of Applied Physics, Academy of Sciences, USSR) in commemoration of the 60th birthday of Nikolay Nikolayevich Davidenkov, Member of the Ukranian Academy of Sciences, founder and head of the Otdel prochnosti materialov (Department of the Strength of Materials) at the Institute of Applied Physics, Academy of Sciences, USSR, founder of the Fakul'tet fizicheskogo metallovedeniya (Department of Physical Metallurgy) at the Leningradskiy politekhnicheskiy institut (Leningrad Polytechnic Institute), recipient of the Stalin Prize (1943), the Order of the Red Banner of Labor (1945) and the Order of Lenin (1953). The articles deal with the strength of materials, phenomena of imperfect elasticity, temper brittleness, hydrogen embrittlement, cold brittleness, influence of deformation speed on the mechanical properties of materials, fatigue of metals, and general problems of the strength, plasticity, and mechanical properties of metals. Numerous personalities are mentioned in the introductory profile of Professor Davidenkov. References are given at the end of each article.

Gindin, I.A., B.G. Lazarev, Ya.D. Starodubov, and V.I. Khotkevich (Fiziko-tekhnicheskiy institut AN USSR-Institute of Applied Physics, Academy of Sciences Ukr. SSR, Khar'kov). Low-temperature Polymorphism of Metals 61

Zhurkov, S.N., and E.Ye. Tomashevskiy (Institute of Applied Physics, Academy of Sciences, USSR, Leningrad). Time Dependency of Strength Under Different Load Conditions 68

Bagdasarov, A.I., T.I. Gudkova, A.A. Zhukhovitskiy, and B.T. Kishkin. Influence of Stresses and Deformation on the Process of Diffusion 76

Pines, B.Ya., and A.F. Sirenko (Gosudarstvennyy universitet imeni Gor'kogo, g. Khar'kov State University imeni Gor'kiy, Khar'kov). Diffusion Creep of Compact Specimens Pressed From Powdered Iron 87

Svetlina, I.I., and E.S. Yakovleva (Institut fiziki metallov UFAN SSSR, Sverdlovsk-Institute of Metal Physics, Ural Branch, Academy of Sciences, USSR, Sverdlovsk). Influence of Aluminum and Copper on the Deformation of Nickel 95

Kosterova, T.A. (Institut poluprovodnikov AN SSSR, Leningrad-Semiconductor Institute, Academy of Sciences, USSR, Leningrad) Relationship Between the Mechanical and Thermal Characteristics of Crystals

Garber, R.I., and I.I. Solgabenko (Gosudarstvennyy pedagogicheskiy institut imeni G.S. Skovorody, Khar'kov-State Pedagogical Institute imeni G.S. Skovorda, Khar'kov). Strengthening of Rock Salt Crystals by Repeated Reverse Bending 105

Gaydukov, M.G., and V.A. Pavlov (Institute for Metal Physics, Ural Branch, Academy of Sciences, USSR, Sverdlovsk) Some Aspects of Stress Relaxation in Bronze $BK_{1\epsilon}Z$-1 111

Tochenilo, S.O., and Z.A. Vashchenko (Polytechnic Institute imeni M.I. Kalinin, Leningrad). Increasing the Elastic Limit and Decreasing the Elastic Aftereffect During Cold Hardening and Tempering of Spring Aluminum Bronze BrA7 118

Glikman, L.A., and S.S. Kolgatin (Nii po pererabotke nefti i polucheniyu iskusstvennogo zhidkogo topliva, Leningrad-Scientific Research Institute for Petroleum Refining and Production of Synthetic Liquid Fuels, Leningrad). Nature of the Physical Yield Point of Steel 130

Card 1/3

PINES, B.Ya.

Mechanism of diffusion in crystalline chemical compounds and of the kinetics of reactive diffusion. Fiz. tver. tela 1 no.3:482-488 Mr '59. (MIRA 12:5)

(Diffusion)

PINES, B.Ya.

More precise evaluation of the durability of a stretched body under load. Fiz. tver. tela 1 no.2:265-274 F '59. (MIRA 12:5)

(Strains and stresses)

PINES, B.Ya.; SMUSHKOV, I.V.

X-ray investigation of heterodiffusion in Cu-Ni alloys. Fiz. tver. 1 no.6:939-945 Je '59. (MIRA 12:10)

1.Khar'kovskiy gosudarstvennyy universitet im. A.M. Gor'kogo.
(Copper-nickel alloys) (Diffusion)

PINES, B.Ya.; CHAYKOVSKIY, E.F.

X-ray investigation of the kinetics of reaction diffusion in the system Al - Sb. Fiz. tver. tela 1 no.6:946-951 Je '59.
(MIRA 12:10)

1.Khar'kovskiy gosudarstvennyy universitet im. A.M. Gor'kogo.
(Aluminum-antimony alloys) (Diffusion)

SOV/20-4-...-/26

AUTHORS. Pines B.Ya. and Grebennik, I.P.

TITLE. Electronographic (Electron Diffraction) Determination of the Coefficients of Heterodiffusion in the Alloys Cu-Ni, Fe-Ni, Cu-Al and Ag-Al (Elektronograficheskoye opredeleniye koeffitsiyentov geterodiffuzii v splavov Cu-Ni, Fe-Ni, Cu-Al and Ag-Al)

PERIODICAL. Kristallografiya, 1959, Vol 4, Nr 1, pp 47-53 (USSR)

ABSTRACT: The electronographic method is an alternative to isotope methods of measuring the diffusion coefficients and values of 10^{-13} - 10^{-10} cm^2/sec can be covered in this way. Values of 10^{-9} - 10^{-13} cm^2/sec can be covered by X-ray methods and the isotopic methods cover the same range. Diffusion coefficients are structure sensitive and measurements can be made in equilibrium or non-equilibrium states according to the time taken for measurements. Changes in layers 10 to 10 m thick can be followed electronographically Diffusion in Cu-Ni, Fe-Ni, Cu-Al and Ag-Al systems was studied at 500°C.

Card 1/3 Specimens were made by condensing a film of Ni on a laye

Electronographic (Electron Diffraction) Determination of the Coefficients of Heterodiffusion in the Alloys Cu-Ni, Fe-Ni, Cu-Al and Ag-Al

of NaCl supported by a glass plate and dissolving the NaCl in water. In the electronograph Cu was evaporated rapidly from a hot source giving an equilibrium layer. The occurrence of a uniform solution could then be observed from the diffraction pattern. For Cu-Ni $D = D_0 \exp(Q/RT)$ where $D_0 = 5.6 \times 10^{-4}$ cm^2/sec $Q = 37$ kcal/mole for equilibrium specimens and $D_0 = 1.2 \times 10^{-4}$ cm^2/sec, $Q = 31$ kcal/mole for non-equilibrium specimens. For Al-Cu $D_0 = 1.4 \times 10^{-9}$ cm^2/sec $Q = 32$ kcal/mole and for Al-Ag $D_0 = 10^{-8}$ cm^2/sec and $Q = 39$ kcal./mole. Graphs for the other system (Fe-Ni) where the relationship between log D and T^{-1} is non-linear are given. Q has values which, particularly for the non-equilibrium case do not agree with those determined by X-ray diffraction.

Card2/3

Electronographic (Electron Diffraction) Determination of the Coefficients of Heterodiffusion in the Alloys Cu-Ni, Fe-Ni, Cu-Al and Ag-Al

There are 5 figures, 3 tables and 6 Soviet references

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A.M. Gor'kogo (Khar'kov State University imeni A.M. Gor'kiy)

SUBMITTED: October 11, 1957

Card 3/3

SOV/126-7-1-8/28

AUTHORS: Barutkin, I.N. and Pines, B. Ya.

TITLE: X-Ray Diffraction Study of the Structure of the Fe-Ni-Al-Cu Alloy With High Coercive Force (Rentgenograficheskoye issledovaniye struktury vysokokoertsitivnogo splava Fe-Ni-Al-Cu)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1959, Vol 7, Nr 1, pp 57-63 (USSR)

ABSTRACT: Fe-Ni-Al alloys (with Co and Cu admixtures) are very sensitive to heat treatment. Quenched samples of these alloys undergo internal changes on tempering. The changes consist of the formation of two body-centred cubic phases β and β_2; the β-phase is close to pure iron in its composition and the β_2-phase is an ordered solid solution of Fe in Ni-Al. The present paper reports a new X-ray diffraction study of changes in the structure of Fe-Ni-Al-Cu alloys (55.6, 25, 14.5 and 4% by weight, respectively) produced by various heat treatments. These changes of structure were then related to changes of the coercive force. The samples were in the form of cylinders of 0.2 mm diameter and 15 mm

Card 1/3

X-Ray Diffraction Study of the Structure of the Fe-Ni-Al-Cu Alloy With High Coercive Force

length. They were homogenised by heating at 1050°C for two hours. Homogenisation and subsequent heat treatment were carried out in an atmosphere of hydrogen. Two types of heat treatment were applied: (a) quenching from 1050°C in water with subsequent tempering at 650°C, and (b) cooling from 1050°C to room temperature at rates from 3000°C/min to 2°C/min with subsequent two-hour tempering at 650°C. The X-ray diffraction paterns were obtained by means of a sharp-focus tube in a camera of 114 mm diameter. Cobalt radiation and an aluminium filter were employed. The aluminium lines due to that filter were used as standards in calibration of the diffraction paterns. The K-line (310) of the alloy was recorded (Fig.1). Magnetic measurements were made by a ballistic "neck" method. Normal magnetisation curves and hysteresis loops were recorded; at the highest magnetising field used (4200 oersted) technical saturation was produced. The X-ray diffraction studies in conjunction with magnetic measurements showed that high values of the coercive force H_c occurred when the ferromagnetic β-phase

X-Ray Diffraction Study of the Structure of the Fe-Ni-Al-Cu Alloy With High Coercive Force

was distributed in highly dispersed state in the weakly magnetic β_2-phase. The optimum size of the β-phase particles for achievement of high H_c was found to be $\sim$250 Å. The degree of dispersion found from the X-ray data agreed with the results of electron-microscope studies of the Fe-Ni-Al-Co alloys (Refs.3-5). There are 2 figures, 1 table and 11 references, of which 6 are Soviet, 2 German and 1 English.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet (Khar'kov State University)

SUBMITTED: May 17, 1957

SOV/126-7-5-21/24

AUTHORS: Pines, B. Ya. and Sirenko, A. P.

TITLE: Non-Equilibrium Conditions and Diffusion Creep in Metallo-Ceramic Bodies (Neravnovesnyye sostoyaniya i diffuzionnaya polzuchest' u metallokeramicheskikh tel)

PERIODICAL: Fizika metallov i metallovedeniye, Vol 7, Nr 5, pp 768-776 (USSR)

ABSTRACT: In order to approach the conditions of diffusion creep experiments were carried out at relatively high temperatures and low applied stresses. Creep investigations under conditions of strain were carried out on metallo-ceramic specimens made by pressing powders of copper (electrolytic), nickel (carbonyl), iron, and mixtures of these metals. The grain size of Cu and Ni powder was 10-15 μ and that of iron powder 30-40 μ. The specimens were made in the shape of rods of 3 x 3 mm cross-section and a working length of 90 mm, with special heads of larger cross-section. The initial porosity of all specimens was 30-32%. The creep experiments were carried out at temperatures of up to 1250°C in a vacuum apparatus shown in Fig.1. The apparatus

Card 1/6

Non-Equilibrium Conditions and Diffusion Creep in Metallic-Ceramic Bodies

was evacuated by means of the diffusion oil pump MM-40. Loading of the specimens to be pulled was carried out with the help of an electromagnet. The grips in which the specimen heads were held were made of stainless steel and had a cross section one and a half times greater than that of the specimens, hence they remained practically undeformed in the experiments. The elongation of the specimens was determined according to the angle through which an indicating mirror had turned. In Fig.2 creep curves (dependence of the elongation $\Delta l/l$ on time t) for various specimens at 1000°C are shown. Fig.3a shows the concentration dependence of the complete elongation $\Delta l/l$ for 4 hours. Fig 3б shows the concentration dependence of the initial creep rate v for Cu-Ni specimens after preliminary annealing. The same dependence for Ni-Fe alloys is shown in Fig 3в. In Fig.3г the dependence of the initial creep rate v on the preliminary annealing time is shown. In Fig.4a isothermal contraction curves for copper specimens at different stresses are shown; Fig.4б shows the dependence of initial creep rate, v_0, on stress at various temperatures, and Fig.4в shows the dependence of the established

Card 2/6

Non-Equilibrium Conditions and Diffusion Creep in Metallo-Ceramic Bodies

creep rate v on stress at various temperatures. Fig.4 shows the dependence of the activation energy, Q, of creep on the time τ and temperature T of preliminary annealing for copper specimens. Fig.5δ shows the concentration dependence of the activation energy Q for Cu-Ni specimens, and Fig.5β shows the concentration dependence of the activation energy of creep for Ni-Fe specimens. Fig.5 shows the same relationship for a Ni-W mixture. The preliminary annealing temperature was 1250°C. In Fig.6 the dependence of the relative elongation $\Delta l/l$ in creep on the time of testing for iron specimens having undergone a preliminary annealing treatment at 1250°C at a load of 100 g/mm^2 is shown. In Fig.7 the dependence of $\Delta l/l$ on the time of creep testing of iron specimens is shown. Fig.8 shows, for various testing temperatures, the dependence of $\Delta l/l$ on the time of testing for iron specimens which have not undergone a preliminary annealing treatment. Fig.9 shows the dependence of the established creep rate v on testing temperature. In Fig.10 the dependence of $\ln(vT)$ on T is shown. The authors arrive at the following

Card 2/4

Non-Equilibrium Conditions and Diffusion Creep in Metallic Ceram Bodies

conclusions.

1. Metallo-ceramic specimens compressed from powders of pure metals and mixtures of metallic powders exhibit diffusion creep at high temperatures. At first a stage of unestablished creep is observed, in which deformation decreases with time. This is followed by a stage in which creep is established at a constant deformation rate.
2. Preliminary annealing of metallo-ceramic specimens decreases the initial rate and extent of the full creep deformation. After a sufficiently lengthy preliminary annealing treatment the first creep stage disappears completely
3. Cold working (compression at room temperature) increases the initial rate and extent of the full deformation in diffusion creep at high temperatures. After cold working the first creep stage, which had been removed by preliminary annealing, is re-established.
4. Metallo-ceramic specimens made from mixtures of powders of metals diffusing into each other exhibit a much greater initial creep rate which corresponds to the first stage. After lengthy annealing the initial creep rate and the full deformation in creep decrease sharply.

Card 2/2

Non-Equilibrium Conditions and Diffusion Creep in Metallo-Ceramic Bodies

5. The creep deformation of a porous metallo-ceramic specimen which is brought about by straining at high temperatures noticeably decreases the sintering rate of the specimen.
6. Specimens with different initial porosities have different initial creep rates. After annealing, the creep rates of the specimens become identical.
7. The initial creep rate and the rate at which creep is established subsequently for metallo-ceramic specimens depend on the applied stress and are somewhat greater than that according to linear law. This may be due to departure from equilibrium conditions.
8. The activation energy of the creep process in one component metallo-ceramic bodies is less than the equilibrium activation energy of volume self-diffusion. Only in iron powder specimens having undergone preliminary annealing the activation energy of creep (particularly the γ-phase) approaches the equilibrium value of the activation energy of self-diffusion. For specimens made of mixtures of various

SOV/[illegible]

Non-Equilibrium Conditions and Diffusion Creep in Metallo-Ceramic Bodies

metal powders, having undergone lengthy annealing treatment the activation energy of creep depends on the concentration of the mixtures according to the linear law.
9. The mechanism in the creep of metallo-ceramic specimens can be explained only on the basis of a diffusion mechanism in which non-equilibrium conditions causing an increase in the value of the self-diffusion coefficient and a decrease in activation energy are taken into consideration.
There are 10 figures and 11 references, of which 6 are Soviet and 5 English.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet imeni A. M. Gor'kogo (Khar'kov State University imeni A. M. Gorkiy)

SUBMITTED: May 6, 1958

Card 6/6

67694

18.6100 SOV/126-8-4-16/22

AUTHORS: Pines, B.Ya., and Teng Ke-seng

TITLE: Study of the Internal Friction in Metal Ceramic Bodies

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 4, pp 599-606 (USSR)

ABSTRACT: In this work the internal friction of specimens of Cu, Ni and Fe powders and those of mixtures of the powders of the above metals was studied experimentally. The investigation was carried out in a vacuum "delaxator" for rotary oscillations of the usual type (Ref 8), in which specimens of 70 mm length and 3 x 3 mm cross sectional area were used. The heads of the specimens had a greater cross sectional area (6 x 3 mm) and were 10 mm long. The above specimens were made by pressing the powders in a special compact. The specimen heads were firmly gripped in stainless steel grips. The frequency of the free oscillations depended on the loads which were slipped on a horizontal rod suspended from the lower specimen grip. As a rule the frequency of oscillation was 1.0-2.7 cps. Oscillations were initiated by means of magnetic coils which attract the

Card 1/5

Study of the Internal Friction in Metal Ceramic Bodies

iron weights. Typical curves for the logarithmic decrement of oscillation damping, Q^{-1}, in relation to temperature, are shown in Fig 1. Here two curves are shown for a specimen made from pure copper. Curve 1 was obtained with weights giving an oscillation frequency at room temperature of $f_1 = 0.86$ cps; Curve 2 is for a frequency of $f_2 = 1.94$ cps. Similar curves for specimens of a mixture of Cu and Ni powders (75% Ni) are shown in Fig 2. Here the frequencies are $f_1 = 0.85$ cps and $f_2 = 2.01$ cps, respectively. From the results of measurements of the temperature dependence of the logarithmic decrement of damping the activation energies for the processes responsible for internal friction were determined. Two separate activation energy determinations were carried out: a) according to the displacement of the internal friction peak observed in relation to the frequency of oscillation; b) according to the temperature course of the smooth part of the curve $Q^{-1} = Q^{-1}(T)$. Fig 3 shows the dependence of the activation energy for metallo-ceramic specimens of Cu-Ni powder mixtures on the volume concentration of Ni.

Study of the Internal Friction in Metal Ceramic Bodies

The specimens were given a preliminary annealing treatment at 1000 °C for different lengths of time. In Fig 4, a and b, internal friction curves for metallo-ceramic specimens of Cu-Ni powder mixtures are shown. In Fig 5 a few data on the temperature of the maximum of "dissimilar" and "similar" peaks (corresponding to the contact between "dissimilar" and "similar" grains) are shown in relation to concentration. These data refer to specimens which were given a preliminary annealing treatment at 1000 °C for 30 minutes. In Fig 6 the calculated and experimental dependences of the height of the maximum are shown. In metallo-ceramic specimens which are not in equilibrium the activation energies obtained depend on the time for which the specimens had been preliminarily soaked at a high temperature. In Fig 7 more accurate results are shown for specimens which had undergone preliminary annealing for various lengths of time at 1000 °C. Fig 8 shows the change in height, H_{max}, and the width, B_{max}, of internal friction peaks of specimens made from copper and a mixture of Cu and Ni powders which had undergone

Card 3/5

Study of the Internal Friction in Metal Ceramic Bodies

preliminary annealing for various lengths of time at 1000 °C. In Fig 9 the dependence of the activation energy of internal friction processes on the volume concentration of the components for metallo-ceramic specimens made from Cu-Fe powder mixtures is shown. Fig 10 shows the dependence of internal friction on temperature for a metallo-ceramic specimen made from a mixture of Cu and Fe (50%) powders. The specimen was preliminarily annealed at 1000 °C for 30 minutes; A - peak for Cu-Cu; B - peak for Cu-Fe; C - peak for Fe-Fe. The authors arrived at the following conclusions. 1) The activation energy, height and width of the peaks of internal friction for specimens of pure metals and Cu-Ni powder mixtures depends on the time of preliminary annealing of the specimens, the activation energy increases with increase in soaking time and the peak heights also increase. 2) In Cu-Ni and Cu-Fe powder mixture specimens the activation energy depends linearly on the volume concentration of the mixtures. 3) The activation energy determined from the frequency displacement of the peak corresponding to the

Card 4/5

Study of the Internal Friction in Metal Ceramic Bodies

contact between dissimilar grains, depends non-linearly on concentration. 4) In the curve for the temperature dependence of the logarithmic decrement for specimens of Cu-Ni and Cu-Fe powder mixtures, three peaks appear; two of them correspond to the contact between similar grains and one to that of dissimilar grains. 5) In powder mixtures where the grain sizes of the components are approximately equal, the height of the peak corresponding to contact between similar grains varies approximately in the same way as the contact surface of the grains, i.e. according to the expression $(1-x)^2$, where x is the volume concentration.
There are 10 figures and 10 references, of which 5 are Soviet, 4 English and 1 is German.

Card 5/5

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet (Khar'kov State University)

SUBMITTED: May 12, 1958

18.6100

67663
SOV/126-8-6-11/24

AUTHORS: Pines, B.Ya. and Teng Ke-seng

TITLE: Investigation of Internal Friction in Sintered Materials. IV. Samples of Binary Powders with Non-Interacting Components: Cu-Mo and Cu-W

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 6, pp 867-871 (USSR)

ABSTRACT: The present paper is part of a series (Ref 1 to 3) dealing with internal friction (i f) in sintered metals. To study in greater detail the i f maxima at like and unlike contacts of grains, the authors investigated metal-ceramic materials made of binary powder mixtures consisting of non-interacting components: Cu-Mo, Cu-W. I f measurements were carried out using a vacuum torsional pendulum (a relaxator, described in Ref 1). The conditions and techniques of measurements were the same as those described earlier (Ref 1 to 3). The samples were prepared by pressing together mixtures of various compositions consisting of electrolytic Cu (99.99%) powder with particles of less than 53 μ size, of Mo (99.98%) and W (99.98%) powders with grains of ~10 μ dimensions. Preliminary annealing of the samples was carried out in

Card 1/5

Investigation of Internal Friction in Sintered Materials. IV. Samples of Binary Powders with Non-Interacting Components: Cu-Mo and Cu-W

the instrument itself at 1000°C in 10^{-4} - 10^{-5} mm Hg vacuum; different durations of this annealing were employed for different samples. Typical temperature dependences of i f are shown in Fig 1 (Cu-Mo) and Fig 2 (Cu-W). The general nature of these curves does not differ from those obtained for pure metals and other binary powder mixtures. In all cases there are two maxima (A and B) obtained at certain temperatures superimposed on i f curves rising rapidly with temperature. The A maximum near 300°C represents like contacts of grains (ie Cu-Cu) and is due to a relaxation effect (diffusion glide) along the grain boundaries. This peak is also observed in powders consisting of Cu alone. The B maximum represents unlike contacts (Cu-Mo and Cu-W) and it occurs at temperatures of 400 to 450°C. No maxima were observed corresponding to like contacts between the components Mo and W; these maxima should appear at much higher temperatures (Ref 4). Fig 1 gives the i f curves of H

Card 2/5

Investigation of Internal Friction in Sintered Materials. I. Samples of Binary Powders with Non-Interacting Components: Cu-Mo and Cu-W

Cu-Mo powders annealed at 1000°C for 30 min (measurements at $f \cong 0.9$ c/s); curves 1, 2 and 3 represent samples with 5, 10 and 25% Mo. Fig 2 shows the i f curves obtained on Cu-W samples with 10% W after annealing at 1000°C and immediate cooling (curve 1) or holding at the latter temperature for 30 min (curve 2), 2 hours (curve 3), 6 hours (curve 4). With increase of the annealing duration the magnitude of i f at high temperatures is decreased. This may be explained by the diffusion nature of processes responsible for the i f "background", since with increase of duration of annealing the diffusion processes are slowed down. Measurement of the i f maxima (A and B) corresponding to like and unlike contacts of Cu-Mo and Cu-W powders subjected to annealing at 1000°C for various lengths of time are shown in Fig 3 to 6. Curves 4, 5 of Fig 3 and curves 3, 4 of Fig 5 show that the i f maximum A is depressed by increase of the amount of the second component. This is due to decrease of the contact area of like grains, S, which varies as

Card 3/5

Investigation of Internal Friction in Sintered Materials. IV. Samples of Binary Powders with Non-Interacting Components: Cu-Mo and Cu-W

$S = S_o(1 - c^2)$ with the concentration c of the second component (Fig 7) in agreement with the authors' theory (Ref 1). On increase of the annealing duration the A maximum is also depressed (cf curves 4 to 6 in Fig 4 and curves 5,6 in Fig 6) which is due to enlargement of Cu grains by "cumulative" crystallization during annealing. The B maximum due to unlike contacts in Cu-Mo rises with increase of the amount of Mo (cf curves 1 to 3 in Fig 3) but it falls on increase of the annealing duration (curves 1 to 3 in Fig 4). In the Cu-W system the B maximum falls with increase of the amount of W (curves 1, 2 in Fig 5) and rises with increase of the annealing duration (curves 1 to 4 in Fig 6). All these different effects are due to the preliminary annealing at 1000°C. This annealing produces good contacts between Cu and Mo grains in Cu-Mo even at 1000°C and this is responsible for the rise of the B maximum with increase of the amount of Mo. The fall of the B maximum in Cu-Mo with increase of the annealing duration is due to the contact area being

Card 4/5

Investigation of Internal Friction in Sintered Materials. IV. Samples of Binary Powders with Non-Interacting Components: Cu-Mo and Cu-W

decreased (the roughness of the contact surface is reduced). In Cu-W mixtures annealing at 1000°C does not produce yet a good contact between Cu and W grains and only after prolonged annealing at this temperature the contact necessary to cause a rise of the B maximum is obtained. Lowering of the B maximum of Cu-W powders with increase of the second component (W) is due to the contacts becoming poorer, possibly because these mixtures are more difficult to compress. There are 7 figures and 4 references, 3 of which are Soviet and 1 German

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im A.M.Gor'kogo (Khar'kov State University imeni A.M.Gor'kiy)

SUBMITTED: May 4, 1959

Card 5/5

66735
SOV/20-129-2-20/66

~~18(3)~~ 18.6100

AUTHORS: Pines, B. Ya., Sirenko, A. F.

TITLE: Service Time Under Load as Dependent on the Applied Stress for Metalloceramic Iron Samples in the α and γ Phase

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 129, Nr 2, pp 310-313 (USSR)

ABSTRACT: Introducingly a report is made on various previous investigations dealing with this subject. According to S. N. Zhurkov and co-workers (Refs 1, 2) the following dependence of the service time τ on the load p and on the temperature T is experimentally observed: $\tau = \tau_o e^{\frac{E-\gamma p}{kT}}$. In this case k denotes Boltzmann's constant, τ_o and γ constants of the material, E - activation energy of the destruction processes the numerical value of which is the same for some metals with high heat of sublimation. The experiments described in the present paper were made with metalloceramic samples (length 30 mm, operating length 20 mm, cross section 3×3 mm^2) which were pressed from iron dust with the grain size $< 50\mu$ (average $\sim 30\mu$). Samples of different porosity were

Card 1/4

Service Time Under Load as Dependent on the Applied Stress for Metalloceramic Iron Samples in the α and γ Phase

produced. The annealing of the samples is described in brief. The authors determined the service time under load for several samples of different porosity and by extrapolation to the value zero the value corresponding to a massive sample was determined. The change in service time due to porosity was only some per cents. The service time under load was determined at the temperatures of 600; 800; 900; 1000; and 1100° in a vacuum apparatus at pressures of $\sim 10^{-4}$ to 10^{-5} torr and in an interval of loads in which the service time varied by 3 to 4 orders of magnitude. The results of these experiments are illustrated by two diagrams. The calculated and the experimental curves are in agreement at the following values of the constants in the formula given by B. Ya. Pines (Ref 4):

$$\tau = \frac{C(kT)^2}{p^3 \delta^4 D} e^{-\frac{p \delta^3 \sqrt{n}}{kT}}$$ at 600, 800 and 900° : C = 5,

α = 430 mm^2.degree/kg, U_o^{α} = 52 - 54 kcal/g mol;

Service Time Under Load as Dependent on the Applied Stress for Metalloceramic Iron Samples in the α and γ Phase

at 1000° and 1100° : C = 5, α = 450 mm^2.degree/kg, U_o^{α} = 68 to 70 kcal/g mol. In the above formula C denotes a numerical factor of the order one, δ - the linear size of the atoms, n_o - the number of the vacancies, the combination of which corresponds to an initial "germination crack", D - the coefficient of autodiffusion. Moreover it holds that $\alpha = \delta^3 \sqrt{n_o}/k$. The values found for the activation energy of the destruction processes are in good agreement with the known values of the activation energy iron autodiffusion in the α and γ-phase. The concepts of diffusion are in complete agreement with the experiments described here. The problem of the service time of the alloys under stress has still to be subjected to an exact

Card 3/4

66735

Service Time Under Load as Dependent on the Applied Stress for Metalloceramic Iron Samples in the α and γ Phase

SOV/20-129-2-20/66

theoretical and experimental investigation. The second diagram shows the dependence of service time on temperature for different constant values of p. Above the point of the α - γ -phase transformation the service time increases jump-like. There are 2 figures and 6 Soviet references.

ASSOCIATION: Khar'kovskiy gosudarstvennyy universitet im. A. M. Gor'kogo (Khar'kov State University imeni A. M. Gor'kiy)

PRESENTED: July 15, 1959, by G. V. Kurdyumov, Academician

SUBMITTED: July 7, 1959

Card 4/4

69430
S/139/60/000/01/004/041
E072/E334

18.6200

AUTHORS: Pines, B.Ya. and Sirenko, A.F.

TITLE: The Problem of the Role of Closed Pores in Sintering in Powder Metallurgy

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Fizika, 1960, Nr 1, pp 23 - 28 (USSR)

ABSTRACT: The variation of final porosity of η_k of a sintered specimen with initial compaction pressure P was studied for various sintering schedules. Figure 1 taken from Ref 3 shows the relationship between the initial porosity η_H (largely determined by P) for < 50 μ Cu powder after heating to 1 000 °C and Curve 1 - immediately cooling. Curves 2, 3, 4, sintering for 15, 60 and 240 min. Minimum η_k is found near 27% η_H and for the lowest lying curve, 4, is about 10%. The non-monotonic relationship is due to gas pressure in the pores. Decrease in η_H does increase the area of intergranular contact thus increasing sintering rate but also increases the number of closed pores which tends to give reduced sintering

Card1/4

The Problem of the Role of Closed Pores in Sintering in Powder Metallurgy

rate. Ref 3 also gave data on rates of shrinkage of unpressed powders of Cu both pure and with additions of other metals (low-melting) These are plotted in Figure 2 whence it can be seen that very large shrinkages were obtained particularly with mixtures (e.g Cu + 3% Pb. ~70% after 5 hours at 1 000°). Pressed mixtures (4.6 tons/cm^2), however showed an expansion (Curves 7-9) though pure Cu (Curve 6) did not. The effect of vacuum pressing at 10^{-1}-10^{-2} mm Hg was now tried. a photograph of the special press being shown in Figure 3. Figure 4 shows $\eta_k - \eta_H$ plots for Cu so prepared after various holding times at 1 000°; η_k decreases monotonically with η_H and can be as low as 5% for 8% η_H. sintering in H_2 or in vacuum gave almost identical results. If however, oxidized Cu powder was used a minimum was again

Card2/4

The Problem of the Role of Closed Pores in Sintering in Powder Metallurgy

obtained (Figure 5), this was ascribed to release of gas on decomposition of the oxide. Some gas is probably still present perhaps as oxide in vacuum-pressed specimens, since unpressed specimens have ρ_k 2% after 8 hours at 1 000 °, and < 1% after 12 hours. Further work was concerned with Ni-Al alloys. Trapped gas can cause marked bloating, as indicated in Figure 6 which suggests that this can largely be avoided by heating for several hours at 620° (below the melting point of Al) prior to sintering at 1 250 °C (specimen 5 30% Al) since specimens 2-4 (10 20 and 50% Al) heated directly to 1 250 ° bloated badly. Pure Ni (Specimen 1) showed no such effects. Bloating is ascribed to formation of liquid Al which rapidly seals any pores and prevents the escape of gas. Some reaction between Ni and Al occurs at 620° as indicated in Figure 4 which shows plots of shrinkage (for 1, 3 and 8 hours heating) as a function of composition. The relatively large expansion for intermediate compositions (maximum at ~ 50% alloy) is not due to bloating but to alloy

Card3/4