solutions of the α- and β-titanium-modifications in connection with a simultaneous interaction of zirconium and hafnium with titanium (figure 1); 2. of the system with solutions, as under 1, of β-titanium with limited solid α-titanium solutions (figure 2). 3. Phase diagram with an eutectoid transformation of alloys rich in titanium with elements that reduce the temperature of its polymorphous transformations and cause an eutectoid decomposition of the β-phase (figure 3). 4. A phase diagram with a peritectic and peritectoid type of the transformations of alloys rich in titanium is produced in the interaction with elements which increase the melting temperature and that of the polymorphous transformation of titanium (C,N,O) and with elements which diminish the former, but increase the latter (Al,B,[illegible],Sn) (figure 4). 5. This type corresponds to the case in which one of the components forms a continuous series of solid solutions with α- and β-titanium, whereas the second one only forms these solutions with α-titanium.

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6. This type is produced due to a combination of the double diagrams of types 1 and 3, that means one component forms continuous solid solutions with α- and β-titanium, whereas the second one reduces the temperature of the polymorphous transformation of titanium and causes an eutectoid decomposition of the β-phase. 7. One component behaves as in case 6, while the second one increases the temperature of the polymorphous transformation, whereafter follows a peritectic or peritectoid reaction (combination of types 1 and 4). 8. This type is produced by a combination of types 2 and 3. 9. Type 9 = types 2 and 4. 10. Type 10 = types 3 and 4. Experimental investigations of some of these systems (references 4-6) confirm the correctness of the above-mentioned classification. These types of diagrams make it possible to obtain concrete compositions of ternary titanium alloys with a certain structure. There are 4 figures and 6 references, 5 of which are Soviet.

Card 3/4

AUTHORS: Kornilov, I. I., Domotenko, N. T. SOV/20-120-2-23/63

TITLE: The Influence of the Atomic Concentration of Chromium, Molybdenum and Tungsten Upon the Properties of Solid Nickel Solutions
(Vliyaniye atomnoy kontsentratsii khroma, molibdena i vol'frama na svoystva tverdykh rastvorov nikelya)

PERIODICAL: Doklady Akademii Nauk SSSR, 1958, Vol. 120, Nr 2, pp. 311-313 (USSR)

ABSTRACT: The three above-mentioned elements of group VI of the periodic system have a body-centered (cubic) lattice and form limited solid solutions with nickel. The solubility of these elements decreases from chromium in the direction of molybdenum and tungsten. The differences of the atomic diameters as compared to those of nickel and their maximum solubility in nickel are given. The replacement of the atoms of the metal solvent by atoms of the dissolved substance causes additional chemical bindings in the system which strengthen the lattice of the metal solvent (Reference 1). This different solubility and the atomic struc-

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ture must also exert a different influence upon solid nickel solutions. The authors wanted to determine the rules governing these changes of property. For this purpose they employed the methods of physical-chemical analysis. The measurements of the lattice period of the solid nickel solution show that at equal atomic concentrations the degree of distortion of the crystalline lattice in nickel increases with the transition from Cr to Mo and W. This rule corresponds to the successive position of these elements in the periodic system of elements and is a consequence of the difference of their atomic diameters as compared to that of nickel (table 1). As is to be seen from it the greatest difference in the lattice parameters occurs in the cases of solid nickel solutions with tungsten (W 4,6 and 10%) and the smallest difference in cases with chromium (at the same concentrations of Cr). Molybdenum takes an intermediate position. The investigation of the specific electric resistance at the same atomic concentrations of Cr, Mo and W showed the sequence of the increase also in this physical constant on transition from chromium to molybdenum and further to tungsten. The solidity was studied in alloys with 4,6 and 10% Cr, Mo and W at room temperature, at 800 and 1000° (table 2), the heat resistance at 800° and a tension of 4 kg/mm^2, as well as at 1000° and a tension of 2 kg/mm^2. From table 2 follows that the ultimate-stress values at equal atomic concentrations increase from chromium to tungsten and from tungsten to molybdenum. Molybdenum yields the highest increase in hardness of the solid nickel solutions. Thus the sequence of influences of Cr, Mo and W in this respect does not correspond to their position in the periodic system. The same holds for the heat resistance (determined by the method of bending). The corresponding curves at 800 and 1000° are shown by figure 1. From this follows that the increase in concentration of Cr, Mo and W leads to the strengthening of the alloys at the isothermal lines given in the diagram. The results of investigation were generalized in a joint

The Influence of the Atomic Concentration of Chromium, Molybdenum and Tungsten Upon the Properties of Solid Nickel Solutions

SOV/ 20-120-2-23/63

diagram. From this follows that the heat resistance of the solid solutions of Cr, Mo and W at all concentrations changes in the same order as the hardness at the same temperature. This yields an order: Cr→W→Mo. A different influence of molybdenum and tungsten upon the electric resistance and upon the change of the period of the crystalline lattice of the solid solution on the one hand and upon the hardness and heat resistance on the other hand can be explained by the fact that the chemical forces of binding decisively influence the mechanical properties. An individual influence of the elements upon the chemical strengthening of solid nickel solutions takes place here. There are 2 figures, 2 tables and 3 Soviet references.

ASSOCIATION: Voyenno-vozdushnaya inzhenernaya akademiya im. N. Ye. Zhukovskogo (Military Aviation Engineering Academy imeni N. Ye. Zhukovskiy)

Card 4/5

KoRNILov I. I.

P.K

18(4,7);25(1) PHASE I BOOK EXPLOITATION SOV/2568

Akademiya nauk SSSR. Institut nauchno-tekhnicheskoy informatsii

Metallurgiya i metallovedeniye; khimiya, metallovedeniye i obrabotka titana (Metallurgy and Metallography; Chemistry, Metallography, and Treatment of Titanium) Moscow, Izd-vo AN SSSR, 1959. 383 p. (Series: Itogi nauki; tekhnicheskiye nauki, 2) Errata slip inserted. 2,700 copies printed.

Ed.: N. V. Ageyev, Corresponding Member, Academy of Sciences, USSR; Ed. of Publishing House: V. S. Rzheznikov; Tech. Ed.: Yu. V. Rylina.

PURPOSE: This collection of articles is intended for metallurgists working with titanium and titanium alloys.

COVERAGE: The articles in this collection deal with the chemistry, metallurgy, and machining of titanium and titanium alloys. The articles are based on abstracts appearing in the Referativnyy zhurnaly for chemistry and metallurgy, from 1953 to 1955. For the most part the articles are based on non-Soviet material. No personalities are mentioned. References follow each article.

Card 1/6

KORNILOV, I. I.

Mechanical Properties of Intermetallic Compounds of Iron and Nickel."

report presented at the Electrochemical Society Meeting, Philadelphia, 3-7 May 59

Eval. B-3,131,204

Kornilov, I.I.

P.2

PHASE I BOOK EXPLOITATION SOV/3559

Akademiya nauk SSSR. Institut metallurgii. Nauchnyy sovet po probleme 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.F. Kuz'min; Editorial Board: I.P. Bardin, Academician, G.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 W on the heat-resisting properties of various alloys are studied. Deformability and workability

KORNILOV, I. I.

21(4) PHASE I BOOK EXPLOITATION SOV/2714

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

Doklady sovetskikh uchenykh; yadernoye goryucheye i reaktornyye metally. (Reports of Soviet Scientists; Nuclear Fuel and Reactor Metals) Moscow, Atomizdat, 1959. 670 p. (Series: Its: Trudy, vol. 3. 8,000 copies printed.

Ed. (Title page): A.A. Bochvar, Academician, A.P. Vinogradov, Academician, V.S. Yemel'yanov, Corresponding Member, USSR Academy of Sciences, and A.P. Zefirov, Doctor of Technical Sciences; Ed. (Inside book): V.V. Parovernev and G.M. Puhelintseva; Tech. Ed.: E.I. Mazel'.

PURPOSE: This volume is intended for scientists, engineers, physicians, and biologists working in the production and peaceful application of atomic energy; for professors and students of schools of higher technical education where the subject is taught; and for people interested in atomic science and technology.

COVERAGE: This is volume 3 of a 6-volume set of reports on atomic energy, presented 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 3 consists of two parts. The first part, edited by A.I. Zubov, is devoted to geology, prospecting, concentration and processing of nuclear source material. The second part, edited by G.L. Zverev, includes 27 reports on metallurgy, metallography, processing technology of nuclear fuels and reactor metals, and neutron irradiation effects on metals. The titles of the individual papers in most cases correspond word for word with those in the official English language edition on the Conference proceedings. See SOV/2081 for the titles of the other volumes of the set.

VOL, Abram Yevgen'yevich; AGEYEV, N.V., red.; ABRIKOSOV, N.Kh., doktor tekhn.nauk, red.; KORNILOV, I.I., red.; SAVITSKIY, Ye.M., red.; OSIPOV, K.A., doktor tekhn.nauk, red.; GUSEVA, L.N., kand.khim. nauk, red.; MIRGALOVSKAYA, M.S., kand.khim.nauk, red.; SHKLOVSKAYA, I.Yu., red.; MURASHOVA, N.Ya., tekhn.red.

[Structure and properties of binary metal systems] Stroenie i svoistva dvoinykh metallicheskikh sistem. Pod rukovodstvom N.V.Ageeva. Moskva, Gos.izd-vo fiziko-matem.lit-ry. Vol.1. [Physicochemical properties of elements; nitrogen, actinium, aluminum, americium, barium, beryllium, and boron systems] Fiziko-khimicheskie svoistva elementov; Sistemy azota, aktiniia, aliuminiia, ameritsiia, bariia, berilliia, bora. 1959. 755 p. (MIRA 13:3)

1. Chlen-korrespondent AN SSSR (for Ageyev).
(Metals) (Phase rule and equilibrium)

24(8) PHASE I BOOK EXPLOITATION SOV/2117

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

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

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

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

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

II. CONSTITUTION DIAGRAM STUDIES

The author bases his method on an overall study of the chemical reactivity of the elements in the periodic table in relation to a given element (in this case, iron), specifically, their ability to form solid solutions with iron. He gives methods for constructing constitution diagrams of multicomponent iron-base alloys (5-8 components).

A range of compositions forming solid solutions when heated was found for the following: 1) ZrO_2-MgO binary mixtures (solid-solution melting points: 2200-2500° C) 2) ZrO_2-MgO-Al_2O_3 ternary mixtures (solid-solution melting points: 2200-2625° C), and 3) MgO-Cr_2O_3-ZrO_2 ternary mixtures (solid-solution melting points: 2200-2600° C). Roentgenometric analysis established the formation of ternary solid solutions of cubic modification in the range of ternary mixtures of the system ZrO_2-MgO-CaO, rich in zirconium--from 80 to 95 mol. percent of ZrO_2. Melting points of these mixtures fall between 2300 and 2660° C. The absence of a eutectic makes these mixtures important refractory materials.

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Kornilov, I.I.

KORNILOV, I.I.; BUDBERG, P.B.

Constitutional diagrams of titanium-base systems. Itogi nauki: no.2:31-102 '59. (MIRA 12:9)
(Titanium alloys) (Phase rule and equilibrium)

18.8200

67294

SOV/180-59-4-31/48

AUTHOR: Kornilov, I.I. (Moscow)

TITLE: Several Problems of the Theory of High Temperature Strength and the Development of New High-Strength Titanium Alloys

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1959, Nr 4, pp 190-199 (USSR)

ABSTRACT: The physico-chemical basis of high temperature strength of alloys is discussed and the various methods of measuring high temperature resistance are compared. Fig 1 shows apparatus for measuring the strength of alloys at elevated temperatures by the centrifugal method. The author considers that the time to reach a given degree of deformation by this method gives a good measure of the strength at high temperatures. Studies of the high temperature strength of different types of alloy system are described and reasons for strengthening put forward. Fig 4 and 5 show the effects of varying the composition of the Au-Ag system and of the Cu-Ni system at 300°C and 900°C respectively. It is shown that the strength of continuous solid solutions is retained at much higher temperatures than had been previously supposed. The high

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temperature strengths of systems with limiting solid solution are given in Fig 7 (Ni-Zr, curve 1; Ni-Nb, curve 2; Ni-Mo, curve 3) at 800°C; Fig 8 (W-Ni, curve 1; Ti-Ni, curve 2; Fe-Ni, curve 3; Co-Ni, curve 4) at 700°C and for Ni-Cr alloys in Fig 9 and Ni-Mo alloys in Fig 10. It is shown that the strength at high temperatures increases with the concentration of the soluble element and reaches a maximum at the transition from solid solution completely saturated to heterogeneous structures with a finely dispersed precipitate of second phase. Results on studies of the high temperature strength by formation of metallic compounds are given in Fig 11. This compares the rate of creep of solid solutions of Ni-10%Nb and Ni-7.5%Ta (curve 1) with compounds Ni_3Ti (curve 2), Ni_3Ta (curve 3), Ni_3Nb (curve 4) at 1030°C. It is shown that metallic compounds have a much higher strength at high temperature than the elements from which they were formed or solid solutions of the elements. Results of heterogeneous systems of alloys with very small ranges of solid solution and no interaction between the

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Several Problems of the Theory of High Temperature Strength and the Development of New High-Strength Titanium Alloys

phases are given in Fig 12 (CuZr) and Fig 13 (NiZr). It is shown that the strength at high temperature depends upon the strength of the individual phases. It changes linearly with the ratio of the phases in the system. There are 14 figures and 40 references, 38 of which are Soviet, 1 English and 1 German.

SUBMITTED: May 4, 1959

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18.1150

67836

SOV/180-59-6-14/31

AUTHORS: Pi Ts'ing-hua, and Kornilov, I.I. (Moscow)

TITLE: The Constitutional Diagram of the $TiFe_2$-V System

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1959, Nr 6, pp 110-112 (USSR)

ABSTRACT: The object of the present investigation was to study by means of thermal analysis, metallographic examination, and hardness measurements, those alloys of the ternary Ti-Fe-V system that lie on the $TiFe_2$-V line. The experimental alloys were prepared from carbon-reduced vanadium, magnesium-reduced titanium and Armco iron, the two latter metals having been used to prepare (in an electric arc furnace) a master alloy of the composition corresponding to $TiFe_2$ whose actual titanium content was 29.29%. This master alloy was then used for the preparation of the experimental samples, made by the powder metallurgy methods, specimens used for the determination of the solidus having been made by melting in an argon arc furnace. The results of the thermal analysis are tabulated on p 110, where the vanadium content (wt-% and atom-%) and the solidus temperature (°C) of several alloys are given.

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SOV/180-59-6-14/31

The Constitutional Diagram of the $TiFe_2$-V System

Fig 1 shows the constitutional diagram of the $TiFe_2$-V system, constructed on the basis of these data (wt-%, bottom scale; atom-%, upper scale). It will be seen that the melting points of both $TiFe_2$ and V were lowered by the addition of the other component, and that the two components form a eutectic, melting at approximately 1400 °C. The metallographic examination was carried out on specimens subjected to the following heat treatments: 1) homogenization followed by annealing at progressively lower temperatures (1000, 800, 600 and 550°C for 50, 250, 300 and 400 hours respectively) and cooling in the furnace to room temperature; 2) water-quenching after holding at 1200, 1000, 800 or 600 °C for 10, 250, 300 and 500 hours, respectively. The metallographic specimens were etched in a 1:1:3 mixture of hydrochloric acid, nitric acid and glycerol. It was found that alloys containing up to 10% V constituted $TiFe_2$-rich solid solutions (the microstructure of an alloy containing 5% V is shown in Fig 2a). The alloys in the 10-90% V range consisted of two phases, the alloy of the eutectic composition containing 32% V. The microstructure

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The Constitutional Diagram of the $TiFe_2$-V System

of a nearly eutectic alloy, containing 35% V, is shown in Fig 2b; Figs 2a and c show microstructure of alloys containing 60 and 90% V, respectively, with a correspondingly smaller proportion of the eutectic. Similar structures were observed in quenched specimens, whose examination showed that the solid miscibility gap narrowed slightly at high temperatures (see Fig 1). The results of Brinell hardness measurements, carried out under the load of 10 kg, are reproduced in Fig 3 where hardness (H_V, kg/mm^2) is plotted against the composition of the alloy (wt.-%) for specimens annealed (open circles) and quenched from 1100 °C (filled circles). Hardness of the quenched alloys was slightly lower than that of the annealed specimens; however, the concentration dependence of H_V was similar in both cases, the hardness curve passing through a maximum at a concentration corresponding to the eutectic composition (approximately 32% V). The obtained results confirmed the pseudo-binary character of the $TiFe_2$-V system. There are 3 figures, 1 table and 6 references, of which 2 are Soviet and 4 English.

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SUBMITTED: May 29, 1959

5 (2)

AUTHORS: Kornilov, I. I., Kantorovich, L. Ye. SOV/62-59-6-2/36

TITLE: Investigation of One Part of the Four-component System Fe-Cr-Ni-Mn (Issledovaniye chasti chetvernoy sistemy Fe-Cr-Ni-Mn)

PERIODICAL: Izvestiya Akademii nauk SSSR. Otdeleniye khimicheskikh nauk, 1959, Nr 6, pp 963-970 (USSR)

ABSTRACT: The phase diagram of the four-component system mentioned in the title is investigated in one section (I) (Fig 3) on the line with constant Ni-content of 10 %, parallel to the Fe-Cr part. Alloys were investigated with variable content of Cr in 6 sections and Mn (Cr 10, 20, 30, 50, 60 and 75 %, and a change of the Mn-content at each of these values in the range of from 0-70 %). Armco iron, metallic chromium, and electrolytically produced nickel and manganese were the components of the alloys. The chemical composition of the alloys investigated is given in table 1 (Table 2 contains data on their microstructure). With the alloys the microstructure, the strength, the electric resistance, and with some, also their magnetic properties were investigated. The data obtained by these investigations served for constructing the diagram of the system. In the iron corner of this diagram the boundaries of the phase ranges α, $\alpha+\gamma$, γ and σ, and that of

a number of interlaying ranges were determined. Furthermore, the dependence of the change in strength and electrical conductivity on the composition and the phase construction was investigated. Alloys with a composition of 49.7 % Mn, 38 % Cr, 5 % Ni, 7.3 % iron exhibited the highest ohmic resistance (1.31 Ω/mm^2). In the system investigated 15 different phase ranges were determined. The most important share in the phase diagram is held by the solid austenite (γ) solution with manganese. The phase ranges α, γ and σ denote: α solid solution, α-Fe on Fe-basis (ferrite), and α-Cr on Cr-basis, the solid solution γ-Fe (austenite), σ the phase of the compound FeCr, α-Mn the solid solution on α-Mn-basis. There are 12 figures, 3 tables, and 9 references, 6 of which are Soviet.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR (Institute of Metallurgy imeni A. A. Baykov of the Academy of Sciences, USSR)

SUBMITTED: September 13, 1957

5(0)

AUTHOR: Kornilov, I.I. SOV/62-59-7-1/38

TITLE: Investigation in the Field of Metallochemistry (Issledovaniya v oblasti metallokhimii) Communication 2. The Interaction of Iron and Different Chemical Elements (Soobshcheniye 2. Vzaimodeystviye zheleza s razlichnymi khimicheskimi elementami)

PERIODICAL: Izvestiya Akademii nauk SSSR. Otdeleniye khimicheskikh nauk, 1959, Nr 7, pp 1147 - 1153 (USSR)

ABSTRACT: In this paper the problem mentioned in the title is considered from a general point of view on the basis of data available in publications. The different types of interaction (ionic and metallic interaction) of iron with other elements are determined from the standpoint of the position of these elements in the periodic system. The following rules are given: the metallic analogues being similar in their electron configuration of that of iron (situated in the proximity of iron in the periodic system) are predominantly capable of forming solid solutions. The elements with a different electron configuration tend to form chemical compounds.

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APPROVED FOR RELEASE: 06/14/2000 CIA-RDP86-00513R000824720008-0"

Investigation in the Field of Metallochemistry. Communication 2. SOV/62-59-7-1/38
Interaction of Iron and Different Chemical Elements

In the solid solutions the two crystalline variations α and γ (the ferrites and austenites) were found. Iron forms ferrites with the nearest related elements chromium and vanadium. Austenite is always a homogeneous solid solution, and is formed by iron with the near related elements of the VIII group. A great number of elements (Be of the II group, B, Al (Sc) of the III group, all elements of the IV, some of the V and VI group) forms limited solid solutions. Also elements with small atomic radius as H, C, and N belong to them. The elements O, S and the halogens form only covalent or ionic bounds. The alkali metals and some heavy metals (Ag, Cd, Hg, Te, Pb and Bi) cannot at all form compounds with iron, and the same applies to all rare gases. 9 elements belong to the first group, 56 to the second, 10 to the third and 24 to the fourth. For an investigation of the interaction in multicomponent alloys and solid solutions the possible maximum number of components was equated 56 + 9 = 64 + iron = 65. Since of these elements some form homogeneous solid solutions, and the others only limited solid solutions, the number and the limit

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concentration of the elements can be determined which go into the composition of the unsaturated solid solutions at a certain combination of the elements. Next, the case of a 10-component solid solution is thoroughly discussed in which the elements forming ferrite and austenite are taking part (Ni, Fe, Mo, W, Ta, Cr, Nb, V, Ti). The possible equilibria between solid and liquid solutions (alloy) and the possibility of a synthesis of these alloys are dealt with. In figure 2 and 3 the α-phase and the γ-phase of this 10-component system are represented. There are 3 figures and 14 references, 13 of which are Soviet.

ASSOCIATION: Institut metallurgii im. A.A. Baykova Akademii nauk SSSR (Institute of Metallurgy imeni A.A. Baykov of the Academy of Sciences USSR)

SUBMITTED: September 13, 1957

SOV/78-4-7-28/44

5(2), 18(7)

AUTHORS: Kornilov, I. I., Vlasov, V. S.

TITLE: The Phase Diagram of the System Titanium - Vanadium - Niobium (Diagramma sostoyaniya sistemy titan - vanadiy - niobiy)

PERIODICAL: Zhurnal neorganicheskoy khimii, 1959, Vol 4, Nr 7, pp 1630-1637 (USSR)

ABSTRACT: In a previous paper (Ref 12) the authors stated that all alloys of the system mentioned in the title crystallize as continuous solid solutions on the basis of β-titanium. This is explained by the small differences in the atomic diameters (Table 1) of these elements and by the isomorphism of the lattices of V and Nb with that of β-titanium. The present paper reports about the experimental investigation of the phase diagram and the phase transformations in the ternary system mentioned by means of microstructural analysis, measurement of hardness, thermal expansion, and of the electric resistance. The composition of the alloys investigated is shown by table 2 and figure 1. Figure 2 shows pictures of some microstructures, figures 3-6 show the isothermal cross sections of the system at 1000°, 800°, 700° and 600°. Figure 7 is a spatial representation

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The Phase Diagram of the System Titanium - Vanadium - Niobium

of the phase diagram. The upper part has the continuous character of the solidus surface. At 885° a closely limited range of the solid α-solution is formed in the titanium corner on the basis of the hexagonal α-modification of titanium. Between this range and the β-solution there is a biphase α+β-range. There are 7 figures, 2 tables, and 12 references, 9 of which are Soviet.

SUBMITTED: April 2, 1958

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5(2)

AUTHORS: Kornilov, I. I., Mints, R. S. SOV/78-4-9-39/44

TITLE: A Nickel-aluminum Alloy With a Low Linear Expansion Coefficient

PERIODICAL: Zhurnal neorganicheskoy khimii, 1959, Vol 4, Nr 9, pp 2169-2171 (USSR)

ABSTRACT: In connection with the investigation of the phase diagram of the ternary system Ni - Cr - NiAl (Refs 1-4) an alloy with a low expansion coefficient was found in the system Ni - Al . In order to determine the composition of this alloy the hardness (Fig 1), microstructure, electric conductivity and its temperature coefficient (Fig 2), as well as the linear expansion coefficient (Fig 3) were determined for different Ni-Al alloys. The results showed that the alloy with the lowest linear expansion coefficient corresponds to the compound Ni_3Al. There are 3 figures and 8 references, 6 of which are Soviet.

SUBMITTED: January 12, 1959

Card 1/1

5(2)

AUTHORS: Boriskina, N. G., Kornilov, I. I. SOV/78-4-9-40/44

TITLE: A Ternary Metal Compound in the System Iron - Chromium - Titanium

PERIODICAL: Zhurnal neorganicheskoy khimii, 1959, Vol 4, Nr 9, pp 2171-2173 (USSR)

ABSTRACT: On the occasion of the investigation of the phase diagram of the ternary system Fe - Cr - Ti the authors investigated the alloys in the cross section $TiFe_2$ - FeCr (σ-phase). The alloys were prepared by melting in an electric arc in an argon atmosphere. By means of a microstructure analysis it was found that the alloy consisting of 15.7 atom% Ti, 25.8 atom% Cr, and 58.5 atom% Fe is a single-phase alloy and highly brittle in a cast state. By tempering at 1000° the alloy is decomposed, and finely-dispersed needles develop which form a definite angle with the ground surface (Widmannstätten texture). The radiographs of this alloy were taken for the cast and tempered state (Table 1, Fig 1). The lattice constant corresponds to that phase which was found in the system Fe - Cr - Mo (Ref 3) and later in alloys of

A. Ternary Metal Compound in the System Iron - Chromium - Titanium

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binary and ternary systems (Refs 4-6) and which is called the χ-phase. In the system Fe - Cr - Ti, therefore, such a phase would also form. Its composition corresponds to the formula $Ti_5Cr_7Fe_{17}$. It decomposes at 1000° and forms the Laves phase $TiFe_2$. Thus it is, in fact, a transitional stage between the Laves phase and σ-phase. There are 1 figure, 1 table, and 6 references, 2 of which are Soviet.

SUBMITTED: April 6, 1959

Card 2/2

SOV/126-8-2-5/26

AUTHORS: Kornilov, I.I., Pylayeva, Ye.N. and Volkova, M.A.

TITLE: Investigation of the Properties of Titanium Alloys. IV. Properties of Alloys of the Ternary Ti-Al-Fe System

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 2, pp 182 - 186 (USSR)

ABSTRACT: The ternary-phase diagram at 550 °C is given in Figure 1. Samples containing up to 20% Al+Fe were prepared by powder metallurgical methods. The high temperature strength was tested by the centrifugal method using a stress of 15 kg/mm^2 at temperatures from 550 to 700 °C. The change in the degree of deformation up to 100 hours for various alloys is given in Figure 2. From this it can be seen that minimum high-temperature strength is shown by two-phase alloys (Curves 1 and 2). The microstructure of an alloy containing 3.75% Al and 11.25% Fe is given in Figure 3. The light constituent is α solution and the dark is a eutectoid of α+TiFe. The high-temperature strength of alloys containing Fe and Al in the ratio 1:1 is greater (Curves 3 and 4). The microstructure of an

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Investigation of the Properties of Titanium Alloys. IV. Properties of Alloys of the Ternary Ti-Al-Fe System

alloy containing 6.5% Al and 6.5% Fe is given in Figure 4. The high-temperature strength of ternary alloys containing 3.75% Al and 1.25% Fe is even greater. The microstructure of such an alloy is shown in Figure 5. It consists of solid solution with a small amount of eutectoid in the grain boundaries. The greatest high-temperature strength is shown by alloys containing 0.5% Fe and 1-8% Al (Curves 7 and 8). These alloys correspond to the limiting region of transition to a two-phase structure. Curves of high-temperature strength against time are given in Figure 6. These show that pure Ti has the least strength and an alloy containing 7.5-8% Al and 0.5% Fe has the greatest strength. Figure 7 shows the microstructure of this alloy after test. It consists of solid solution with a finely dispersed phase. As in binary Ti-Al alloys, increase in Al content leads to increase in strength but decrease in plasticity. Increasing the Fe content to greater than 0.5% causes a decrease in high-temperature strength.

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Investigation of the Properties of Titanium Alloys. IV. Properties of Alloys of the Ternary Ti-Al-Fe System

There are 8 figures and 13 Soviet references.

ASSOCIATION: Institut metallurgii im. Baykova (Insitute of Metallurgy imeni Baykov)

SUBMITTED: March 25, 1958

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18.1285

66225

SOV/126-8-3-8/33

AUTHORS: Kornilov, I.I., Glazunov, S.G. and Yakimova, A.M.

TITLE: Influence of Hydrogen on the Properties of a Higher Creep Limit VT-8 Alloy

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 3, pp 370-377 (USSR)

ABSTRACT: The present paper is a continuation of a series of papers dealing with the study of the influence of hydrogen on the properties of commercial titanium alloys of α + β-structure. The aim of the present investigation was to study the influence of different hydrogen contents on the properties of the VT-8 alloy (residual deformation not more than 0.2% after 100 hours at a stress of 24 kg/mm^2 at 500°C). The following melts of the VT-8 alloy were studied: (1) melt 7: 6.3% Al, 2.9% Mo, 0.12% Fe, 0.08% Si, 0.1% O_2 at the following hydrogen contents: 0.005, 0.015, 0.025, 0.05 and 0.08%; (2) melt 8: 6.3% Al, 3.25% Mo, 0.20% Fe, 0.07% Si and 0.2% O_2 at the same hydrogen contents; (3) melt 10-1: 6.6% Al, 3.0% Mo, 0.05% Fe, 0.04% Si and 0.1% O_2 at the following hydrogen contents: 0.005, 0.015, 0.025%; (4) melt 10-3: 6.6% Al, 3.0% Mo, 0.05% Fe, 0.04% Si and 0.3% O_2 at the same hydrogen content as (3).

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Influence of Hydrogen on the Properties of a Higher Creep Limit VT-8 Alloy

The alloys were saturated with hydrogen in a specially constructed universal instrument for the saturation of metals with gases and for the analysis of hydrogen. Extremely pure hydrogen was obtained by thermal dissociation of titanium hydride; the saturation temperature was 700°C. Melts of the VT-8 alloy with different oxygen contents were obtained by alloying with titanium dioxide. An identical initial state of the billets after saturation was ensured by subsequent heat treatment which was carried out in electric furnaces in air atmosphere. The heat treatment of the VT-8 alloy consisted in annealing at 880°C for 1 hour, followed by cooling in air. The mechanical properties were investigated by using Gagarin-type specimens at a straining rate of 2.5 mm/min (Fig 1). The properties were investigated of specimens in the original condition (880°C - 1 hour), of specimens aged at 500°C for 100 hours and specimens aged under a stress σ = 10 kg/mm^2 at 500°C for 100 hours. The UTS was found to have increased after ageing from 112 to 125 kg/mm^2 and to have changed little

APPROVED FOR RELEASE: 06/14/2000 CIA-RDP86-00513R000824720008-

with increase in hydrogen content. Fig 2 shows the dependence of the mechanical properties of the VT-8 alloy on the hydrogen content and the rate of testing. (Full lines - annealed at 880°C for 1 hour: dashed lines - annealed at 80°C for 1 hour followed by 500°C for 100 hours.) Fig 3 shows the dependence of impact resistance of the VT-8 alloy on the hydrogen content and the testing temperature. Metallographic investigation of the VT-8 alloy with various hydrogen contents was carried out. At room temperature, the alloy has a two-phase α + β-structure. The effect of hydrogen on the structure of the alloy consists in coarsening the structural components as the hydrogen content increases (Fig 4 and 5) and apparently also in increasing the quantity of untransformed β-phase. Fig 6 and 7 show the results of tensile testing of two VT-8 alloys containing 0.1 and 0.3% oxygen, respectively, in relation to the hydrogen content. Fig 8 and 9 show photomicrographs of two VT-8 alloys with an oxygen content of 0.1 and 0.3% and different hydrogen contents. An investigation of the influence of hydrogen

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Influence of Hydrogen on the Properties of a Higher Creep Limit VT-8 Alloy

on the creep of the alloy VT-8 was carried out. Two VT-8 alloys of 0.1 and 0.2% oxygen and 0.005, 0.015 and 0.025% hydrogen were investigated for creep properties at 500°C, after 100 hours at a stress of 10 kg/mm². As the hydrogen content increased from 0.005 to 0.025 an increase in the residual deformation was observed (see Table 1). The influence of hydrogen on the stabilization of the residual β-phase in the VT-8 alloy under various heat treatments is shown in Table 2. The authors arrive at the following conclusions: (1) Investigation of the influence of hydrogen within the limits 0.005 and 0.05% on the mechanical properties of the VT-8 alloy has shown that a considerable lowering of plastic properties occurs at a hydrogen content of 0.015% which is associated with the instability of the β-phase in the structure and its decomposition. (2) The investigation of the influence of hydrogen on the properties of the above alloy at various straining rates has shown that the plasticity of the alloy decreases considerably at low testing rates, particularly when the hydrogen content is increased. The UTS of the

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Influence of Hydrogen on the Properties of a Higher Creep Limit VT-8 Alloy

alloy increases from 109 to 117 kg/mm^2 on increasing the testing rate from 0.17 to 48.2 mm/min respectively (at a hydrogen content of 0.005%). (3) The impact resistance of the alloy at room temperature and sub-zero temperatures (-78 to -196°C) changes relatively little in the hydrogen content range of 0.005 to 0.08%. The testing temperature exerts a considerably greater influence than the hydrogen content up to 0.08%. (4) As the oxygen content increases, the hydrogen exerts an ever increasing unfavourable influence on the properties of the alloy. (5) In the investigation of the influence of hydrogen on the creep of the alloy at 500°C in 100 hours, it has been found that as the hydrogen content increases, the extent of residual deformation increases. Oxygen increases the creep resistance of the alloy. (6) The phase analysis of VT-8 alloys with different hydrogen contents has confirmed the presence of residual β-phase in the structure. At low hydrogen contents (up to 0.015%) the residual β-phase is unstable and during ageing a redistribution of molybdenum between the α and β-phases takes place. As the

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Influence of Hydrogen on the Properties of a Higher Creep Limit VT-8 Alloy

hydrogen content increases, the β-phase becomes stable and its unit cell parameter increases. There are 9 figures, 2 tables and 9 references, 2 of which are Soviet and 7 English.

SUBMITTED: June 21, 1958

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5 (2)

AUTHORS: Kornilov, I. I., Vul'f, B. K. SOV/74-28-9-4/7

TITLE: Metallic Compounds

PERIODICAL: Uspekhi khimii, 1959, Vol 28, Nr 9, pp 1086-1113 (USSR)

ABSTRACT: In the present paper the authors want to show by means of some examples the wide distribution of metallic compounds in alloys, they also refer to the importance of a further development of this branch of inorganic chemistry. The paper begins with brief historical survey on the origin of metallic compounds (Refs 1-16). This introduction is followed by classification and description of the physico-chemical nature of these compounds (Refs 10, 15, 17-42), as well as by a description of the conditions under which the metallic compounds are formed, in particular in regard to their solid solutions (Refs 12, 15, 43-48), whereupon the general properties of these compounds are set forth (Refs 49-55). To give a general characteristics of these compounds it is recommen to subdivide them into specific groups having certain features in common, e.g. on the basis of similar crystal structures, or their genetic relationship as reflected by their conditions of origin and formation. The authors describe certain characteristics of the origin within the frame

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of the different groups and lay stress on the modifications of their composition and properties according to the position of the elements within the periodic system. Such compounds are the following: compounds according to Kurnakov (Refs 56-111), metallic compounds with the valency correspondence to the atoms (Refs 43, 52, 112-116); electron bonds; (Refs 16, 117-121), metal bonds of the type of the phases according to Laves (Refs 122-126); bonds of the type of nickel-arsenic phases (Refs 127-129); hydrides (Refs 19, 133-137), borides (Refs 138-141), carbides (Refs 142-152); silicides (Refs 153-155), and nitrides (Refs 156-159). The origin of the Kurnakov compounds is highly interesting as the chemical interaction between the metals becomes clearly apparent. These examples cannot any more be considered as exceptions, but as typical, regular results of transformations, taking place during the cooling of the majority of the solid solutions. As the authors emphasize that many alloys are gaining in practical importance in view of their particular, highly valuable properties such as a high degree of hardness, thermal stability, chemical stability, resistance to corrosion. This refers also to magnetic and properties (semi conductors), and the like. A step further leads us to the use of metallic compounds as independent bases for the development of new alloys. Further researches in the field of binary, ternary, and even higher metallic compounds on the basis of the periodic system of Mendeleyev might greatly help in revealing the chemical nature of these compounds so as to enlarge the field of practical use. If the researches were to bring to light certain regularities or natural laws in certain groups, this might permit to predict the appearance of such rules also in still uninvestigated domains of binary, ternary, and even higher systems. One of the most characteristic features of the metals and the metallic compounds is their capability to form solid solutions with one another and with other metals. Such solid metallic solutions on the basis of these compounds, may consist of a great number of components. They are the chief components in the composite multi-component metallic alloys. Thanks to this fact it is possible to simplify substantially the analysis of composite systems by dividing them into simple components in which the double compounds are independent components. The following Soviet authors are mentioned: V. I. Mikheyeva, G. B. Bokiy, P. I. Kripyakevich, Ye. Ye. Cherkashin, N. V. Ageyev, Ye. S. Makarov, Ye. M. Savitskiy, A. F. Ioffe, S. T.

Metallic Compounds SOV/74-28-9-4/7

Konobeyevskiy, Dzh. Bernal, I. S. Gayev. There are 13 figures, 2 tables, and 159 references, 90 of which are Soviet.

ASSOCIATION: Voyenno-vozdushnaya inzhenernaya Akademiya im. N. Ye. Zhukovskogo (Military Academy of Aviation-engineers imeni N. Ye. Zhukovskiy)

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5(4)

AUTHOR: Kornilov, I. I., Doctor of Chemical Sciences SOV/30-59-1-31/57

TITLE: News in Brief (Kratkiye soobshcheniya) Symposium on Physical Chemistry of Metallic Solutions and Compounds (Simpozium po fizicheskoy khimii metallicheskikh rastvorov i soyedineniy)

PERIODICAL: Vestnik Akademii nauk SSSR, 1959, Nr 1, pp 118 - 119 (USSR)

ABSTRACT: The symposium took place in London, June 4-6, 1958 and had been called by the English National Physical Laboratory. Task of the symposium was the discussion of theoretical and experimental investigations in the field of physical chemistry of metals and alloys and the solution of practical problems. 200 representatives from 15 countries took part in the symposium. Apart from the reports by western scientists O. Kubashevsky (England) read a report by N. V. Ageyev (USSR) on the experimental investigation of electron density of metals and alloys. A. F. Kapustinskiy (USSR) discussed the electronegativity of metals and some properties of metallic solutions. I. I. Kornilov (USSR) regarded the formation of mixed crystals of metallic compounds from the general point of view. The

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5(2)

AUTHORS: Kornilov, I. I., Kolomytsev, P. T. SOV/20-125-2-23/64

TITLE: Continuous Solid Metallide Solutions in the Trinary System Co-Ni-B (Nepreryvnyye metallidnyye tverdyye rastvory v troynoy sisteme Co-Ni-B)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 125, Nr 2, pp 325-326 (USSR)

ABSTRACT: The first-mentioned author (Refs 1, 2) has formulated the basic conditions of isomorphism in metal compounds on the fulfilment of which continuous solid solutions among these compounds can be formed: 1) the crystal lattices should be of the same type; 2) the compounds participating in the formation must be atomically similar; 3) the types of chemical linkage must be identical; 4) one and the same element must be contained in the compounds; 5) the stoichiometrical composition of the compounds must be identical, and 6) continuous solid solutions must be formed among the metals forming the compounds. For the above-mentioned solutions, the author has coined the term metallide solutions (metallidnyye rastvory) (Ref 2). Scientific publications do not contain any investigations into the systems from lower borides with regard to the formation of the solutions

Continuous Solid Metallide Solutions in the Trinary System Co-Ni-B SOV/20-125-2-23/64

mentioned in the title. Therefore, the authors investigated 2 metallide systems: Co_3B-Ni_3B and Co_2-Ni_2B. First, the binary compounds Co_3B, Co_2B; Ni_3B and Ni_2B were produced. The investigation of the x-ray photographs of all samples showed the alloys of the system Co_3-Ni_3B to be monophasic (Fig 1). Their crystal lattices are isomorphous to the lattices of the pure compounds Co_3B and Ni_3B. The alloys of the system Co_2-Ni_2B (Fig 2) are also homogeneous and possess tetragonal crystal lattices which are isomorphous to the lattices of Co_2B and Ni_2B. Figure 1 shows the x-ray photograph of the trinary system. The volume of the unit cell decreases with rising nickel content in the solid solution. Microscopic analysis confirmed the formation of monophasic structures in said systems. Figure 3 shows a microphotograph of the system Co_3B-Ni_3B (30 and 70%). As may be seen from it, the alloys have homogeneous structures. Figure 4 shows the alloy Co_2B and Ni_2B with 50% contents of each of the components.

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Continuous Solid Metallide Solutions in the Trinary System Co-Ni-B SOV/20-125-2-23/64

Measurings of micro-hardness showed the hardness of the continuous solutions in the system Co_3B-Ni_3B to be practically independent of the composition of this system, and to amount to 1145 kg/mm², also with respect to the components, at a load of 50 g. Thus the existence of continuous metallide solid solutions among the above-mentioned lower borides has been established. There are 4 figures, 1 table, and 8 references, 7 of which are Soviet.

ASSOCIATION: Voyenno-vozdushnaya inzhenernaya Akademiya im. N. Ye. Zhukovskogo (Military Aviation Engineering Academy imeni N. Ye. Zhukovskiy)

PRESENTED: December 27, 1958, by I. I. Chernyayev, Academician

SUBMITTED: December 22, 1958

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5 (2)

AUTHOR: Kornilov, I. I. SOV/20-128-4-24/65

TITLE: Synthesis of Multicomponent Solid Titanium Solutions

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 128, Nr 4, pp 722 - 725 (USSR)

ABSTRACT: Most metals, particularly those with an unfilled d-electron shell belonging to the group of transition metals, tend to form solid solutions with many elements. One of these metals is titanium (Ref 2). Similar chemical properties of the crystal lattice, and a not too large difference in atomic radii, are necessary for the formation of a solid solution. With such elements, titanium forms continuous solid solutions, whereas with many others only limited solid solutions are formed. The rules found by the author in previous papers (Refs 2-5) concerning binary and ternary systems on a titanium basis make it possible to solve the problem of synthesizing solid solutions with given compositions. This is possible in the case of n components if the respective elements form, with titanium, solid solutions of the two types mentioned (Ref 6, example of nickel). On the basis of the theory of metal chemistry, the author calculated the compositions of solid 5-, 9-, and 10-component titanium solutions,

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APPROVED FOR RELEASE: 06/14/2000 CIA-RDP86-00513R000824720008-0"

Synthesis of Multicomponent Solid Titanium Solutions SOV/20-128-4-24/65

for the following systems:

With 5 components: Ti - Al - Si - Cr - Fe
" 9 " : Ti - Al - Sn - Si - V - Nb - Cr - Mo - Cu
" 10 " : Ti - Zr - Al - Sn - Si - V - Nb - Cr - Mo - Cu

Table 1 indicates some properties of the above elements, further the concentrations calculated for synthesizing the said systems. The present paper discusses solid solutions on the basis of solid α-titanium solutions with hexagonal lattice. They are produced by prolonged homogenization annealing, and slow cooling of the alloys down to room temperature. The components were melted in a vacuum arc furnace. The sample castings were forged to 20-25% reduction, and subjected to homogenization annealing at 1200-1250° in vacuum for 10 hours, then slowly cooled down to 600°, and annealed at this temperature for 300 hours. After cooling down to room temperature in the furnace, the alloys were subjected to a micro- and X-ray structure analysis, and their hardness was measured. It was found that the 5-, 9-, and 10-component alloys synthesized on the basis of calculations correspond to a nonequilibrium solid solution of α-titanium. This titanium is marked by a peculiar "basket" microstructure of the

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decomposition product of the solid α-solution without excess phases (Fig 1). The author did not succeed in obtaining completely homogeneous polyhedra in this procedure. The X-ray pictures show that, in all of the 3 alloys, all additional lines are missing, except for those corresponding to the hexagonal lattice of the solid α-titanium solutions. The lattice periods of these solid solutions (measured by a precision method) show that the hexagonal lattice is maintained with an increasing number of alloying constituents, while the lattice parameters a,c and the ratio c/a, as well as the hardness, are increasing. Thus, the synthesis mentioned in the title with a given chemical composition is well possible. T. S. Chernova investigated the alloys, A. Ya. Snetkov made the X-ray investigations. There are 1 figure, 1 table, and 6 Soviet references.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR (Metallurgical Institute imeni A. A. Baykov of the Academy of Sciences, USSR)

PRESENTED: May 15, 1959, by I. I. Chernyayev, Academician

SUBMITTED: May 12, 1959

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KORNILOV, I.I.

P. 2

PHASE I BOOK EXPLOITATION SOV/3791

Soveshchaniye po obrabotke zharoprochnykh splavov, Moscow, 1957.

Obrabotka zharoprochnykh splavov; [sbornik dokladov...] (Treatment of Heat-Resistant Alloys; Collection of Papers Read at the Conference), Moscow, Izd-vo AN SSSR, 1960. 231 p. 3,500 copies printed.

Sponsoring Agencies: Akademiya nauk SSSR. Institut mashinovedeniya. Komissiya po tekhnologii mashinostroyeniya; Akademiya nauk SSSR. Institut metallurgii im. A.A. Baykova. Nauchnyy sovet po problemam zharoprochnykh splavov.

Resp. Ed.: V.I. Dikushin, Academician; Ed. of Publishing House: V.A. Kotov; Tech. Ed.: V.V. Bruzgul'.

PURPOSE: This book is intended for metallurgists.

COVERAGE: The book consists of thirty papers read at the Conference on the Treatment of Heat-Resistant Alloys held in Moscow by the Committee on Machine-Building Technology, Institute of the

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KORNILOV, I.I.

PHASE I BOOK EXPLOITATION SOV/4558
SOV/16-S-5

Akademiya nauk SSSR. Institut metallurgii

Metallurgiya, metallovedeniye, fiziko-khimicheskiye metody issledovaniya (Physicochemical Research Methods in Metallurgy and Metal Science) Moscow, Izd-vo AN SSSR, 1960. 251 p. (Series: Its: Trudy, vyp. 5) Errata slip inserted. 2,800 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut metallurgii imeni A.A. Baykova.

Resp. Ed.: I.P. Bardin, Academician (Deceased); Ed. of Publishing House: V.A. Klimov; Tech. Ed.: T.P. Polenova.

PURPOSE: This collection of articles is intended for metallurgists and metal researchers.

COVERAGE: The collection contains articles on metallurgy, metal science, and physicochemical research methods. Separate articles discuss the structure and properties of some metals and alloys. The effect of cold treatment and inclusions on the properties of alloys are analyzed, and instruments and

KORNILOV, I.I.

PHASE I BOOK EXPLOITATION SOV/4617

Akademiya nauk SSSR. Komissiya po analiticheskoy khimii

Analiz gazov v metallakh (Analysis of Gases in Metals) Moscow, 1960. 304 p. (Series: Its: Trudy, tom. 10) Errata slip inserted. 4,000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut geokhimii i analiticheskoy khimii imeni V.I. Vernadskogo. Komissiya po analiticheskoy khimii.

Resp. Ed.: A.P. Vinogradov, Academician; Ed. of Publishing House: A.L. Bankvitser; Tech. Ed.: V.V. Bruzgul'.

PURPOSE: This book is intended for laboratory personnel concerned with gas analysis in metals.

COVERAGE: This collection of articles is based on materials of the Commission on Analytical Chemistry AS USSR on problems dealing with gas analysis in metals. The articles present data on: 1) The vacuum-fusion method, developed by European scientists and the Soviet scientists N.P. Chizhevskiy and Yu.A. Klyachko, for the analysis of gases in steel and aluminum, and now applicable to analysis of gases in other metals. 2) The research of Z.M. Turovtseva and coworkers at

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the Institute of Geochemistry and Analytical Chemistry imeni V.I. Vernadskiy AS USSR, Moscow, making it possible to evaluate the practicability and fields of application of the different analytical methods. 3) The contributions of Yu.A. Klyachko and coworkers in their study of thermodynamic methods for the evaluation of suitable conditions for carrying out analysis. 4) The determination of gases in metals by the sulfurous method as developed by A.K. Babko. 5) The spectrum isotope method for the determination of hydrogen as developed by A.N. Zaydel' and coworkers. The authors of these articles systematize and review critically the various analytical methods, describe the apparatus used in analysis, and indicate the basic trends of research. References accompany most of the articles.

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S/180/60/000/01/006/027
E111/E135

AUTHORS: Boriskina, N.G., and Kornilov, I.I. (Moscow)

TITLE: Investigation of the Equilibrium Diagram of Iron-Chromium-Titanium in the Region of Alloys Rich in Iron and Chromium

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, Nr 1, pp 50-58 (USSR)

ABSTRACT: The object of this work was to elucidate the nature of the chemical reaction of iron with chromium and titanium and establish the equilibrium diagram for iron- and chromium-rich alloys. Although much work has been published on Fe-Cr (surveyed in Ref 1), Fe-Ti (Refs 5-9) and Ti-Cr (Refs 10-14), there is little on the ternary system, and in some of these (e.g. Ref 15) impure materials were used. The compositions of alloys used in the present work are shown in Fig 1 and tabulated. They included alloys of the $TiFe_2$-FeCr and the $TiFe_2$-Cr sections, and of three sections with constant Ti : Cr ratios of 3 : 1, 1 : 1 and 1 : 3, and some alloys along sections parallel to the Fe-Cr side with 5, 10, 15, 20 and 25% Ti. Alloys were made from electrolytic iron (99.94% Fe), electrolytic chromium (99.95% Cr), and

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iodide titanium (99.85% Ti) by arc melting under argon. The cast alloys were homogenized at 1100 °C for 100 hrs enclosed in quartz capsules and were studied after quenching from 1000 °C (holding time 100 hours) and after annealing at 550 °C for 500 hours. X-ray analysis was carried out with unfiltered vanadium radiation in a RKU86 camera; hardness was measured with a diamond-tipped Vickers machine, and microstructures were also examined. Fig 2 shows microstructures of various alloys after different heat treatments, and Fig 3 typical X-ray patterns for $TiFe_2$-FeCr. The hardness of specimens of the different constant Ti:Cr sections as functions of % (Ti + Cr) is shown in Fig 4. The 550 °C and 1000 °C isothermal sections of the Fe-Cr-Ti system are shown in Figs 5 and 6, respectively. The work showed the presence of a compound of composition $Ti_5Cr_7Fe_{17}$ of the alpha-Mn type; at high temperatures this compound forms a narrow range of solid solutions with alpha and gamma phases decomposing at 1000 and 550 °C. The eutectic nature has

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been demonstrated of crystallization in the region of alloys adjacent to the Ti-Fe side, in $TiFe_2$-Cr section alloys and in a wide range of alloys on the right-hand side of this section with a higher chromium content. The range of the Fe and Cr-base ternary alloy at 1000 and 550 °C lies along the Fe-Cr side. The solubility of Ti in the alpha-solid solution at 1000 °C increases from the Ti-Fe side and is about 5% on the average, falling at 550°. The extents of phases at 1000 and 550 °C have been found. The hardness was found to be greatest in the χ-phase region, which decomposes to form the compound $TiFe_2$.

There are 6 figures, 1 table and 16 references, of which 6 are Soviet, 7 English, 2 German and 1 Japanese.

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SUBMITTED: October 5, 1959

S/180/60/000/01/011/027
E071/E135

AUTHORS: Kornilov, I.I., and Polyakova, R.S. (Moscow)

TITLE: The Melting Diagram of the Ternary System Titanium-Vanadium-Molybdenum

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, Nr 1, pp 85-89 (USSR)

ABSTRACT: The melting diagram of the complete ternary system titanium-vanadium-molybdenum was determined. As starting materials for the preparation of alloys, powdered metals of the following purities were used: Ti 99.6%, V 99.2%, and Mo 99.9%. For the determination of temperature of the beginning of melting, specimens were prepared by the ceramometallic method in the form of rectangles 60 x 5 x 5 mm. All alloys were sintered at 1500 °C for 50 hours which was sufficient for vanadium-rich alloys; the remaining alloys were resintered at 1800 °C for 50 hours. For the determination of polymorphic transformations of ternary alloys in solid state, 10-g specimens were prepared by melting in an arc furnace (3 times). The specimens were sealed in quartz tubes and thermally treated by the following procedure: heating to

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The Melting Diagram of the Ternary System Titanium-Vanadium-Molybdenum

1100 °C, soaking for 100 hours, slow decrease of the temperature to 800 °C, soaking for 50 hours, decrease in temperature to 500 °C, soaking for 300 hours and cooling with the furnace. The melting temperatures of the alloys were determined by the method described in Ref 15. The composition of alloys and temperatures of the beginning of melting are given in Table 1, polythermal cross-sections of the system in Fig 1, the solidus diagram of the system in Fig 2. Polymorphic transformations of the ternary alloys in solid state were studied by differential thermal analysis (Table 2, Fig 6). Steady changes of melting curves with changes in composition of alloys indicate that they crystallise as continuous solid solutions. Microstructural analysis of hardened specimens confirmed unlimited solubility of the elements in each other above the temperature of polymorphic transformation of titanium. The temperature of polymorphic transformation of ternary alloys decreases with increasing content of molybdenum and vanadium in

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The Melting Diagram of the Ternary System Titanium-Vanadium-Molybdenum

the alloys. On the basis of the data obtained, the equilibrium diagram of the system was constructed (Fig 7).
There are 7 figures, 2 tables and 15 references, of which 10 are English, 3 Soviet and 2 German.

SUBMITTED: June 24, 1959

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69660

S/180/60/000/02/016/028
E111/E152

18.1250

AUTHORS: Kornilov, I.I., Pryakhina, L.I., and Ryabtsev, L.A.
(Moscow)

TITLE: Properties of Multi-Component Nickel Solid Solutions

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, Nr 2, pp 110-114 (USSR)

ABSTRACT: Kornilov has already shown (Refs 1 and 2) that the ability of elements to form solid solutions and intermetallic compounds with nickel depends on the relative positions of these elements in the Periodic Table. A number of multi-component nickel solid solutions were synthesized for that work (the crystal-lattice type, atomic diameter and solubility in nickel are tabulated). In the present work the equilibria and some physico-chemical properties of solid solutions in the following systems were studied: 0, Ni-Al; I, Ni-Cr-Al; II, Ni-Cr-Ti-Al; III, Ni-Cr-Ti-W-Al; IV, Ni-Cr-Ti-W-Mo-Al; V, Ni-Cr-Ti-W-Mo-Nb-Al; VI, Ni-Cr-Ti-W-Mo-Nb-Co-Al. In each system one section with 0-12% Al and a constant quantity of other elements, except nickel, was studied: 10 wt.% Cr, 2 of Ti, 6 of W, 3 of Mo, 2 of Nb,

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E111/E152

Properties of Multi-Component Nickel Solid Solutions

5 of Co. The fusion diagrams for these systems were studied, the Al solubility limit being determined by microstructure, X-ray, hardness and electrical resistivity methods. The results for each system are plotted against wt.% aluminium in Fig 1. Fig 2 shows microstructures of one- and two-phase systems after hardening from 1200 °C. The lattice parameters for the solid solutions at 1200 °C as functions of aluminium content are shown in Fig 3. The resistivity of alloys after annealing and their hardness after hardening from 1200 °C are shown as functions of aluminium content in Figs 4 and 5, respectively. In this work the limiting concentrations of the elements were determined and the nature of the excess phases established. The degree of strain in the solid-solution crystal lattice increases with increasing difference between atomic diameters of the introduced element and of nickel. In order of decreasing lattice-disturbing effect the elements are Nb, W, Ti, Mo, Cr and Co. The hardness of nickel solid solutions could be increased considerably by

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Properties of Multi-Component Nickel Solid Solutions

multi-component alloying with those elements which increase the state of strain of its lattice.
There are 5 figures, 1 table and 2 Soviet references.

SUBMITTED: June 24, 1959

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78134
SOV/129-60-3-13/16

AUTHORS: Kornilov, I. I., Ivanova, V. S.

TITLE: At the International Symposium on Problems of Developing Heat-Resistant Materials

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov, 1960, Nr 3, pp 58-60 (USSR)

ABSTRACT: An International Symposium on the above problems was initiated by the Learned Council of the Czechoslovakian Scientific and Technical Society (Nauchnyy sovet Chekhoslovatskogo nauchno-tekhnicheskogo obshchestva). It took place at Marianske Lazne (Czechoslovakia) from September 11 to 13, 1959. Seventy scholars from Czechoslovakia, the USSR, the German Democratic Republic, France, Switzerland, Australia, Belgium, Sweden, China, Poland, Austria, and England participated in the symposium. The Soviet Union was represented by the authors as well as by M. V. Pridantsev, (Professor and Doctor of Technical Sciences) and A. I. Chizhik (Candidate of Technical Sciences). The agenda included such subjects as (1) creep theory

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and stress-rupture; (2) low-alloy and modified stainless heat-resistant steels; (3) austenitic steels; (4) heat-resistant and special alloys; (5) modern methods of developing heat-resistant alloys; and (6) control and evaluation methods to determine the applicability of heat-resistant materials. The Soviet scholars submitted the following reports: I. I. Kornilov, "Basic Types of Composition vs Heat-Resistance Diagrams"; I. A. Oding, V. S. Ivanova, and Yu. P. Liberov, "Effect of Parting Plane Surfaces on Protracted Failure of Metals"; M. V. Pridantsev, "Problems of Steel and Alloy Heat-Resistance." The papers and discussions of the symposium are published in a supplement to the journal Hutnicky Listy, Nr 12 (1959).

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S/180/60/000/03/012/030
E111/E352

AUTHORS: Kornilov, I.I., Mikheyev, V.S. and Chornova, T.S. (Moscow)

TITLE: Study of the Partial Phase Diagram of Titanium-aluminium-chromium-iron-silicon

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, Nr 3, pp 70 - 72 + 1 plate (USSR)

ABSTRACT: Kornilov has previously worked on the reactions of titanium with various elements (Refs 1-3) and the phase diagrams of some binary and ternary titanium base alloys (Refs 4,5). In the present work experimental data from his and his co-workers' study of the partial phase diagram for the five-component Ti-Al-Cr-Fe-Si system are presented. The diagram is represented by the tetrahedron method (Ref 6) in which the origin is taken as the composition of the solid solution (here the alloy corresponding to the binary Ti-Si solid solution with 0.5 wt.% Si is taken), the three remaining components being assigned to the three axes (Figure 1). As shown in Table 1, aluminium has a high solubility in both alpha and beta-titanium, that of the others being small in alpha-titanium. Grade TG-00 titanium

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86071

S/180/60/000/005/012/033
E193/E183

18.8200 1045, 1418, 1413

AUTHOR: Kornilov, I.I. (Moscow)

TITLE: Some Problems of the Theory of High Temperature Strength and the Development of New High-Strength Titanium-Base Alloys. (Basic Types of the Composition/High-Temperature Strength Diagrams)

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, No.5, pp.128-132

TEXT: The author of the present paper correlates the high-temperature strength of alloys with their constitution diagrams and describes three main types of the high-temperature strength/composition diagrams. Type I corresponds to the systems which form continuous series of solid solutions with, or without, solid state transformations. In the absence of solid state transformations as, for instance, in the Au-Ag, Cu-Ni, Ni-Pd, Ti-Mo, Ti-Nb, Mo-W, V-W systems, the high-temperature strength increases gradually with increasing concentration of either component, passes through a flat maximum and then decreases again. This holds true even at temperatures equal 0.6-0.8 T, where T is the

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E193/E183

Some Problems of the Theory of High-Temperature Strength and the Development of New High-Strength Titanium-Base Alloys. (Basic Types of the Composition/High-Temperature Strength Diagrams)

melting point of the low melting point component, i.e. at temperatures considerably higher than the recrystallization temperature of these alloys. The position of the maximum depends on the high-temperature properties of the components and is usually shifted towards the higher concentrations of the component, which has relatively higher strength at elevated temperatures. In the case of systems representing continuous series of solid solutions, in which solid state transformations take place (e.g. Fe-Ni, Mg-Cd, Au-Cu, Fe-Cr, Fe-V, Fe-Pt, Fe-Pd), the high-temperature strength of the alloys at temperatures above the maximum transformation temperatures varies with composition in the manner described above. At temperatures at which the two components no longer form a continuous series of solid solutions, the high-temperature strength increases gradually with increasing concentration of either component and then rises sharply to a point maximum, situated usually at a

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Some Problems of the Theory of High-Temperature Strength and the Development of New High-Strength Titanium-Base Alloys. (Basic Types of the Composition/High-Temperature Strength Diagrams)

composition corresponding to an intermediate phase, intermetallic compound, or an ordered phase. Type II of the high-temperature strength/composition diagram corresponds to the eutectiferous systems with a wide range of solid solubility at each end of the constitution diagram and with the solubility in these ranges increasing with rising temperature(e.g. Al-Mg, Ni-Cr, Ni-W systems). In this case, the high-temperature strength/composition curve has two sharp maxima corresponding to solid solutions with the maximum solute content, irrespective whether the solute is an element, intermediate phase, intermetallic compound, or a solid solution. In the composition range between the two maxima, the high-temperature strength of these alloys changes linearly with increasing concentration of the II-nd phase. Generally speaking, the high-temperature strength of the 2-phase alloys is higher than that of either phase, but lower than that of the solid

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Some Problems of the Theory of High-Temperature Strength and the Development of New High-Strength Titanium-Base Alloys. (Basic Types of the Composition/High-Temperature Strength Diagrams)

solutions with the maximum solute contents. Finally, type III of the high-temperature strength/composition diagram corresponds to the eutectiferous systems with no, or very narrow, solid solubility ranges (e.g. Cu-Cr, Cu-Zr, Ni-Zr, etc., systems). In this case, the high-temperature strength of the alloys gradually increases with increasing concentration of the component which is stronger at elevated temperatures.
There are 3 figures and 15 Soviet references.

SUBMITTED: February 23, 1960

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86072

S/180/60/000/005/013/033
E073/E535

18.8200 1416

AUTHORS: Kornilov, I. I. and Nartova, T. T. (Moscow)

TITLE: Refractoriness of Alloys of the System Titanium-Tin

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, No.5, pp.133-136

TEXT: In earlier work (Refs.1-4) the authors established the relations governing changes in the properties of titanium alloys as a function of the chemical composition and the character of the diagram of state. In this paper the results are described of investigations of the high temperature strength of binary Ti-Sn titanium alloys. From results obtained in investigating the diagram of state it was established that a considerable range of solid solution of tin in α-Ti (up to 21 wt.% Sn at 700°C) exists. The two-phase α + γ range extends at 700°C to about 42% Sn; for a content of 45.24% Sn in the Ti-Sn system, Ti_3Sn compounds form. In addition to investigating the structure and the properties of alloys of this system, the authors studied the high temperature strength of binary Ti-Sn alloys from the range of α solid solutions and the two-phase α + γ range with a tin concentration between 0 and 30 wt.%. The high temperature strength of alloys with over 30 wt.% Sn was

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not investigated with the exception of the alloy corresponding to the γ-phase, the Ti_3Sn base solid solution. The alloys were smelted in an arc furnace in an argon atmosphere from a charge consisting of titanium sponge of 99.8% purity and a specially smelted Sn-Ti alloy containing 69.5% Sn. Alloys containing up to 25% Sn were forged at 900°C and annealed in vacuum with step-wise cooling in accordance with the following regime: 50 hours at 1100°C, 100 hours at 1000°C and 200 hours at 800°C, followed by slow cooling in the furnace down to room temperature. The microstructure of the specimens, which was investigated after the high temperature tests, had either a single-phase structure of α and γ solid solutions or a two-phase α + γ structure. Some characteristic microstructure photographs of the studied alloys are reproduced. The composition of the etching agent was: 25% HF, 25% HNO_3 and 50% glycerine. Investigation of the high temperature strength of binary alloys was carried out by the centrifugal method in four stages; in each of these stages the same bending stress of 15 kg/mm^2 was applied. During the first stage, the specimens were stressed for 100 hours

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at 500°C, then the temperature was raised to 550°C and the tests were continued for another 100 hours (second stage). Following that, the temperature was raised to 600°C and the tests continued for 100 hours (third stage) and, finally, the temperature was raised to 650°C and the tests continued for another 100 hours (fourth stage). This regime was chosen in view of the very low high temperature strength of titanium, of rarefied solid solutions of titanium and its two-phase alloys on the one hand, and the high strength at elevated temperatures of alloys in the range of concentrated, saturated and slightly over-saturated solid solutions on the other hand. On the basis of the obtained data, the creep curves of alloys of various compositions are plotted for all the four stages of investigation. It was found that the high temperature strength of Ti-Sn alloys increased gradually with increasing concentration of the tin in the α solid solution and the maximum high temperature strength is obtained for alloys whose composition approaches the limit solubility (18 to 22% Sn). Alloys with a clearly pronounced two-phase structure have a low high temperature strength, due to the coarse inclusions of the second phase. The Ti_3Sn base alloy had the highest high temperature strength at all the applied test temperatures. The results obtained

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Refractoriness of Alloys of the System Titanium-Tin

on investigating the high temperature strength of binary Ti-Sn alloys are in good agreement with earlier established relations governing its changes in the metallic systems (Refs.1-4 and 6-11). There are 3 figures and 11 Soviet references.

SUBMITTED: February 23, 1960

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86073

S/180/60/000/005/014/033
E073/E535

18.8200

AUTHORS: Kornilov, I. I., Ozhimkova, O. V. and Pryakhina, L.I.
(Moscow)

TITLE: Relations Between the Composition, the Temperature and the High Temperature Strength of Alloys of the System Nickel-Chromium-Tungsten-Titanium-Aluminium

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, No.5, pp.137-141

TEXT: The aim of the here described work was to study the dependence of the diagram "composition-high temperature strength" on the test temperature and the composition of alloys of a 5-component system Ni-Cr-W-Ti-Al for a variable Al content. For investigating the properties of some alloys of the Ni-Cr-W-Ti-Al system, one polythermic cut was taken of the alloys with a constant content of Cr, W, Ti and a variable content of Al (from 0 to 16%). Increase in the Al content proceeded as a result of a drop in the Ni content. Basically, the alloys of this section correspond to quaternary uniform solid solutions. It can be seen from the fusion diagram that addition to Al brings about a reduction of the liquidus temperature from 1430°C (0% Al) to 1275°C (16% Al). For contents

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Relations Between the Composition, the Temperature and the High Temperature Strength of Alloys of the System Nickel-Chromium-Tungsten-Titanium-Aluminium

of 6.5% Al and more the cooling curves show a second step, which corresponds to the crystallization of the second phase that separates out in the form of a eutectic. For determining the solubility of Al in the nickel solid solution, the following heat treatment was applied: soaking for 100 hours at 1200°C, quenching in water with subsequent soaking at 1100, 1000, 950 and 800°C for 1000 hours, followed by cooling in water. The compositions of the alloys were in the range of quinquary nickel-base solid solutions and rejection of the excess γ'-phase (on the basis of the Ni_3Al compound with a face-centred cubic lattice). Presence in alloys of the γ-phase was established by inter-metallide and X-ray structural analysis. It was established by microstructural analysis that the solubility of Al equals 5.5% at 1200°C, 4.2% at 1100°C, 3% at 1000°C and 2.2% at 800°C. The influence of temperature on the strength of the alloys was investigated on alloys with Al contents between 0.5 and 7.9% that correspond to uniform solid solutions as well as to two-phase alloys. The test specimens were produced by precision casting

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Relations Between the Composition, the Temperature and the High Temperature Strength of Alloys of the System Nickel-Chromium-Tungsten-Titanium-Aluminium

and subsequent soaking at 1150°C for 7 hours, followed by cooling in air. Study of the high temperature strength was effected by applying the centrifugal bending method at the following initial stresses

t, °C	700,	800,	950,	1000,	1100,	1200
σ, kg/mm²	50,	30-40,	15,	10,	3,	1.2

It was established that at 1200°C the maximum high temperature strength is obtained for alloys which correspond to strongly rarefied solid solutions; in the temperature range 1100 to 1050°C the highest strength was obtained for alloys that are distributed along the line of limit solubility and regions adjacent to it; at temperatures of 1000°C and lower, the highest strength was obtained for alloys from the range of saturated solid solutions that contain rejected finely dispersed excess phases. There are 3 figures and 4 Soviet references.

SUBMITTED: April 1, 1960

Card 3/3

KORNILOV, I.I.; POLYAKOVA, R.S.

Investigating the heat resistance of platinum alloys with rhodium, iridium, ruthenium, chromium and aluminum by the flexure method. Trudy Inst.met. no.5:139-144 '60. (MIRA 13:6)
(Heat-resistant alloys)
(Platinum alloys--Testing)
(Flexure)

KORNILOV, I.I.; PRYAKHINA, L.I.; OZHIMKOVA, O.V.

Effect of the time factor on the characteristics of the constitution - heat-resistance diagram of five-component alloys in the system Ni - Cr - W - Ti - Al. Issl. po zharopr. splav. 6:278-283 '60. (MIRA 13:9)

(Alloys--Thermal properties) (Phase rule and equilibrium)

18.1275

69056

AUTHORS: Kornilov, I. I., Nartova, T. T.

S/078/60/005/03/021/048
B004/B015

TITLE: The Phase Diagram of the System Titanium - Tin

PERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol 5, Nr 3, pp 622-629 (USSR)

ABSTRACT: The study of the ternary system Ti - Al - Sn induced the authors to investigate the phase diagram of the system Ti - Sn including the compound Ti_3Sn (0 - 25 atom% of Sn). Figure 1 shows the equilibrium diagrams of this system in the region of $\alpha \rightleftharpoons \beta$ transformation as taken from publications (Refs 6-10). The authors point out the contradictions of these data. The raw materials were titanium metal of the type TG-0 (99.7% of Ti) and tin (99.9% of Sn). The alloys were molten in the arc in argon atmosphere for the purpose of structural analysis, thermal analysis, and hardness test. Alloys produced by way of powder metallurgy were used for the purpose of measuring the electrical resistance and testing the thermal stability. The authors describe in detail the homogenization of these alloys. Figure 2 shows the thermograms recorded by a Kurnakov pyrometer. The temperature of the $\alpha \rightleftharpoons \beta$ transformation of solid solutions (Table 1) passes through a minimum (860°) at 5 atom% of Sn, after which it rises (20 atom% of Sn) to 890°, at which temperature the peritectic reaction $\alpha \longrightarrow \beta + \gamma$ occurs. Table 2 shows the microstructures of differently treated alloys with varying tin con-

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18.1100

69025

S/078/60/005/04/022/040
B004/B016

AUTHORS: Bi Tsin-khua, Kornilov, I. I.

TITLE: Investigation of the Phase Diagram of the System TiFe - V

PERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol 5, Nr 4, pp 902 - 907 (USSR)

ABSTRACT: The authors investigated the quasibinary section TiFe - V of the ternary system Ti - Fe - V by means of thermal analysis, microstructural analysis, radiograms, and hardness test. TiFe was prepared from TG-0 titanium and Armco iron. The 22 investigated alloys with a content of 3 - 90 wt% of V were obtained by melting from TiFe and vanadium powder by the method of powder metallurgy. Table 1 gives the melting points of the individual alloys from which the phase diagram TiFe - V was constructed (Fig 1). The diagram only gives the solidus line. The liquidus line was not investigated. The microstructures of the alloys treated in a different way revealed that the distribution of the phases is independent of the thermal treatment (Table 2, Fig 2). X-ray analysis was carried out by L. N. Guseva (Fig 3, Table 3) and confirmed the data of the microstructural analysis. The hardness test was made by means of a Vickers device, diamond pyramid, and a load of 10 kg (Fig 4). In the system investigated the authors detected a

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Investigation of the Phase Diagram of the System TiFe - V

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ternary compound (TiFe)V which is formed by peritectic reaction and occupies a small region of solid gamma solutions. This compound has a hexagonal lattice with a = 4.88 Å, c = 7.96 Å, c/a = 1.63, and a hardness of about 800 H_V. The system TiFe - V has three regions of homogeneous solid solutions (δ, γ, and β) on the basis of TiFe, (TiFe)V, and V and two diphase regions (δ + γ and γ + β). The solubility of compound (TiFe)V in V increases with increasing temperature, whereas the solubility of TiFe in the solid gamma solution changes but little with increasing temperature. The present paper provides the foundations for the investigation of the influence exercised by compound (TiFe)V upon the properties of vanadium, and for the investigation of the phase diagram of the ternary system Ti - TiFe - V. There are 4 figures, 3 tables, and 5 references, 2 of which are Soviet.

SUBMITTED: January 23, 1959

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S/078/60/005/06/28/030
B004/B014

5.4700

AUTHORS: Kornilov, I. I., Matveyeva, N. M.

TITLE: Reaction Heat of the Transition of the σ-Phase Into the Solid α-Solution in the System Iron - Chromium

PERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol. 5, No. 6, pp. 1387 - 1388

TEXT: By way of introduction, the authors describe the thermographic method which they used for their experiments. This method was suggested by L. G. Berg and V. Ya. Anosov (Refs. 1 and 2), and was improved by G. G. Tsurinov (Ref. 4). A substance which does not react with the substance to be tested, and whose thermal effects are exactly known serves as standard substance. Its thermal differential curve is recorded by a Kurnakov pyrometer along with the differential curve of the substance to be tested. The values of these thermal effects are obtained by graphical integration of the deviations from zero and on the strength of the known values of the standard substance. The present paper describes the transition of the σ-phase (composition of the alloy similar to that of FeCr)

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Reaction Heat of the Transition of the σ-Phase Into the Solid α-Solution in the System Iron - Chromium

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into the solid α-solution. The alloys were made from electrolytic chromium and Armco iron in an arc furnace filled with argon. Then, they were homogenized and annealed for 500 - 700 hours at 700°C in order to obtain the σ-phase. Iron with an $\alpha \rightarrow \beta$ transformation equal to 0.27 kcal/gram-atom and a $\beta \rightarrow \gamma$ transformation equal to 0.25 kcal/gram-atom was used as standard. The endothermic effects of the $\sigma \rightarrow \alpha$ transformation of the Fe-Cr alloy are between these two effects of the standard iron (Fig. 1). Analyses of the alloys under consideration, as well as their temperatures and heats of transformation are given in a table. The heats of transformation varied between 1.06±0.05 and 0.73±0.05 kcal/gram-atom, depending on the composition of the σ-phase. There are 1 figure, 1 table, and 7 references: 6 Soviet and 1 British.

SUBMITTED: January 6, 1960

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83125

S/078/60/005/009/008/017
B015/B064

18.1200

AUTHORS: Kornilov, I. I., Vlasov, V. S.

TITLE: Investigation of the Physicochemical Properties of the Alloys of the Ternary System Titanium - Vanadium - Niobium

PERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol. 5, No. 9, pp. 2017-2024

TEXT: The electrical resistivity, its thermal coefficient, thermal expansion, and the hardness of the systems Ti-Nb and Ti-V-Nb were investigated. The thermal preliminary treatment of the samples was done in two ways. The electrical resistivity was determined at 20° and 100°C with a ППТВ(PPTV) potentiometer. The hardness was investigated on samples that were subjected to microstructural analysis. The samples were annealed at different temperatures in accordance with the titanium content. On the basis of the phase diagrams obtained, a similar dependence of the electrical resistivity and temperature coefficient on the composition were found to exist in the titanium corner of the phase diagram of the three-component system, as well as the two-component system. The diagrams of

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Investigation of the Physicochemical Properties of the Alloys of the Ternary System Titanium - Vanadium - Niobium

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the thermal expansion of the ternary system in the range of a composition V : Nb = 1 : 1 showed that in the two-phase range there are sections of an irregular change of expansion, i.e., where the most intensive phase transformation takes place. The temperature of these sections decreases with the increase of the vanadium- and niobium content, which corresponds to the phase diagram. Lines of the same hardness, i.e., isosclerie lines of the isothermal cross section for 600°C were drawn on the diagram of the system Ti-V-Nb according to the values of hardness measurement (Fig. 9). Change of hardness is also dependent on the phase structure. The optimum compositions of the alloys on the basis of α- and β-phases with certain properties can be determined on the basis of the phase diagrams. There are 9 figures and 10 references: 7 Soviet and 2 US.

SUBMITTED: June 19, 1959

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69508

18.1285
5.4110

AUTHORS: Kornilov, I.I., Nartova, T. T.

S/020/60/131/04/033/073
B011/B017

TITLE: Equilibrium Diagram of the Ternary System Ti - Al - Sn

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol 131, Nr 4, pp 837-839 (USSR)

TEXT: Since no data are available in publications on the diagram mentioned in the title, the authors studied the equilibrium of the alloys of the mentioned system in the range limited by the partial ternary system Ti - Ti_3Sn - TiAl. The binary systems Ti - Al and Ti - Sn which form the latter ternary system show that in these two systems limited solid solutions are formed on the basis of α-titanium at 1240° in the system Ti - Al (due to peritectoid reaction between the β-phase of titanium and the γ-phase on the basis of the TiAl compound); these solutions are formed between the β-phase of titanium and the δ-phase (on the basis of compound Ti_3Sn), at 890° in the system Ti - Sn. For their investigation the authors employed the microstructural X-ray method and the hardness test of alloys. Several alloys were forged to accelerate the establishment of equilibrium. They were subjected to gradual thermal treatment in the vacuum: homogenization at 1200° for 100 h, annealing at 1100° for 50 h, 1000° for 200 h, 800° for 300 h, 600° for 500 h, and then left to cool in the furnace. Ti_3Sn - TiAl alloys were annealed for a longer period, and cooled slowly. The phase diagram (Fig 1)

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Equilibrium Diagram of the Ternary System Ti - Al - Sn S/020/60/131/04/033/073
B011/B017

was drawn on the basis of part of the Ti - Al - Sn system investigated at 600°. The following phases were observed: 1) Solid solution of aluminum and tin in α-titanium (α); 2) solid solution on the basis of the chemical compound TiAl (γ); 3) continuous solid solutions of the compounds Ti_3Al - Ti_3Sn which are in agreement as to their structure with the α- and δ-phases; 4) so.. d solution on the basis of the chemical compound Ti_3Sn (δ). As is shown by fig.. 1, the main part of the diagram consists of the one-phase range of the soli. ternary α(δ)-solution on titanium basis, and on the basis of the quasi-binary cross section Ti_3Al - Ti_3Sn. Between the latter compounds continuous solid solutions are formed. Alloys with a two-phase structure α+δ (Fig 2b) were, in view of a possible formation of continuous solid solutions between α-titanium and Ti_3Sn, additionally annealed at 800° (for 1,000 h). Hence, their microstructure was slightly changed. Thus, the given conditions at which the state of equilibrium is attained are characterized by the presence of a two-phase range α+δ which adjoins the side Ti - Sn of the diagram. As may also be seen from the diagram, the range of the solid γ-solution is considerably extended (≈ to 18% of Sn). In the part of the diagram investigated, no 3-phase range was observed. There are 2 figures and 8 references.

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81703

18.7500
18.8100

S/020/60/132/05/31/069
B011/B126

AUTHORS: Kornilov, I. I., Pryakhina, L. I., Ozhimkova, O. V.

TITLE: The Influence of the Time Factor on the Character of the Composition - Heat Resistance Diagrams of Alloys of the Ni - Cr - W - Ti - Al Five Component System

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 132, No. 5, pp. 1086 - 1089

TEXT: The authors wanted to examine the simultaneous influence of the composition and a long conversion time on the heat resistance of alloys. With this object in view, they studied the creeping of alloys of one of the cross sections of the above system, with Ni replaced by Al, within 0 to 7.9%, and with a constant Cr, W, and Ti content. The phase diagram of the cross-section analyzed is given in Fig. 1. In order to examine creeping, the samples were heated to 1150°C, maintained at this temperature for seven hours, and then cooled in air. After such homogeneization, the compounds with up to 5.1% Al showed a structure of solid five-component solutions with a small quantity of excess γ'-phase, which was

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81703

The Influence of the Time Factor on the Character of the Composition - Heat Resistance Diagram of Alloys of the Ni - Cr - W - Ti - Al Five Component System

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B011/B126

separated due to the cooling in air. Above this Al content, an eutectic appears, consisting of solid γ-solution and the γ'-phase. The alloys were analyzed for creeping by the centrifugal method at 900° with an initial tension of 6 kg/mm^2. From the curves in Fig. 2 it can be seen that the alloys with a high Al content (6.5 and 7.9%), whose composition comes in the range of common crystallization of the solid γ-solution and the eutectic, have proved themselves to be not resistant to heat. From the curves in Figs. 2 and 3 it follows that an alloy with a maximum supersaturation (with 5.1% Al) for a short deformation-time (300-400 hours), is the most heat-resistant. If the time is increased to 700-800 hours, then alloys with a lesser degree of supersaturation are the most heat-resistant (3.4, 2.8, and 1.8% Al), which lie on the border of the maximum aluminum solubility. On further tests for creeping of up to 10,000 hours duration, the whole character of the curves for single alloys does not change, except in alloys with 2.8 and 3.4% Al. This shift of the heat resistance maximum in the phase diagram is due to the

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81703

The Influence of the Time Factor on the Character of the Composition - Heat Resistance Diagram of Alloys of the Ni - Cr - W - Ti - Al Five Component System

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influence of the time factor on the physico-chemical conversion processes and on the structure changes of the alloys during the tests. The alloys with maximum supersaturation have, on a short test, the highest solidity, since the inner tensions in the lattice of the solid solution are great. This solidifying effect decreases in the range of less supersaturated solutions and in the range of the formation of eutectic mixtures on crystallization. On longer tests the solidifying also decreases due to the varied effect of the time factor. The solidification decreases even more, the higher the degree of supersaturation and the longer the duration of the test. In the latter case, diffusion processes also take effect. The formation of an excess phase, and its subsequent coagulation lower the heat resistance. Thus the authors have proved that the heat resistance maxima in the isothermic diagrams composition versus heat resistance are dependent on both temperature and time. Kurnakov compounds are mentioned. There are 3 figures and 9 references: 5 Soviet, 1 British, and 3 American.

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87405

18.0010 2308, 1273

S/020/60/135/006/021/037
B016/B060

AUTHOR: [redacted]

TITLE: Metallochemical Properties of Niobium

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 135, No. 6, pp. 1399-1401

TEXT: The author describes the metallochemical properties of niobium and classifies the elements of the periodic table into groups according to their chemical interactions with niobium. According to data found in the literature, niobium as a metal of the transition group has an unfilled outer d-electron shell, and its atomic radius 1.45 A is very close to that of nearby metals. As for electronegativity, Nb occupies an intermediate position in the metal series (Ref. 5). About 35 metals are electropositive with respect to Nb, while 37 behave electronegatively with it. Its lattice is body-centered. Fig. 1 shows a periodic table by D. I. Mendeleyev as modified by the author, with Nb being placed on top outside the table. All other elements are divided into four "families": I. 8 metals forming continuous solid solutions when crystallizing with Nb,

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Metallochemical Properties of Niobium

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and whose metallochemical properties diverge little from those of Nb. They are Ti, Zr, V, Ta, Pa, Mo, W, and U. II. This family encompasses a large group of elements forming limited solid solutions with Nb. Outside the range of solubility, compounds with a metallic character of the bond are formed with Nb. They are a total of 58 when all lanthanides are included, and 68 when taking in also all the 10 actinides. From among the 68 elements of family II the interaction with Nb has been investigated for 27 elements only. The peak solubility of these elements in niobium drops with increasing divergence of their metallochemical properties from niobium. The compounds of niobium with metalloids (borides, carbides, silicides of niobium) have a metallic type of bond. This holds also for the very limited solid solutions and compounds of niobium with N, P, As, Sb, and O. The degree of metallic properties of these Nb compounds rises with increasing difference between their metallochemical properties and those of niobium. III. This family comprises 9 typical metalloids which are the most strongly electronegative. They form no solid solutions with Nb, but only compounds with covalent or ionic bonds. Oxygen occupies an intermediate position. IV. This family comprises 16 elements of the first and second group of the periodic system (hydrogen and beryllium excepted)

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Metallochemical Properties of Niobium S/020/60/135/006/021/037
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as well as the inert gases. These elements exhibit no interaction with Nb and form no compounds with it. It is finally noted that the concentrations of the components in niobium systems can be calculated on the basis of the classification of the individual elements under I and II. Also alloys with given structure and properties can be produced. There are 1 figure and 6 references: 5 Soviet.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR (Institute of Metallurgy imeni A. A. Baykov of the Academy of Sciences, USSR)

PRESENTED: June 27, 1960, by I. I. Chernyayev, Academician

SUBMITTED: June 14, 1960

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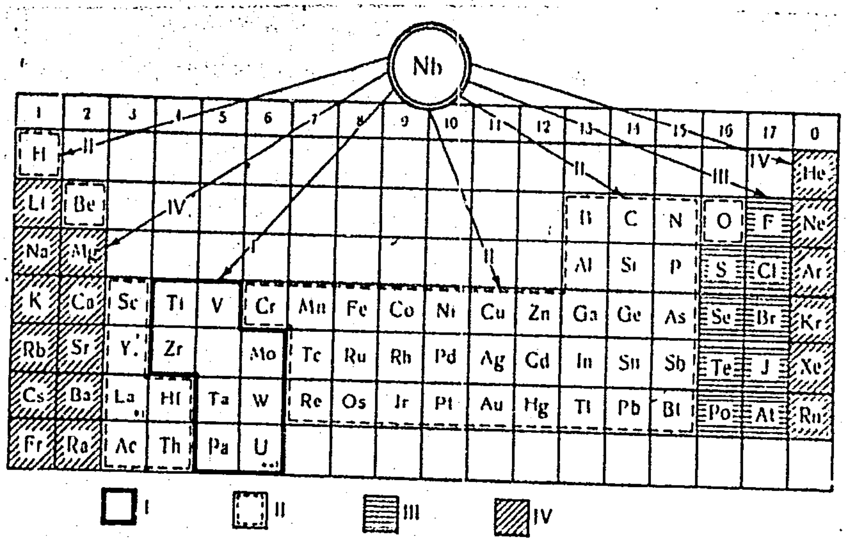
B016/B060



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KORNILOV, I.I.; BUDBERG, P.B.; SOKOLOVA, N.V., tekhn. red.

[Phase diagrams of two- and three-component systems of titanium] Diagrammy sostoianiia dvoinykh i troinykh sistem titana. Moskva, Vses. in-t nauchnoi i tekhn. informatsii, 1961. 172 p. (MIRA 14:6)

(Titanium alloys) (Systems (Chemistry))

PHASE I BOOK EXPLOITATION SOV/5946

Kornilov, Ivan Ivanovich

Fiziko-khimicheskiye osnovy zharoprochnosti splavov (Physical and Chemical Bases for the Heat Resistance of Alloys) Moscow, Izd-vo AN SSSR, 1961. 515 p. Errata slip inserted. 3200 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut metallurgii imeni A. A. Baykova.

Resp. Ed.: I. A. Oding, Corresponding Member, Academy of Sciences USSR; Ed. of Publishing House: S. G. Fedotov; Tech. Eds.: P. S. Kashina and Yu. V. Rylina.

PURPOSE: This book is intended for physicists, chemists, metallurgists, metallographers, and technical personnel engaged in the study, production, and application of heat-resistant materials. It may also be useful to aspirants at scientific research institutes and schools of higher education and to students.

COVERAGE: The book summarizes the author's extensive work on the physicochemical principles of the heat resistance of pure metals and alloys, as well as the published material on this subject. Particular attention is given to the

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strength and heat resistance of pure metals and alloys of single-component and multicomponent systems and to basic problems of the physicochemical theory of heat resistance. The book is based primarily on experimental material on the problem of heat resistance collected over a period of 10 to 15 years by the author and a group of workers of the Laboratory of the Chemistry of Metal Alloys, Institute of Metallurgy imeni A. A. Baykov. For purposes of analysis and generalization, numerous Soviet works and non-Soviet works have been utilized.

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89906

solubility of Ni_3Ti - Ni_3Ta - Ni_3Nb indicates, for the compound Ni_3Ti, the possible existence of a second high-temperature modification of the β - Cu_3Ti type rhombic syngony, as it is the case with the compounds Ni_3Nb and Ni_3Ta. The authors stress that no published data exist on the equilibrium in the mentioned ternary system, apart from a brief mention of the possibility of formation of continuous, solid solutions. Fig. 2 shows the composition of the alloys studied. A table provides data on the thermal analysis and the stability of alloys of the ternary system. The authors plotted the liquidus surface of the ternary system on the basis of thermal analysis data of three binary systems formed by the compounds, and of the three polythermal cross sections of the ternary system. The liquidus surface consists of a field of primary crystallization of continuous, ternary solid metallide solution of the system Ni_3Nb + Ni_3Ta + Ni_3Ti. Microstructural analyses of cast and annealed alloys confirm the existence of solid solutions in the ternary system. Fig. 6a shows the cast (mostly dendritic) structure of the

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alloy: 15% Ni_3Nb, 15% Ni_3Ta, and 70% Ni_3Ti. Fig. 6b - of the alloy: 17% Ni_3Nb, 33% Ni_3Ti, 50% Ni_3Ta, and Fig. 6c - of the alloy: 12% Ni_3Nb, 70% Ni_3Ta, 18% Ni_3Ti. The microstructure of alloys of the same composition has become polyhedral after annealing at 1200°C for 24 hr (Figs. 6d, e, f). Finally, the authors studied the hardness in the cast and the annealed state. The table shows the results of measurements of polythermal cross sections. Not only microstructure, but also hardness confirm the data of thermal analysis on the existence of continuous, solid solutions of metallides in the ternary system. There are 7 figures, 1 table, and 7 Soviet-bloc references.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR (Institute of Metallurgy imeni A. A. Baykov, Academy of Sciences USSR)

SUBMITTED: October 2, 1959

18.1152 1454, 1045, 1496

28873
S/180/61/000/004/011/020
E021/E580

AUTHORS: Kornilov, I.I. and Polyakova, R.S. (Moscow)

TITLE: Study of the properties of titanium-vanadium-molybdenum alloys

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Metallurgiya i toplivo, 1961, No.4, pp 76-82 + 1 plate

TEXT: The Ti-V-Mo system was studied by microstructural and X-ray analysis, and hardness, electrical resistance and high temperature strength measurements. Alloys were studied along quasi-binary sections with constant vanadium contents of 10, 20, 30, 40, 50, 60, 70 and 80 wt.%. The initial materials had purities of Ti - 99.6%, V - 99.2% and Mo - 99.9%. Alloys were prepared by melting in an arc furnace using a non-consumable electrode, and by sintering powdered materials. In the quenched state, the alloys consisted of a homogeneous solid solution based on β-titanium. In the annealed state, Ti rich alloys showed an acicular structure of two phases (α + β) whereas alloys rich in Mo and V had the polyhedral structure of a solid solution. All alloys with 40-80% V had a homogeneous structure. X-ray analysis

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Study of the properties of ... S/180/61/000/004/011/020
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confirmed the metallographic examination and showed that the transition from a single phase to a two-phased region occurred between 70 and 75% Ti. Fig.4 shows the hardness and electrical resistance of alloys. The highest hardness values were observed in alloys containing 10, 20 and 30% V, in the region of the β-solid solution. High temperature strength was measured by the centrifugal method with a constant bending stress of 15 kg/mm² at 500, 550, 600, 650 and 700°C. The highest values were obtained with alloys consisting of β-solid solution, with V contents of 10, 20 and 30%. On the basis of the microstructural and X-ray analysis, isothermal sections of the phase diagram were constructed for room temperature (Fig.6) and for 1100°C (concentrations in wt.%). There are 6 figures and 5 references: 3 Soviet and 2 non-Soviet. The English-language references read as follows: Ref.2: Taylor.J.L. Beta Phase Parameters in the System Ti-V-Mo. J. Metals, 1956, 8, No.8, Sec.2, 956-961; Ref.3: Adenstedt, H., Reqignot J., Raymer, J. The titanium-vanadium system. Trans. Amer. Soc. Metals, 1952, 44, 990. N. I. Davydov participated in the experiments.

SUBMITTED: April, 1961

Card 2/4

33181

S/180/61/000/006/015/020
E193/E383

18.8200

AUTHOR: Kornilov, I.I. (Moscow)

TITLE: High-temperature strength of intermetallic compounds

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Metallurgiya i toplivo, no. 6, 1961, 130 - 136

TEXT: It is pointed out, in a general discussion of high-temperature strength of intermetallic compounds and alloys based on such compounds, that thermal stability of intermetallic compounds is determined by the strength of interatomic bonds which, in turn, depends on the difference between the chemical nature of the interacting component. All metallic compounds have a hardness and strength higher than that of the respective pure metals or solid solutions and they retain these properties at temperatures higher than their components. Among the large number (about 4 000) of intermetallic compounds, Ni_3Al is distinguished by high strength combined with a relatively high ductility. The high-temperature strength of this compound can be further increased by alloying it with elements (Co, Cu, Fe, Cr,

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High-temperature strength E193/E383

Mo, Ti, Si, V and Mn) with which it can form a limited series of solid solutions. Similarly, intermetallic compounds Ti_6Al, Ti_3Al and TiAl alone, or alloyed with other metals, have a high-temperature strength superior to that of pure Ti. The discussion is illustrated by experimental data quoted from American, British and Soviet sources, the latter including earlier works of the present author. Typical of these are data reproduced in Fig. 5 (Ref. 21 - the author and Ye.N. Pylayeva - Zh. neorganich. khim. 1958, no. 3 673), where the deformation (f, mm) of various test pieces tested for creep under a bending stress of 6 kg/mm^2 at 800, 900 and 1 030 °C (graphs a, б and B, respectively) is plotted against time (τ, hours), Curves 1-6 relating to pure Ni (1) and to Ni-base solid solutions containing Nb (2), Ta (3), Ni_3Ti (4), Ni_3Nb (5) and Ni_3Ta (6).

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S/180/61/000/006/015/020
E193/E383

High-temperature strength ....

There are 7 figures and 24 references: 18 Soviet-bloc and 6 non-Soviet-bloc. The four latest English-language references mentioned are: Ref. 10: Nat. Phys. Lab., 1959, v. 1, II; Ref. 12 - J. Westbrook: Mechanical properties of intermetallic compounds. John Wiley and Sons, USA, 1960; Ref. 19: R.W. Guard, J.H. Westbrook - Trans. Met.Soc. AIME, 1959, Oct.v.215, no. 5, p. 807; Ref. 20: M. Hansen - Constitution of Binary Alloys. McGraw-Hill Book Co., New York, 1958.

SUBMITTED: April 26, 1961

X

Card 3/3

34523
S/659/61/007/000/010/044
D217/D303

18.1150

AUTHORS: Kornilov, I.I., and Snetkov, A.Ya.

TITLE: Lattice parameters of the terminal solid solutions of certain elements in nickel

SOURCE: Akademiya nauk SSSR. Institut metallurgii. Issledovaniya po zharoprochnym splavam, v. 7, 1961, 106 - 111

TEXT: The results of an investigation of the influence of Mo, Nb, Ta, V, Ru, W and Zr on the change in lattice parameter of nickel when these elements dissolve in it, is reported. Most of the alloys were prepared in a vacuum furnace. Ni-Ta alloys were prepared by Ye. N. Pylayeva, Ni-W and Ni-Mo alloys by N.T. Domotenko, and Ni-Ru, Ni-Nb and Ni-Zr alloys by K.P. Myasnikova. The above workers investigated the equilibrium diagrams and properties of the alloys of the respective systems. Powders or filings of the alloys were subjected to X-ray photography. Prior to exposure, specimen lumps of the alloys were first homogenized at 1100 - 1150°C for 100 - 150 hours, transformed into powder and sealed into evacuated quartz ampoules.

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The latter were annealed at the required temperatures for periods of time sufficient to ensure equilibrium, and then cooled in water. After heat treatment, one portion of the filings was submitted to chemical analysis, and the rest sifted through a 200 mesh sieve and mounted in the camera for exposure. X-ray exposures were taken in back-reflection cameras using CuKα-irradiation, the distance between the specimen and the film being 75 mm. The temperature, at which the pictures were taken was 21 ± 1.5°C, the total error in measuring the lattice parameter without correction for temperature being 0.0006 - 0.0009 KX. It was found that the change in lattice parameter of nickel on dissolving various elements in it depends on the position of these elements in the periodic system and on their atomic diameters, i.e. it follows the same laws as those which determine the limiting concentration of partly soluble metals in nickel. Elements having the same type of crystal lattice (body centered cubic) owe their influence mainly to their atomic diameter, even though they may belong to different groups and periods of the periodic table. The strengthening effect of an element is the greater the greater the extent to which, on dissolving in nickel, it increa- X