

VERKHIVKER, G.P., inzh.; LAGUTKIN, O.D., inzh.

Caloric properties of Freon-12 in the supercritical region. Izv.vys.  
ucheb.zav.; energ. 4 no.5:72-76 My '61. (MIRA 14:6)

1. Odesskiy tekhnologicheskiy institut. Predstavlena kafedroy  
teplotekhniki.

(Atomic power plants) (Freons)

VERKHIVKER, G.P.; ZUBATOV, N.G.; KOTLYAREVSKIY, P.A.

Diagram of gas combustion products allowing for dissociation.  
Inzh.-fiz. zhur. 6 no.6:68-73 Je '63. (MIRA 16:6)

1. Tekhnologicheskii institut imeni M.V. Lomonosova, Odessa.  
(Saratov--Gas, Natural)  
(Combustion)

25671

S/096/61/000/009/008/008

E194/E155

26.2/24

AUTHORS: Datskovskiy, V.M., Candidate of Technical Sciences,  
Verkhivker, G.P., Engineer, and  
Lagutkin, O.D., Engineer

TITLE: Calculations of mixing of flows of gas and liquid

PERIODICAL: Teploenergetika, 1961, No.9, pp. 92-93

TEXT: It is often necessary to make calculations relating to mixed flows of gas and liquid, particularly when the liquid vapourises. One instance is the intermediate cooling of air in a compressor by injecting water between compressor stages. The object of the present article is to provide an approximate simple solution for this particular problem. If the gas and fluid are mixed and no liquid is present at the discharge from the mixer ( $d_{\chi 2} = 0; P_{n2} \ll P_{H2}$ ) we have the following expressions:

$$i_{r2} + d_{n2} i_{n2} - i_{r1} - d_{n1} i_{n1} - d_{\chi 1} i_{\chi 1} = 0$$

(4)



Card 1/3

Calculations of mixing of flows ....

25671

S/096/61/000/009/008/008  
E194/E155



$$d_{n2} = \frac{1}{\frac{R_n}{R_r} \left( \frac{p_2}{p_{n2}} - 1 \right)} \tag{5}$$

$$d_{n1} + d_{\kappa 1} = d_{n2} \tag{6}$$

The notation used here is: indexes (1) inlet to mixer; (2) discharge from mixer;  $\kappa$  liquid; 2 dry gas; n vapour of injected liquid; H saturated vapour; i enthalpy in kcal/kg; d flow of liquid or vapour per unit flow of dry gas kg/kg; R the gas constant kg.m/kg°C. The application of these equations to the cooling of compressed air by water injection is explained. A nomogram is given to determine  $t_{r2}$  and  $d_{n2}$  from given values of  $t_{r1}$ ,  $d_{n1}$  and  $p_2$  when injecting water into unsaturated wet air until it is saturated. In drawing up the nomogram it was taken that  $i_{\kappa 1} = 15$  kcal/kg,  $a = 0.413$  kcal/kg°C;  $b = 598$  kcal/kg. The method of using the nomogram is indicated by a dotted line. For convenience two scales are plotted on the  $d_{n2}$  axis. The difference between the calculations made by the equations given

Card 2/3

25671

Calculations of mixing of flows ... S/096/61/000/009/008/008  
E194/E155

above using a slide rule and those obtained by the nomogram  
differ in practice by 1 - 2%.  
There are 1 figure and 2 Soviet references.

Card 3/3

VERKHIVKER, G.P.; SHEVCHENKO, G.Z.

Increasing the efficiency of high-duty gas-turbine units. Trudy  
Od. tekhn. inst. 14:31-38 '62. (MIRA 16:12)

1. Rabota vypolnena na kafedre teplotekhniki Odesskogo tekhnologicheskogo instituta. Rukovoditel' raboty - doktor tekhn. nauk prof. Gokhshteyn, D.P.

GOKHSHTEN, D.P., prof., doktor tekhn.nauk; VERKHIVKER, G.P., inzh.;  
GOIRODETSKIY, A.E., inzh.

Expansion of existing electric power plants. Izv.vys.ucheb.zav.;  
energ. no.11:71-78 N '58. (MIRA 12:1)

1. Odesskiy tekhnologicheskii institut imeni I.V. Stalina. Pred-  
stavlena kafedroy obshchey teplotekhniki.  
(Electric power plants)

SOV/96-59-5-6/19

**AUTHORS:** Gokhshteyn, D.P., Doctor of Technical Sciences and  
Verkhivker, G.P., Engineer

**TITLE:** Some Methods of Reconstructing Steam Turbine Electric  
Power Stations Using Steam-Gas Circuits (Nekotoryye puti  
rekonstruktsii paroturbinnnykh elektrostantsiy po  
parogazovym skhemam)

**PERIODICAL:** Teploenergetika, 1959, Nr 5, pp 33-37 (USSR)

**ABSTRACT:** As a number of steam-driven power stations become  
converted to natural gas fuel, it will be possible to  
make extensive use of open-cycle gas-turbine installations.  
A combined gas-steam cycle offers thermo-dynamic  
advantages. If the heat of the gas-turbine exhaust is  
used to heat feed-water for the steam cycle, the amount of  
steam tapped from the turbines for this purpose is reduced  
and the output for a given steam consumption can be  
increased by 20%. A combined gas-steam installation can  
quite easily be introduced into existing stations with  
quite small cost for equipment and structural alterations.  
The simplest steam-gas circuit for reconstructing existing  
installations with 100-MW condensing turbines type VK-100-2

Card 1/7



SOV/96-59-5-6/19

Some Methods of Reconstructing Steam Turbine Electric Power Stations  
Using Steam-Gas Circuits

is given in Fig 1. In this the turbine exhaust gases are used first to heat the air entering the combustion chamber and then to heat the feed-water of the steam cycle. Table 1 gives the results of calculations of the effective efficiency and output of a steam-gas installation using the circuit of Fig 1 for various feed-water temperatures. It is shown that the efficiency of the steam-gas installation is increased by raising the feed-water temperature after the water-gas heater. The increase in efficiency is quite marked up to a feed-water temperature of 220°C but beyond this it does not increase so rapidly. The circuit shown in Fig 2 considerably reduces the power taken from the gas-turbine part of the installation. Here the feed-water draws heat both from the turbine exhaust gas that has already passed through an air regenerator and from the air between the high and the low-pressure compressors. In this case, the highest efficiency is obtained if the feed-water is heated to a temperature of 101.3°C in the water-gas heat-exchanger with subsequent

Card 2/7

SOV/96-59-5-6/19

Some Methods of Reconstructing Steam Turbine Electric Power Stations  
Using Steam-Gas Circuits

heating to 220°C in the regenerative heaters of the turbine. With this circuit the increase in efficiency is less than with circuit 1, because the output of the gas-turbine part of the installation is less. The results of calculations on circuit 2 are given in Table 2 and it is shown that in this case quite a small gas-turbine offers an appreciable increase in efficiency as compared with a straight steam cycle. A circuit with two-stage fuel consumption is shown in Fig 3 and the results of calculations on this circuit are given in Table 3. It is of interest to note the efficiencies with two-stage compression and two-stage expansion of gas in the gas-turbine installation: they fall into a pattern similar to that observed with single-stage compression and single-stage expansion. A schematic circuit for two-stage expansion and two-stage fuel combustion with single-stage compression is shown in Fig 4. It increases the efficiency of the steam-gas installation to 36.7% which is 13% higher

Card 3/7

SOV/96-59-5-6/19

Some Methods of Reconstructing Steam Turbine Electric Power Stations  
Using Steam-Gas Circuits

than for the purely steam cycle. The total output of the steam-gas installation is 138600 kW and the feed-water temperature after the steam-gas heater is 220°C. The improved performance of this circuit as compared with that shown in Fig 1 results from the greatly increased output of the gas-turbine part. An important disadvantage of the circuits mentioned is that the gas-air regenerators and water-gas heaters are very big. In order to increase the unit output of the gas-turbine and to reduce the size of the regenerators and water heaters, there is some point in using the semi-closed steam-gas-turbine cycle, illustrated in Fig 5. Here the main gas-turbine operates against a back-pressure; the exhaust gases pass through an air regenerator and water-heater before delivery to the inlet part of the compressor. The part of the gas needed to supply air to burn the fuel in the combustion chamber of the main turbine passes into the combustion chamber of the auxiliary turbine. The chamber also receives air, from the first stage of the auxiliary compressor, and fuel. The gas temperature at the chamber

Card 4/7

SOV/96-59-5-6/19

Some Methods of Reconstructing Steam Turbine Electric Power Stations  
Using Steam-Gas Circuits

outlet is 700°C, as it is after the combustion chamber of the main turbine. The exhaust gases from the auxiliary turbine are passed to a regenerator where they heat up the air and gas supply to the combustion chamber and are then discharged to atmosphere. The auxiliary turbine drives the two-stage compressor which delivers combustion air to the main system. With this arrangement the size of the different heat-exchangers can be much reduced. Semi-closed steam-gas cycles are better than closed ones for modernising existing power stations because there is no need to instal an air boiler; also, the heating surfaces are smaller and the circuit is simpler and more efficient. Results of efficiency calculations for the circuit are given in Table 4. It is possible to use a circuit in which part of the turbine exhaust gas is used as air to maintain combustion in the boiler furnaces. This circuit, shown schematically in Fig 6, embodies the semi-closed part operating on the circuit already described but without

Card 5/7

SOV/96-59-5-6/19

Some Methods of Reconstructing Steam Turbine Electric Power Stations  
Using Steam-Gas Circuits

the second combustion chamber. In addition, there is an open-cycle part. Exhaust gases from the gas turbine No 3 are used as combustion air in the boiler furnace. Air from the compressors is heated in the tail-end heating surfaces of the boiler and then passes to the combustion chamber and the turbine. Calculations made for a stated set of conditions with this circuit show that the effective efficiency of the installation is 36.6%, which is 12.5% greater than that of the steam installation, whilst the total output is 141300 kW. It is of interest to note that with a steam pressure of 90 atm and a temperature of 480°C, the efficiency of a steam-gas installation operating on this circuit is only 15% less than the efficiency of a steam installation operating at 300 atm and 650°C with double reheat. A valuable advantage of all the circuits considered is the possibility of burning mixed fuel, that is, solid fuel in the steam boiler and liquid or gas fuel in the combustion chambers of the gas turbine. Therefore, these circuits may be used in the power stations of metallurgical works

Card 6/7

SOV/96-59-5-6/19

**Some Methods of Reconstructing Steam Turbine Electric Power Stations  
Using Steam-Gas Circuits**

which burn blast furnace or coke oven gas as well as solid fuel. For comparison the calculations were made on a closed steam-gas cycle, with single-stage compression and two-stage heating operating under the same conditions as the steam-gas semi-open cycle. The effective efficiency of this installation is 34.7% and the increase in effective efficiency of the closed steam-gas cycle compared with the straight steam cycle is 8.05%. As the ordinary gas-turbine installations developed by Soviet factories are not the best ones for steam-gas circuits, there is a need for special versions suited to operation in combined installations. There are 6 figures, 4 tables and 3 references, 2 of which are Soviet and 1 English.

ASSOCIATION: Odesskiy Tekhnologicheskii Institut (The Odessa Technological Institute)

Card 7/7

L 08060-67 EWT(m)/EWP(f) FIN/WW/DJ/WE SOURCE CODE: UR/0143/66/COO/008/0053/0061  
ACC NR: AP7001676

AUTHOR: Vorokhivker, G. P. (Candidate of technical sciences); Smirnov, G. F. (Engineer)

ORG: Odessa Technological Institute im. L. V. Lomonosov (Odesskiy tekhnologicheskii institut) 57 B

TITLE: Selection of optimal regenerator parameters for a gas turbine 23

SOURCE: IVUZ. Energetika, no. 8, 1966, 53-61

TOPIC TAGS: gas turbine, heat transfer coefficient, hydraulic resistance

ABSTRACT: A solution of the problem similar to that stated in an earlier work, which did not allow consideration of the influence of a change in operating fluid flow with a change in regenerator surface, and which required knowledge of the total heat transfer coefficient in the regenerator. The method suggested allows determination of optimal parameters with consideration of: the influence of local conditions of the operation of the installation, that is fuel cost, assignment of the turbine, (peak load or basis operation), cost of manufacture of regenerator; it also allows selection of the optimal type of finning under the given conditions. The method considers the influence of hydraulic resistance to a change in operating fluid flow in the installation and the influence of a change in gas velocity on the effectiveness of the finning. The method can also be used for selection of the optimal increase in pressure in planning a new installation, as well as for determination of

UDC: 621.432+669.183:213 0924 1445

Card 1/2

I. 08060-67

ACC NR: AP7001676

the optimal surface of air coolers and other elements of a gas turbine and of steam gas installations. An expression is given which makes it possible to determine the limiting expediency of introduction of regeneration in a gas turbine with a given cost per meter of surface. Orig. art. has: 4 figures, 1 table and 32 formulas. [JPRS: 38,490]

SUB CODE: 13, 20 / SUBM DATE: 29Jan65 / ORIG REF: 012

Card 2/2 *AW*



GOKHSHEYN, David Petrovich; VERKHIVKER, Grigoriy Petrovich; KURITS,  
S.Ya., red.; SHIKIN, S.F., tekhn.red.; LARIONOV, G.Ye., tekhn.red.

[Problem of increasing the efficiency of steam power plants]  
Problema povysheniia K.P.D. paroturbinnnykh elektrostantsii.  
Moskva, Gos.energ.izd-vo, 1960. 206 p. (MIRA 13:11)  
(Steam power plants)

C#

Cement manufacture as a way of utilizing boiler slag and spare working capacity of electric power stations. A. M. Verkhman and V. V. Romashkov. *Stal. Prom.* 23, No. 10-11, 4-7 (1945).—The manuf. of slag cement from the residue from lean coal burned at power stations is described. Of the 3 components, fly ash, boiler ash, and slag, only the last is usually used, but admixture of boiler ash is allowed in special cases. At Novosibirsk power station a cement equal in quantity to one based on granulated blast-furnace slag (strength grade (S.G.) 80), but with a shorter setting time, is obtained with slaked CaO 20, gypsum 3, and slag 77%. Another cement contains slag 70, portland cement 27, and gypsum 3% (S.G. 200).  
H. A.

TURK, V.I., kand. tekhn. nauk, dots.; PREGER, Ye.A., dots., retsenzent;  
VERKHODANOV, M.Kh., inzh., retsenzent; ZANESKIY, M.S., dots.,  
nauchnyy red.; SMIRNOVA, A.P., red. izd-va; BOROVNEV, N.K.,  
tekhn. red.

[Pumps and pumping stations] Nasosy i nasosnye stantsii. Izd.2.,  
perer. Moskva, Gos. izd-vo lit-ry po stroit., arkhit., i stroit.  
materialam, 1961. 332 p. (MIRA 15:2)

1. Kafedra vodosnabzheniya i kanalizatsii Leningradskogo inzhenerno-  
stroitel'nogo instituta (for Preger).  
(Pumping machinery)

STAROVEROV, I.G., otv. red.; YASTREBOV, M.M., zam. otv. red.;  
YERKHODANOV, M.Kh., red.; GULISHAMBAROV, F.I., red.;  
OSIPOV, V.S., red.; FINKEL'SHTEYN, S.M., red.;

[Album of equipment; condensate outlets] Al'bum oborudovaniya;  
kondensatootvodchiki. Moskva, 1963. 33 p. (MIRA 16:12)

1. Moscow. Gosudarstvennyy proyektnyy institut Santekhproyekt.
2. Glavnyy inzhener Gosudarstvennogo proyektного instituta Gosudarstvennogo tresta sanitarno-tekhnicheskogo proyektirovaniya (for Staroverov).

(Water heaters)

STAROVEROV, I.G., otv. red.; YASTREBOV, M.M., zam. otv. red.;  
VERKHODANOV, M.Kh., red.; GULISHAMBAROV, F.M., red.;  
~~OSIFOV, I.G., red.; FINKEL'SHTEIN, S.M., red.~~

[Equipment album; air heaters and heating units] Al'bom  
oborudovaniia; kalorifery i agregaty. Moskva, 1964. 96 p.

[Equipment album; unit air conditioners] Al'bom oborudovaniia;  
mestnye konditsionery. Moskva, 1964. 105 p.

(MIRA 18:4)

1. Moscow. Gosudarstvennyy proyektyny institut santekhproyekt.

VERKHOGLYADOV, V.A. (Kiyev)

Observation of recurrent nosebleeding following a conchotomy.  
Zhur. ush., nos. i gorl. bol. 23 no.5:82-84 S-0'63  
(MIRA17:3)

VERKHOGLYADOV, V.A.

Angiofibroma of Highmore's antrum. Zhur. ush., nos. 1 gorl. bol.  
20 no. 3:66-67 My-Je '60. (MIRA 14:4)

1. Iz otolaringologicheskogo otdeleniya (nachal'nik - kand.med.  
nauk B.L. Frantsuzov) Kiyevskogo Okruzhnogo voyennogo gospi'talya.  
(NOSE, ACCESSORY SINUSES OF--TUMORS)  
(ANGIOMA)

BRODSKIY, Yu.S.; VERKHOGLYADOVA, T.P.

Clinical aspects and pathomorphology of ependymomas of the cauda equina region. Vop.neirokhir. 22 no.6:22-27 N-D '58. (MIRA 12:2)

1. Ukrainskiy nauchno-issledovatel'skiy institut neyrokhirurgii.  
(EPENDYMOMA, case reports,  
cauda equina (Rus))  
(CAUDA EQUINA, neoplasms,  
ependymoma (Rus))



VERKHOGLYADOVA, T.P. (Kiyev, ul. Otravnaya, d.25, kv.4)

Ependymoma of the cauda equina. Nov.khir.arkh. no.3:41-45 My-Je '57.  
(MIRA 10:8)

1. Otdel patomorfologii (zav. - prof. B.S.Khominskiy) Instituta  
neyrokhirurgii Ministerstva zdravookhraneniya USSR  
(SPINAL CORD--TUMORS)

VERKHOGLYADOVA, T.P. (Kiyev)

Histological structure of ependymomas and the rate of their clinical course. Vrach.delo no.2:129-131 P '57. (MLRA 10:6)

1. Otdel patomorfologii (zav. - prof. B.S.Khominskiy) Instituta neyrokhirurgii Ministerstva zdavookhraneniya USSR.  
(NERVOUS SYSTEM--TUMORS)

VERKHOGLYADOVA, T.P.

Malignant ependymomas. Zhur. nevr. i psikh. 61 no.4:504-508 '61.  
(MIRA 14:7)

1. Otdel patomorfologii (zav. - prof. B.S.Khominskiy) Ukrainskogo  
nauchno-issledovatel'skogo instituta neyrokhirurgii (dir. - prof.  
A.I.Arutyunov), Kiev.

(NERVOUS SYSTEM--CANCER)

VERKHOGLYADOVA, T.P.

Pathomorphology of ependymomas in early childhood. Ped., akush. i gin.  
19 no.2:44-45 '57. (MIRA 13:1)

1. Otdel patomorfologii (zav. otdelom - prof. B.S. Khominskiy) In-  
stituta neyrokhirurgii Ministerstva okhrany zdorov'ya USSR (direktor -  
zasluzhenyy deyatel' nauki prof. A.I. Arutyunov).  
(BRAIN--TUMORS)

VERKHOGLYADOVA, T. P. Cand Med Sci -- (diss) "The pathomorphology of ependymomata."  
L'vov, 1957. 12 pp (L'vov State Med Inst), 200 copies (KL, 5-58, 103)

18(0)

SOV/21-59-1-9/26

AUTHORS: Samsonov, G.V., Koval'chenko, M.S., Verkhoglyadova, T.S.

TITLE: Diffusion of Silicon in Titanium, Tantalum, Molybdenum and Iron (Diffuziya kremniya v titan, tantal, molibden i zhelezo)

PERIODICAL: Dopovidi Akademii nauk Ukrain's'koi RSR, Nr 1, 1959, pp 32-36 (USSR)

ABSTRACT: The authors tell of their study of the diffusion of silicon in the surface of metals, to form protective coatings thereon. Experiments were made on specimens of 99.98% titan, 99.98% molybdenum, ARMCO-iron and 99.6% Ta, 0.4% Nb tantal. Silicon was purified by the method described in reference [ 8 ]. The specimens were treated with silicon in an argon atmosphere, in a solid-phase bath consisting of 97% Si and 3%  $NH_4Cl$ . Ammonium chloride was introduced into the mixture to create  $SiCl_4$ , which accelerates the diffusion and educes

Card 1/3

SOV/21-59-1-9/26

## Diffusion of Silicon in Titanium, Tantalum, Molybdenum and Iron

gaseous HCl, which pickles the metal surface and facilitates the diffusion. The specimens were subjected to saturation at 600-1200°C, at intervals of 100°C, during a period of four hours. It was established that the relative change in weight, height  $\frac{\Delta p}{p}$  of specimens depends on the absolute temperature<sup>p</sup> and time of saturation, as expressed by the empiric equation  $\frac{\Delta p}{p} = \sqrt{A\tau} - \frac{B}{T}$ , wherein  $\frac{\Delta p}{p}$  is the relative change in weight, diameter or height,  $\tau$  is the time of saturation,  $T$  is the absolute temperature, A and B are constants determined experimentally. The experiments showed that at low temperature, a single-layer silicon coating appeared at a high temperature. (1000-1200°C) a double-layer silicon coating appeared. The thicker the silicon layer, the harder the surface.

Card 2/3

SOV/21-59-1-9/26

Diffusion of Silicon in Titanium, Tantalum, Molybdenum and Iron

The principal formations of phases  $TiSi$ ,  $TaSi_2$ ,  $Mo_3Si_2$  and  $FeSi$  were determined, along with the coefficients and activation energy quantities of the diffusion of the above named metals. The results of the study are presented in a table. There are one table, one graph and 12 references, 9 of which are Soviet, 2 English and 1 German.

ASSOCIATION: Institut metallokeramiki i spetsial'nykh splavov AN UkrSSR (Institute of metal-Ceramics and Special Alloys of AS UkrSSR)

PRESENTED: September 17, 1958, by V.N. Svechnikov, Member of the AS UkrSSR

Card 3/3



SOV/170-59-3-8/20

AUTHORS: Samsonov, G.V., Koval'chenko, M.S., and Verkhoglyadova, T.S.

TITLE: An Investigation of the Diffusion of Silicon Into Certain Transition Metals (Issledovaniye diffuzii kremniya v nekotoryye perekhodnyye metally)

PERIODICAL: Inzhenerno-fizicheskiy zhurnal, 1959, Nr 3, pp 62-67 (USSR)

ABSTRACT: The possibility of forming on the metal surface of solid silicide layers is of considerable interest for modern technique in view of their high durability against acids, molten salts, high heat, and their antithermal emission properties. The authors undertook this investigation for studying silicon diffusion into titanium, tantalum, molybdenum and iron by means of surface saturation. Specimens of these metals and silicon powder served as initial materials for the study. The saturation of specimens with silicon was conducted in a solid-phase pool consisting of 97% Si and 3%  $\text{NH}_4\text{Cl}$  by weight. The saturation with silicon was carried out at temperatures from 600 to 1,200°C in the atmosphere of argon. The relative changes in weight  $\frac{\Delta P}{P}$  in dependence on temperature T and saturation time  $\tau$  can be described by the empirical equation:

$$\frac{\Delta P}{P} = \sqrt{A\tau} \exp\left(-\frac{B}{T}\right) \quad (1)$$

Card 1/3

SOV/170-59-3-8/20

An Investigation of the Diffusion of Silicon Into Certain Transition Metals

where A and B are constants determined experimentally. After saturation the specimens were subjected to determination of electric resistance and spark-over voltage, to a metallographic investigation, and to measurements of the layer thickness and microhardness of the phases formed. The electric measurements were performed with a device described by G.B. Klark and G.V. Akimov. [Ref. 9]. The measurements of layer thickness and microhardness were performed with a PMT-3 device, and the results of them are shown in Table 1. The values of the spark-over voltage are given in Table 2 and the values of activation energy and of certain constants contained in the formulae for diffusion coefficients are given in Table 3. The temperature dependence of silicon diffusion coefficients for all the four metals is shown graphically in Figure 2.

Card 2/3

SOV/170-59-3-8/20

An Investigation of the Diffusion of Silicon Into Certain Transition Metals

There are 3 tables, 1 diagram, 1 graph and 12 references,  
9 of which are Soviet, 2 English, and 1 German.

ASSOCIATION: Institut metallokeramiki i spetsplavov AN USSR (Institute  
of Metal-Ceramics and Special Alloys of the AS UkrSSR), Kiyev

Card 3/3

VERKHOGLYADOVA, T. S.

5 (2)  
AUTHORS:Samsonov, G. V., Koval'chenko, M. S.,  
Verkhoglyadova, T. S.

SOV/78-4-12-16/35

TITLE:

Production of Disilicides of Difficultly Fusible Metals

PERIODICAL:

Zhurnal neorganicheskoy khimii, 1959, Vol 4, Nr 12,  
pp 2759 - 2765 (USSR)

ABSTRACT:

Pure, finely powdered Ti, Zr, V, Nb, Ta, Cr, Mo, and W were mixed with silicon powder in stoichiometric ratio, pressed into small briquets and annealed in argon atmosphere at 600-1,200° for 0.5-32 hours. The heating took place in an apparatus depicted in figure 1. The reaction products were analytically tested (under the supervision of T. Ya. Kosolapova) and radio-graphically (RKE and KROS cameras) for free and bound Si. The reaction time needed for the production of completely homogeneous disilicides is given in table 1. There is an exponential relation between reaction temperature and reaction time (Fig 3), which allowed to calculate the activation energy for the diffusion of Si into the metals. The values of this energy are likewise listed in table 1 and compared with the data given in reference 6 for the activation energy during Si diffusion into compact metal. The fact that the activation energy of metallic

Card 1/3

Production of Disilicides of Difficultly Fusible Metals 80V/78-4-12-16/35

powder is much higher is explained by the crystallization pressure occurring in the formation of disilicide particles which interrupts the contact between metallic and Si particles not yet entered into reaction and complicates diffusion (Refs 7,8). The effect of diffusion-inhibiting oxide films is also likely to be more strongly pronounced in the case of pulverulent mixtures. As a variant, the authors investigated formation of disilicides by vacuum reduction of the metallic oxides according to the formula  $Me_xO_y + zSi = Me_xSi_{z-y} + ySiO$  and checked the beginning of the reaction by measuring the pressure which rose as a result of SiO formation. The results obtained for Ti, V, Nb, and Ta are listed in table 3. This method requires a more complicated apparatus and is more difficult to employ in industry than the direct fusion of metal with silicon. Furthermore, it yields less pure products and is inappropriate for metals with volatile oxides (Mo, W). The optimum conditions for a direct reaction between metal and silicon are:  $TiSi_2$  1000 C, 2 hours;  $ZrSi_2$  1000 C, 2 hours;  $VSi_2$  1200 C, 0.5 hours;  $NbSi_2$  1000 C, 0.5 hours;  $TaSi_2$  < 1100 C < hours;  $CrSi_2$ ,  $MoSi_2$  and  $WSi_2$  1000 C, 0.5 hours.

Card 2/3

Production of Disilicides of Difficultly Fusible Metals SOV/78-4-12-16/35

L. M. Khrenova, G. N. Makarenko, and V. P. Dseganovskiy assisted in the experiments. There are 4 figures, 3 tables, and 11 references, 6 of which are Soviet.

ASSOCIATION: Institut metallokeramiki i spetsialnykh spлавov Akademii nauk USSR  
(Institute of Cermets and Special Alloys of the  
Academy of Sciences, UkrSSR)

SUBMITTED: July 2, 1958

Card 3/3

17.4311  
26.218!  
AUTHORS:

S/180/61/000/001/013/015  
E021/E406

Bolgar, A.S., Verkhoglyadova, T.S. and Samsonov, G.V.  
(Kiyev)

TITLE:

The Vapour Pressure and Rate of Evaporation of Several  
Refractory Compounds in a Vacuum at High Temperatures

PERIODICAL:

Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh  
nauk, Metallurgiya i toplivo, 1961, No.1, pp.142-145

TEXT:

The vapour pressure and rate of evaporation in a vacuum of  
the borides of titanium, zirconium, chromium, strontium; the  
carbides of titanium, zirconium, chromium; the silicides of  
molybdenum and the nitrides of titanium, niobium and tantalum were  
studied. The rate of evaporation was measured by the method of  
Langmuir, based on the decrease in weight of the material from unit  
surface in unit time. The apparatus used was based on a vacuum  
laboratory furnace. Measurements could be made in the range  
1100 to 1900°C and the temperature was measured by an optical  
pyrometer. The results are given in Table 2 and in Fig.2.  
Table 3 gives comparative data on the change in composition when  
heated at 1700°C in vacuo. It can be seen that all the compounds  
evaporate as molecular complexes except AlB<sub>12</sub> which dissociates with  
Card 1/1

89631

S/180/61/000/001/013/015  
E021/E406

The Vapour Pressure and ...

evolution of aluminium. The heats of evaporation are given in Table 4. There are 2 figures, 4 tables and 12 references: 9 Soviet and 3 English.

ASSOCIATION: Institut metallokeramiki i spetsplavov AN UkrSSR  
(Institute of Cermets and Special Alloys AS UkrSSR)

SUBMITTED: August 7, 1960

Caption to Table 2.

The temperature relationship of the vapour pressure (bottom line in  $p \times 10^5$  mm Hg) and rates of evaporation (top line in  $g/cm^2 \text{ sec}$ ) of the studied compounds.

Card 2/2



36128

S/137/62/000/003/061/191

A006/A101

21.2110  
15.2240

AUTHORS: Verkhoglyadova, T. S., Dubovik, T. V., Samsónov, G. V.

TITLE: Nitration of transition metal powders with the formation of nitride phases

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 3, 1962, 40, abstract 36277 ("Poroshk. metallurgiya", 1961, no. 4, 9 - 20, English summary)

TEXT: The authors studied kinetics of nitration of Ti, Zr, V, Nb, Ta, Mo, Cr and Re powders at 500 - 1,200°C. On the basis of X-ray and chemical analyses of the compounds obtained, the optimum nitration conditions were established. The constants of the rate and activation energy of nitration were calculated from kinetics of overweight of the reaction products. For nitrides of Ti and Zr, V(VN), Nb(NbN), Ta(TaN), Cr(Cr<sub>2</sub>N), the optimum nitration temperature is 1,200°C; for V<sub>3</sub>N, Nb<sub>2</sub>N, Ta<sub>2</sub>N, CrN it is 900°C; for Mo<sub>2</sub>N - 700°C and for Re<sub>3</sub>N it is 300 - 350°C.

[Abstracter's note: Complete translation]

R. Andriyevskiy

Card 1/1

SAMSONOV, G.V.; VERKHOGLYADOVA, T.S.

Hardness of transition metal nitrides. Zhur.strukt.khim. 2  
no. 5:617-618 S-0 '61. (MIRA 14:11)

1. Institut metallokeramiki i spetsial'nykh splavov AN USSR.  
(Nitrogen alloys) (Hardness)

30178

152240

S/078/61/005/012/004/001  
B110/B147AUTHORS: Samsonov, G. V., Verkhoglyadova, T. S.

TITLE: Nitration of powdery niobium and some properties of phases formed

PERIODICAL: Zhurnal neorganicheskoy khimii, v. 6, no. 12, 1961, 2732-2737

TEXT: Nitration conditions for the formation of niobium nitrides of various compositions, and the determination of their physical characteristics were studied. Nb powder with a cubic lattice constant  $a = 3.29 \text{ \AA}$  and a particle size of  $2 - 7 \mu$ , sodiothermally obtained from  $K_2NbOF_5$ , was

used. Nitration was carried out in a special unit (Fig. 3). According to experimental results, a solid solution of N in Nb ( $\alpha$ -phase) forms after short nitration (15 - 30 min) at  $< 500^\circ\text{C}$ . At  $600 - 1200^\circ\text{C}$ , a mixture of the nitride phases  $\beta, \epsilon, \delta'$ , and  $\xi$  is formed. After 30 - 60 min, other phases form at  $900^\circ\text{C}$   $Nb_2N$  ( $\beta$ -phase) and  $1200^\circ\text{C}$   $NbN$  ( $\xi'$ -phase) without admixtures  $\alpha, \beta, \gamma, \delta'$ , and  $\xi$ -phases were found radiographically. The Card 1/8

30178

S/078/61/005/012/001/001  
B110/B147

Nitration of powdery niobium and ...

lattice constant of Nb increases from 3.29 to 3.35 Å with an N concentration  $\leq 0.7\%$  by weight, that of Nb<sub>2</sub>N ( $\beta$ -phase) (Nb = 92.0%; N = 7.1%) was: a = 3.04; c = 4.98 Å. The  $\gamma$ -phase only obtained in a mixture with other nitrides has the lattice constants: a = 3.22; c = 3.33 Å. The lattice constants of the  $\delta$ - and  $\epsilon$ -phases which are sufficiently constant at a high N content, were: a = 2.97; c = 5.55 Å for the  $\delta$ -phase (Nb = 86.8%, N = 12.5%), and a = 2.99; c = 11.16 Å for the  $\epsilon$ -phase (Nb = 86.95%; N = 13.1%). A study of the nitration curves (dependence of  $\log \% N - \log \tau$ ; N = N content,  $\tau$  = time of nitration) showed that the nitrogen saturation was linear for a time of 15 - 120 min and with formation of  $\delta$ Nb and one-phase Nb<sub>2</sub>N, and parabolic with formation of NbN<sub>2</sub>.

The rate of N<sub>2</sub> stream does not affect the composition of nitration products. The rate of furnace heating, however, has a considerable effect. On the semilogarithmical curve of temperature dependence of the rate constants, the sections of: (1) formation of the solid solution of N in Nb ( $\alpha$ -phase); (2)  $\beta$ -phase, (3)  $\epsilon$ -phase are distinguished. The activation energies are:  $\alpha$ -phase = 7260,  $\beta$ -phase = 7680,  $\epsilon$ -phase = 10,000 cal/mole. This corresponds to the lower heat of formation of NbN (from elements).  
Card 2/1

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S/073/61/006/012/004/013  
B110/B147

Nitration of powdery niobium and ...

which is 56.8 kcal/mole ( $Nb_2N = 61.1$  kcal/mole), and to less firm Nb-N bonds, whereas the Nb-Nb bonds of  $Nb_2N$  are firm. The microhardnesses of NbN =  $1396 \pm 26$  and  $Nb_2N = 1720 \pm 100$  kg/mm<sup>3</sup> obtained by hot pressing of powdery nitration products at 1850 - 1900°C and 120 - 150 kg/cm<sup>2</sup> were in good agreement with the ratios of the heats of formation of the nitration reaction and coefficients of thermal expansion ( $Nb_2N = 3.26 \cdot 10^{-6}$ , NbN =  $10.1 \cdot 10^{-6}$  degree<sup>-1</sup>). Measurements of the specific gravities of sintered specimens yielded extreme values on the curves of dependence of the specific gravities of the N concentration in the alloys. They correspond to the N concentration in the solid solution of Nb and in the nitride phases  $\beta$  and  $\epsilon$ . The thermo-emf of NbN was 5.0  $\mu$ v/degree. The thermo-emf of  $Nb_2N$  increased linearly with the temperature from 5 to 9 at 180°C and to 15.5 at 750°C. The resistivity of nitride phases increases as the N content decreases, due to the increase of Nb-Nb bonds, i. e., increase of the ion component in the bond. Thus, energy disruptions causing semiconductor properties are to be expected in N

Card 3/9 4

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Nitration of powdery niobium and ...

B110/B147

impoverishment ( $\beta$ -phase) and decrease of the lattice defectiveness. The temperature dependence of the vapor pressure of NbN:  $\log p = 5.1 - 20,000/T$ , measured according to the Langmuir method, yielded a vaporization heat of 91.5 kcal/mole, and a boiling point of  $\sim 3700^\circ\text{C}$  at 1 atm. The authors thank Professor G. A. Meyerson for advice. There are 8 figures, 3 tables, and 7 references: 3 Soviet and 4 non-Soviet. The three references to English-language publications read as follows: B. Matthias. J. Phys. Rev., 92, 874 (1953); E. Gulbransen, K. Andrew. J. Metals., 2, 586 (1950); G. Brauner. J. Metals, 2, 131 (1960).

ASSOCIATION: Institut metallokeramiki i spetsial'nykh splavov AN USSR  
(Institute of Powder Metallurgy and Special Alloys AS UkrSSR)

SUBMITTED: October 6, 1960

Fig. 3. Diagram of nitration unit. Legend: (1) nitrogen bomb; (2) furnace with Cu filings; (3) and (6) traps; (4) absorption cylinders with Cu filings in  $\text{NH}_4\text{Cl}$  solution; (5) absorber with  $\text{H}_2\text{SO}_4$ ; (7) absorbers with

Card 4/0

15 2240

<sup>30450</sup>  
S/126/61/012/003/004/021  
E021/E180

AUTHORS: Vaynshteyn, E.Ye., Verkhoglyadova, T.S.,  
Zhurakovskiy, Ye.A., and Samsonov, G.V.

TITLE: The fine structure of X-ray absorption K-spectra of  
the metal in the homogeneous region of titanium  
nitride

PERIODICAL: Fizika metallov i metallovedeniye, v. 12, no.3, 1961,  
360-364

TEXT: X-ray spectrographic studies of titanium carbide were  
published earlier. The present work investigated the effect of  
concentration changes of the titanium nitrogen system in the  
region where only the phase TiN exists (30-50 at.% N). Samples  
containing 11.7, 12.8, 14.7, 15.4, 17.5, 18.1, 18.8, 20.6, 21.2  
and 22.4 wt.% nitrogen were prepared by the method given by Samsonov  
and his team (Ref.5: Sb. Metallokeramicheskiye materialy i  
metody ikh issledovaniya, AN USSR, Kiyev, 1959, p.53 (Symposium:  
Cermets and methods of studying them, AS Ukr.SSR, Kiev, 1959, p.53).  
X-ray phase analysis showed that in all the specimens only one  
phase existed with a NaCl-type lattice having a parameter  
Card 1/3

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S/126/61/012/003/004/021  
E021/E180

The fine structure of X-ray ....

increasing from 4.212 to 4.235 kX with increasing nitrogen content. X-ray spectrographic studies were carried out on apparatus described earlier by I.B. Staryy, (Ref.7: Izv. AN SSSR, ser. fiz., 1958, Vol.20, 798). The crystalline structure of titanium nitride is always octahedral. Decreasing nitrogen content in the nitride phase, although maintaining the octahedral coordination, should lead to a reduction in the role of the p-functions, decreasing their contribution to the d-band and therefore decreasing the coefficient of absorption in the corresponding spectral region; this was actually observed for all compositions, except those with 21.2 and 22.4 wt.% nitrogen, which very nearly correspond to the stoichiometric composition of TiN. Another explanation of the change in the fine structure of absorption spectra is that in the nitride phase there is a considerable ionic component in the bonds which decreases with transition from the samples deficient in nitrogen to the compound with stoichiometric composition. This is confirmed by results of measurements of the electrical properties and microhardness of the samples. S.N. L'vov and V.F. Nemchenko are mentioned in the article for their contributions in this field.

Card 2/3



30450

The fine structure of X-ray ....

S/126/61/012/003/004/021  
E021/E180

There are 2 figures and 16 references: 13 Soviet-bloc and 3 non-Soviet-bloc. The English language reference reads as follows:  
Ref.12: G. Kimball, J. Chem. Phys., 1940, Vol.8, 188.

ASSOCIATION: Institut metallokeramiki i spetsial'nykh splavov  
AN USSR (Institute of Powder Metallurgy and Special  
Alloys, AS Ukr.SSR)  
Institut neorganicheskoy khimii Sibirskogo  
otdeleniya AN SSSR (Institute of Inorganic  
Chemistry, Siberian Department AS USSR)

SUBMITTED: January 2, 1961

X

Card 3/3

15 2640  
24 7700

31-59  
S/126/61/012/004/021/021  
E073/E535

AUTHORS: Verkhoglyadova, T.S., L'vov, S.N., Nemchenko, V.F.  
and Samsonov, G.V.

TITLE: Electric and galvanomagnetic properties of chromium  
nitrides

PERIODICAL: Fizika metallov i metallovedeniye, v.12, no.4, 1961,  
622-624

TEXT: In the system chromium-nitrogen two stable nitride  
phases are known - Cr<sub>2</sub>N and CrN. According to one of the authors  
(Ref.1: Samsonov G.V. Zhurnal strukturnoy khimii, 1960, 1, 447)  
these are characterized by a combination of metallic and ionic  
bonds, whereby the latter predominate to some extent. This is  
due to the high ionization potential of the nitrogen atom and the  
low acceptor ability of the incomplete d-shell of the chromium  
atom. This assumption on the nature of the chemical bond in  
nitride phases of chromium is confirmed by the results of X-ray  
structural investigations, according to which the chemical bond in  
the higher nitride Cr<sub>2</sub>N approaches the type of bond of the  
chromium oxide Cr<sub>2</sub>O<sub>3</sub>. In this paper the electric and galvano-  
Card 1/54

IX

Electric and galvanomagnetic ...

3009  
S/126/61/012/004/021/021  
EO73/E535

magnetic properties of chromium nitrides are studied. The compact specimens were produced by sintering briquettes with a porosity of 20-25% pressed from powder of electrolytic chromium. The sintering was at 950°C (for alloys with a composition approaching CrN) to 1300°C (for alloys approaching the composition of Cr<sub>2</sub>N) for durations of 3 to 4 hours in nitrogen which was carefully purified from oxygen. The porosity of the specimens varied between 0 and 5%. This method of preparing specimens enabled avoiding changes in their phase state and the formation of carbonitride phases which are unavoidable in hot pressing of preliminarily manufactured chromium nitride powders. From thus produced specimens the specific electric resistance  $\rho$  and the absolute coefficient of thermo e.m.f.  $\alpha_T$ , the Hall coefficient  $R$  and the thermal conductivity  $\kappa$  were determined. The results are entered in a table, which also contains data from the literature for pure chromium as published by A. Ye Vol (Ref.4: Stroyeniye i svoystva dvoynnykh metallicheskih sistem\*, v.1, Fizmatgiz, M., 1959) and S. Foner (Ref.5: Phys.Rev., 1957, 107, 1513). It was found that in contrast to most of the intermediate phases (including chromium Card 2/7 4 \* (Structure and properties of binary metallic systems)

Electric and galvanomagnetic ...

3109  
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E073/E535

carbides), the resistance of chromium nitrides increases from the lower nitrides to the higher ones. Similarly, the Hall coefficient and the thermo e.m.f. coefficient increase with increasing nitrogen content. On the other hand, the thermal conductivity of the higher chromium nitrides is lower than of the lower chromium nitrides. This behaviour can be qualitatively explained on the basis of the electron structure of chromium proposed by Ye. S. Borovik and V. T. Volotskaya (Ref.7: ZhETF, 1959, 36, 1650) who assumed that the electric conductivity of Cr is basically due to highly mobile holes and electrons in the overlapping 4s- and 4p-bands. With some degree of approximation this enables utilizing the known expressions of the Hall coefficient and the electric conductivity for the case of two types of carriers and to determine the numerator  $(n_{-}u_{-}^2 - n_{+}u_{+}^2) = \delta$  of the Hall coefficient. The appropriate values are given in the table. X  
The chromium nitride CrN can be classified as an electron semiconductor, the use of which is promising as a negative branch of high temperature thermocouples (particularly for operation inside nitrogen) and also for producing thermoelectric transducers of heat  
Card 3/34

Electric and galvanomagnetic ...

3167  
S/126/61/012/004/021/021  
E073/E535

into electricity with an efficiency of up to 18-20% if paired for instance with MnSi. There are 1 table and 8 references: 7 Soviet-bloc and 1 non-Soviet-bloc. The English-language reference is quoted in the text. y

ASSOCIATIONS: Institut metallokeramiki i spetsial'nykh splavov AN UkrSSR (Institute for Cermets and Special Alloys AS UkrSSR) and Khersonskiy pedagogicheskiy imeni N.K.Krupskoy (Kherson Pedagogic Institute imeni N.K.Krupskaya)

SUBMITTED: March 7, 1961

Card 4/5/4

23833

S/020/61/138/002/016/024  
B104/B207

18.7530 3209, 1454, 2808

AUTHORS: Samsonov, G. V. and Verkhoglyadova, T. S.

TITLE: The physical properties of titanium nitride in the region of homogeneity

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 138, no. 2, 1961, 342-343

TEXT: The authors investigated the microhardness and resistivity of nitrogen - titanium alloys in the region of homogeneity of the TiN phase. Microhardness was determined on powders which had been prepared by nitration of pure Ti powder (99.8 % Ti, 0.1 % Ca, 0.09 % Fe and 0.02 % H). The powders contained 35.6-49.8 % N. Briquets were sintered (pressed with 2-4 tons/cm<sup>2</sup>, sintered at 900-1300°C for 2-4 hr) to measure the resistance. Subsequently, the samples contained 34.7-49.8 % N. Fig. 1 graphically shows the microhardness, determined with a load of 50 g, as a function of the nitrogen content. Figs. 2 and 3 show the resistance at room temperature and high temperature (up to 2000°C). The microhardness of TiN depends linearly on N in the same way as the microhardness of TiC, ZrC, Ta<sub>2</sub>C and

X

Card 1/3

23833

The physical properties of titanium...

S/020/61/138/002/016/024  
B104/B207

X

TaC on the C content. For carbides, however, extrapolation of the microhardness to 0 % C gives approximately the microhardness of the metal. This is not the case for TiN. The authors explain this by the fact that a considerable amount of ionic bond occurs in TiN which causes the chemical bond, the electron structure, and the electron density to assume a form different from that of carbides; in the latter, electron structure, chemical bond, and electron density are similar as in metals. This is due to formation of metal-metal bonds causing a reduction of the titanium electron ratio in the bonds with nitrogen, a lesser disturbance of the nitrogen valency electrons and a corresponding increase of the energy difference between the nitrogen and titanium atoms. Therefore, the dependence of the resistance of titanium nitride differs from that of titanium carbide (Fig. 2). Fig. 3 shows that TiN with approximately stoichiometric nitrogen content (48.4 %) reveals an almost linear function between resistance and temperature. A maximum occurs at 1800°C. From these diagrams the authors conclude that in the regions of homogeneity of this compound, a reduction of the nitrogen content affects an increase of the ion bond. Finally, it is stated that the same effect may also be expected in the nitrides of other transition metals. There are 3 figures

Card 2/3 3

23833

The physical properties of titanium...  
and 9 Soviet-bloc references.

S/020/61/138/002/016/024  
B104/B207

ASSOCIATION: Institut metallokeramiki i spetsial'nykh splavov Akademii nauk USSR (Institute of Powder Metallurgy and Special Alloys, Academy of Sciences UkrSSR)

PRESENTED: January 4, 1961, by G. V. Kurdyumov, Academician

SUBMITTED: December 29, 1960

X

Card 3/0 3



32417

S/021/62/000/001/006/007  
D251/D303

15.2230

21.2100

AUTHORS: Samsonov, G.V., Corresponding Member AS UkrSSR, and Verkhohlyadova, T.S.

TITLE: Physical properties of zirconium nitride in the homogeneity region

PERIODICAL: Akademiya nauk Ukrayins'koyi RSR. Dopovidni, no. 1, 1962, 48 - 50

TEXT: The authors investigated the properties of 99.96 % pure zirconium nitride powder, prepared by a method similar to that described for titanium nitride in T.S. Verkhohlyadova, T.V. Dubovik and G.V. Samsonov (Ref. 4: Poroshkovaya metallurgiya, 1, 4, 1961). X-ray analysis showed that the homogeneity region of zirconium nitride lies between 40 - 50 at.% of nitrogen (9.5 - 13.3 % by weight). A table is given of the physical properties of zirconium nitride in this region. By comparisons of the specific conductivity, microstrength and temperature-concentration of zirconium nitride and titanium nitride, it is shown that the role of the ionic bond in

Card 1/2

Physical properties of zirconium ... <sup>32417</sup> S/021/62/000/001/006/007  
D251/D303

the zirconium nitride lattice increases in this region as the nitrogen content decreases, and that this increase is higher than in the corresponding homogeneity region of titanium nitride. It is stated that this phenomenon is due to the fact that the d-shell of electrons is less unfilled in the zirconium atom than in titanium. There is 1 table, 3 figures and 4 references: 3 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: D. Domagala, D. Pherson, and M. Hansen, J. of Metals, 8, 98, 1956. ✓

ASSOCIATION: Institut metalokeramiki ta spetsial'nykh splaviv AN URSR (Institute of Metal Powders and Special Alloys of the AS UkrSSR)

SUBMITTED: June 28, 1961

Card 2/2

15.2600  
15.2240

34752

S/020/62/142/003/019/027  
B106/B110

AUTHORS: Samsonov, G. V., and Verkhoglyadova, T. S.

TITLE: Physical properties of nitrides of transition metals

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 142, no. 3, 1962, 608 - 611

TEXT: In continuation of a systematic study of electrical properties and hardness of the nitrides of transition metals, the authors determined electrical resistivity, thermo-e.m.f, Hall effect, microhardness, thermal conductivity, and melting point of titanium, zirconium, hafnium, vanadium, niobium, tantalum, chromium, and molybdenum nitrides. They nitrided metals into nitrides excluding the possibility of oxygen impurities and simultaneous or subsequent sintering in a nitrogen atmosphere. Samples of various porosities were used for measurements which were extrapolated for zero porosity (for electrical properties according to a formula by V. I. Odelevskiy (Ref. 6: ZhTF, 21, 667 (1951)) for thermal conductivity according to the formula of Ref. 7 (see below)). Table 1 shows the results of measurement. All nitrides studied except for vanadium, niobium, and molybdenum nitrides, mainly show n-type conductivity. Thermo-e.m.f.

Card 1/4

Physical properties of nitrides...

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B106/B110

coefficients increase almost linearly as the receptivity of empty d-shells increases, which can be estimated from the ratio  $1/Nn$  ( $N$  = main quantum number of incompletely filled d-shells;  $n$  = number of electrons in it). The electrical resistivity of the nitrides in question decreases with decreasing degree of d-shell filling. This fact, together with the character of the change of thermo-e.m.f. coefficients indicates an increasing number of transitions of valence electrons of nitrogen into the d-shells of metal atoms under formation of spd-hybrid conditions and reduction of the polarization degree of the metal - nitrogen bond. The decrease of the electrical resistivity with increasing nitrogen content in the systems V - N, Nb - N, and Ta - N corresponds to the decrease of the ion bond portion. The thermal conductivity decreases as the portion of ion bonds increases. Experimental data on the thermal conductivity of all nitrides studied, except tantalum and chromium nitrides, agree more or less with the values calculated for n-type conductivity. As to tantalum and chromium nitrides, the values measured exceed by far those obtained by calculation. This suggests predominant thermal conductivity of the crystal lattices of these nitrides. The results of microhardness measurements confirm the assumption of A. M. Belikov and Ya. S. Umanskiy (Ref. 15):

Card 2/5

Physical properties of nitrides...

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B106/B110

Nauchn. dokl. vyssh. shkoly, no. 1, 192 (1958)) on the weakening of the Me-Me cohesive forces during the penetration of nonmetallic atoms into the crystal lattices of metals. For the nitride phases  $Me_2N$ , the Me-Me bond remains predominant, whereas the weaker Me-N bond prevails in MeN phases. This is also confirmed by higher melting points of  $Me_2N$  phases.

In conclusion it is assumed that transition metals of group IV whose d-shells are almost empty, combine with hardly ionizable nitrogen into nitrides with a prevailing number of metal bonds. An energy gap appears between the sd-states of metals and p-states of nitrogen as the nitrogen content decreases in the homogeneous regions of these phases. This causes semiconducting properties. In the nitrides of the transition metals of groups V and VI whose d-shells are filled to a larger extent, the portion of ion bonds is higher, the homogeneous regions are smaller, and a hexagonal structure of mononitrides stabilizes. Stable  $Me_2N$  nitrides form.

The semiconducting character of mononitrides increases as the degree of d-shell filling increases. As to chemical bonds in nitride lattices, the previous assumption (Ref. 1: G. V. Samsonov, Zhurn. strukturn. khim., 1, 447 (1960)) that titanium, zirconium, hafnium, and vanadium nitrides mainly  
Card 3/5

Physical properties of nitrides...

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B106/B110

have metal bonds, whereas molybdenum and apparently also tungsten nitrides mainly have ion bonds. Both, metal and ion bonds occur in niobium, tantalum, and chromium nitride lattices. Ion bonds, however, are slightly predominant. There are 2 figures, 2 tables, and 15 references: 14 Soviet and 1 non-Soviet. The reference to the English-language publication reads as follows: J. Vasilos, W. Kingery, J. Am. Ceram. Soc., 37, 409 (1954).

ASSOCIATION: Institut metallokeramiki i spetsial'nykh splavov Akademii nauk USSR (Institute of Powder Metallurgy and Special Alloys of the Academy of Sciences UkrSSR)

PRESENTED: September 2, 1961, by A. N. Frumkin, Academician

SUBMITTED: August 21, 1961

Table 1. Physical properties of the nitrides of transition metals.

Legend: (1) nitride; (2) nitrogen content; (a) % by weight; (b) atom%; (3) coefficient of thermo-e.m.f. (abs) $\alpha$ ,  $\mu\text{v}/\text{degree}$ ; (4) electrical resistivity,  $\rho$ ,  $\mu\text{ohm}\cdot\text{cm}$ ; (5) Hall coefficient,  $R$ ,  $\text{cm}^3/\text{coul}$ ; (6) thermal Card 4/5

SAMSONOV, G.V.; VERKHOGLYADOVA, T.S.

Physical properties of transition metal nitrides. Dokl. AN SSSR  
142 no.3:608-611 Ja '62. (MIRA 15:1)

1. Institut metallokeramiki i spetsial'nykh splavov AN USSR.  
Predstavleno akademikom A.N.Frumkinym.  
(Transition metal nitrides)

34481  
S/020/62/142/004/018/022  
B101/B110

15.2240

AUTHORS: Samsonov, G. V., Verkhoglyadova, T. S., L'vov, S. N. and Nemchenko, V. F.

TITLE: Effect of oxygen on the electric properties of titanium nitride

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 142, no. 4, 1962, 862 - 865

TEXT: The electric properties of TiN, in the lattice of which N was stepwise substituted by O, were investigated. The TiN - TiO melts were obtained by treating a mixture  $TiO_2 + Ti$  for 4 hr with  $NH_3$  at  $800^\circ C$

(reduction of  $TiO_2$ ) and 4 hr at  $1300^\circ C$  (formation of TiN and solid solutions of TiN + TiO). Metallographic investigation and X-ray diffraction proved that the melts were monophasic. The electric properties changing with the TiO content were: ✓

Card 1/3



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B101/B110

Effect of oxygen on the...

Mole%		I	II	III	Mole%		I	II	III
TiN	TiO				TiN	TiO			
100	0	26	-0.67	-9.3	62.7	37.3	12.7	-1.36	-8.6
90	10	17.9	-0.4	-7.1	47.6	52.4	14.2	-1.64	-
79.6	20.4	13.1	-0.17	-6.4	46.7	53.3	-	-1.70	-13.4
73.1	26.9	11.3	-0.48	-0.75	46.0	54.0	14.3	-2.02	-
65.0	35.0	12.1	-0.82	-	41.8	58.2	27.0	-2.64	-

I = electric resistivity,  $\mu\text{ohm}\cdot\text{cm}$ ; II = Hall coefficient  $R \cdot 10^4$ ,  $\text{cm}^3/\text{coulomb}$ ; III = coefficient of thermo-emf,  $\mu\text{v}/\text{deg}$ . The course of the electric resistance points to a superimposition of two factors: at low O content, the effect of its lower ionization potential, as compared with N, predominates; at high O content, the effect of the larger atom radius, as compared with N, predominates, thus reducing the overlapping of energy bands, and increasing the lattice spacing. All melts investigated showed reversal of the sign of the temperature coefficient of the electric resistance (Fig. 4) when a certain temperature was reached. The earlier passage through the maximum for melts rich in TiO is caused by the geometric factor: the larger radius of the oxygen ion. The pointed

Card 2/4

Effect of oxygen on the...

S/O20/62/142/004/018/022  
B101/B110

maxima correspond to the preponderant effect of one of the two nonmetals, the flat maxima correspond to the combined action of both nonmetals. Similar electric properties are assumed for the systems ZrN - ZrO, and HfN - HfO. There are 4 figures, 2 tables, and 6 references: 4 Soviet and 2 non-Soviet. The reference to the English-language publication reads as follows: A. Münster, K. Sagel, G. Schlamp, Nature, 174, 1154 (1954).

ASSOCIATION: Institut metallokeramiki i spetsial'nykh splavov Akademii nauk USSR (Institute of Powder Metallurgy and Special Alloys of the Academy of Sciences UkrSSR). Khersonskiy pedagogicheskiy institut im. N. K. Krupskoy (Kherson Pedagogical Institute imeni N. K. Krupskaya) ✓

PRESENTED: September 14, 1961, by G. V. Kurdyumov, Academician

SUBMITTED: September 1, 1961

Card 3/4

SAMSONOV, G.V ; VERKHOGLYADOVA, T.S.; L'VOV, S.N.; SEMCHENKO, V.F.

Effect of oxygen on the electric properties of titanium nitride. Dokl. AN SSSR 142 no.4:862-865 F '62.

(MIRA 15:2)

1. Institut metallokeramiki i spetsial'nykh splavov AN USSR i  
Mhersonskiy pedagogicheskiy institut im. N.K.Krupskoy.  
Predstavleno akademikom G.V.Kurdyumovym.

(Titanium nitride—Electric properties)  
(Oxygen)

L'VOV, S.N.; NEMCHENKO, V.F.; KISLYY, P.S.; VERKHOGLYADOVA, T.S.;  
KOSOLAPCVA, T.Ya.

Electric properties of chromium borides, carbides, and nitrides.  
Porosh.met. 2 no.4:20-25 J1-Ag '62. (MIRA 15:8)

1. Khersonskiy gosudarstvennyy pedagogicheskiy institut imeni  
Krupskoy i Institut metallokeramiki i spetsial'nykh splavov AN  
UkrSSR.

(Chromium compounds--Electric properties)  
(Ceramic metals--Electric properties)

KORSUNSKIY, M.I.; GENKIN, Ya.Ye.; VERKHOGLYADOVA, T.S.

Corrected  $LB_2$  niobium emission band and bonding forces in the  
system niobium - nitrogen. Porosh.met. 2 no.4:35-38 J1-Ag '62.  
(MIFA 15:8)

1. Khar'kovskiy politekhnicheskii institut imeni V.I.Lenina i  
Institut metallokeramiki i spetsial'nykh splavov AN UkrSSR.  
(X-ray spectroscopy) (Crystal lattices)

3/220/62/000/004/003/012  
1003/1203

AUTHORS: L'vov, S.M., Melchenko, V.F., Kislyy, P.S., Verkhoglyadova, T.S.  
and Kosolapova, T.Ya.

TITLE: Electric properties of borides, carbides, and nitrides of chromium

PERIODICAL: Poroshkovaya Metallurgiya, no.4, 1962, 20-25

TEXT: The electric properties of the above compounds have not been sufficiently investigated. In the present work the electric resistivity, the Hall effect, the thermal emf, the thermal coefficient of electric resistivity and the coefficient of heat conductivity  $\eta$  of all borides, and nitrides of chromium were investigated at room temperature. The influence of carbon, boron, and nitrogen on the electric properties of their compounds with chromium is in good agreement with the regularities displayed by the borides, carbides, and nitrides of all group IV-VI transition metals. There are 3 figures and 1 table. ✓

ASSOCIATION: Khersonskiy gosudarstvennyy pedagogicheskiy institut im. N.K.  
Krupskoi i Institut metallokeramik i spetsial'nykh splavov AN USSR

Card 1/2

S/226/62/000/004/003/012  
1003/1203

Electric properties of borides, carbides...

(The Kherson Government Pedagogical Institut im. N.K. Krupskaya, and  
the Institute of Metal Ceramics and Special Alloys AS UkrSSR)

SUBMITTED: January 15, 1962

Card 2/2

CONFERENCE ON BORON, ITS COMPOUNDS, AND ITS ALLOYS (USSR)

Verkhoglyadova, T. S. IN: Akademiya nauk Ukr RSR. Dopovidi, no. 3, 1963, 419. S/021/63/000/003/022/022

A conference on boron and its compounds and alloys, sponsored by the Division of the Metallurgy of Rare Metals and Heat-Resistant Compounds, Institute of Powder Metallurgy and Special Alloys, Ukrainian Academy of Sciences, was held 11-14 December 1962 in Kiev. The conference was attended by 150 representatives from 30 institutions of scientific research and higher education. The 55 reports presented dealt with the processing of raw materials containing boron, the technology of producing pure and semiconductor-grade boron, the hydrochemistry of boron, boron diffusion coatings, chemical processes in the formation of borides of rare transition metals and rare-earth metals and of double borides, physical and chemical properties of borides and their use in modern technology, and the behavior and properties of boride phases after nuclear irradiation.

[MS]

Card 1/1



L'VOV, S.N. [L'vov, S.M.]; NEMCHENKO, V.F. [Niemchenko, V.P.];  
SAMSONOV, G.V. [Samsonov, H.V.]; VERKHOGLYADOVA, T.S.  
[Verkhohliadova, T.S.]

Semiconductor electroconductivity of refractory nitrides. Ukr.  
fiz. zhur. 8 no.12:1372-1377 D '63. (MIRA 17:4)

1. Khersonskiy pedagogicheskiy institut im. Krupskoy i  
Institut metallokeramiki i spetsial'nykh splavov AN UkrSSR.

VERKHOGLYADOVA, T.S. [Verkhobliadova, T.S.]

Conference on boron, its compounds and alloys. Dop. AN URSR no.3:  
419 '63. (MIRA 17:10)

13901-65

SECRET

[Faint, mostly illegible text, possibly a list or report content]

Card 177

change in the 1970s... metals... indicated

SUBMITTED: 08 Jun 64

ENCL: 00

NO REF SOV: 011

ACCESSION NR: AP4021977

S/0073/64/030/002/0143/0146

AUTHOR: Samsonov, G. V.; Verkhoglyadova, T. S.

TITLE: Production of rhenium nitride

SOURCE: Ukrainskiy khimicheskii zhurnal, v. 30, no. 2, 1964, 143-146

TOPIC TAGS: rhenium nitride,  $Re_2N$ , production, rhenium nitriding, superconductor, semiconductor, ammonium perrhenate, x ray analysis, rhenium nitride lattice

ABSTRACT: The conditions were investigated for the production of rhenium nitride, especially interesting because of their superconducting and semiconductor properties and the high ionization potential (14, 51 ev) of the nitrogen atom. Reactions were run with powdered rhenium and ammonium perrhenate with nitrogen and with ammonia in the absence of atmospheric oxygen. The resultant products were subjected to chemical and x-ray analysis. Rhenium and nitrogen heated to 300-900C for 15 and 240 minutes do not form nitrides. Rheni-

Card 1/2

ACCESSION NR: AP4021977

um and ammonia form a product containing some nitrogen at 250C; at 600C the nitrogen content in the product is about 3.5%, approximately equivalent to the formula  $Re_2N$ . The nitrogen content is highest after short periods of heating and decreases with prolonged nitriding (250-1200C), e. g. 4.28% in 30 min., reduced to 2.9% in 60 min. at 500C. This may be caused by the original formation of metastable products which gradually change to the stable nitrides. On heating ammonium perrhenate with ammonia, nitriding starts at 300C, and the nitrogen content again decreases with prolonged nitriding, e. g. from 7.3% in 1/4 hour to 0.85% in 23 hours. X-ray analysis showed the products ranging from  $Re_2N$  to  $Re_3N$  have cubic face-centered lattices. This wide range of homogeneity requires further study. Orig. art. has: 2 tables.

ASSOCIATION: Institut metallokeramiki i spetsial'ny\*kh splavov AN UkrSSR  
(Institute of Metalloceramics and Special Alloys AN UkrSSR)

SUBMITTED: 03Oct63

DATE ACQ: 09Apr 64

ENCL: 00

SUB CODE: IC

NO REF SOV: 006

OTHER: 006

Card

2/2

2.11.12  
APPROXIMATE NO: A13002078

at 1000C for 1 hr. Extrusion of  $ReSi_2$  powder at 1700C yielded solid  $ReSi_2$  with a density of 6.1 g/cm<sup>3</sup>, a hardness of  $1500 \pm 40$  kg/cm<sup>2</sup>, a shear modulus of  $4.7 \pm 0.2 \cdot 10^{10}$  kg/cm<sup>2</sup>, and a coefficient of thermal expansion of  $6.6 \cdot 10^{-6}$  /deg.  $ReSi_2$  has a room temperature resistivity of about 100 ohm-cm. The temperature dependence of thermal emf shows a maximum at 1000C.

ACCESSION NR: AP4042116

S/0073/64/030/007/0667/0670

AUTHOR: Verkhoglyadova, T. S.; L'vov, S. N.; Nemchenko, V. F.

TITLE: Some properties of the niobium-nitrogen system

SOURCE: Ukrainskiy khimicheskii zhurnal, v. 30, no. 7, 1964, 667-670

TOPIC TAGS: niobium nitrogen system, niobium nitrogen phase diagram, niobium nitride, niobium nitrogen alloy, alloy physical property, alloy structure

ABSTRACT: A series of niobium-nitrogen alloys with a nitrogen content up to 50 at% have been investigated. Alloy specimens were obtained by hot compacting of powders of the required composition at 1850 to 1900C under a pressure of 120—150 kg/cm<sup>2</sup>. X-ray diffraction and metallographic analyses showed the existence of a  $\alpha$ -solid solution and  $\beta$ -,  $\gamma$ -,  $\epsilon$ -, and  $\delta$ -phases (See Fig. 1 of the Enclosure). The  $\beta$ -phase appears at a nitrogen content of 2.6 at%; it has a region of homogeneity from 23.4 to 33.7 at% N. The  $\gamma$ -phase could not be isolated. The  $\delta$ -phase was isolated only in specimens rapidly cooled from the compacting temperature. The  $\alpha$ -phase, the solid solution

Card

175 APPROVED FOR RELEASE: 09/01/2001

CIA-RDP86-00513R001859510010-1"



ACCESSION NR: AP4042116

of nitrogen in niobium, the mixture of  $\alpha$ - and  $\beta$ -phases, and pure niobium have hole-type conductivity the proportion of which decreases with increasing nitrogen content. At a nitrogen content of 27.3 at%, the alloy conductivity is predominantly of the electron type; only in the region of  $\delta'$  +  $\delta$  phases does hole-type conductivity become again predominant. The composition dependence of resistivity and of the Hall constant is rather complicated (See Fig. 2 of the Enclosure). The composition dependence of density, thermal emf, and heat conductivity were also determined. Orig. art. has: 4 figures, and 1 table.

ASSOCIATION: Institut metallokeramiki i spetsplavov AN USSR  
(Institute of Powder Metallurgy and Special Alloys, AN USSR);  
Khersonskiy pedagogicheskii institut (Kherson Pedagogic Institute)

SUBMITTED: 05Jul63

ATD PRESS: 3068

ENCL: 01

SUB CODE: IC, MM

NO REF SOV: 004

OTHER: 004

Card 2/3

ACCESSION NR: AP4042116

ENCLOSURE: 01

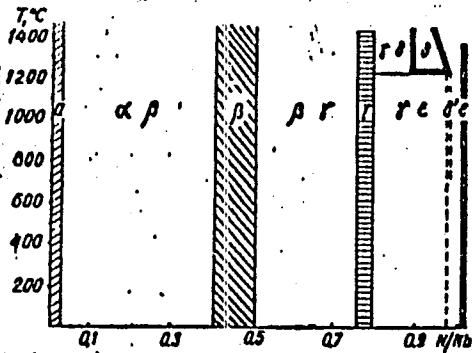


Fig. 1. Phase diagram of the niobium-nitrogen system

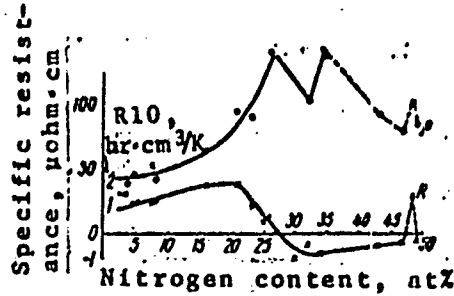


Fig. 2. Composition dependence of resistivity and Hall constant of niobium-nitrogen alloys

Card 3/3

T 25074 KE

ACCESSION NR: A14-48...

are reported to be stable. However, the expansion coefficient of  $ScB_2$  was quite resistant to expansion. The expansion coefficient of  $ScB_2$  was considerably stronger than that of  $ScB_4$ , due apparently to the strong bonding of the boron atoms which is characteristic for tetraborides. This latter would also cause the high electrical resistance of  $ScB_4$ . The new  $ScB_4$  phase may be a good material for increasing electric resistance and thus simplify the heating of cathodes. It may be used as a hexa- or tetraborides. With the latter it should form narrow ranges of solid solutions owing to its specific crystal structure. Orig. art. has: 8 chemical equations and 2 figures.

ASSOCIATION: none

SUBMITTED: 131 n84

DVORINA, L.A. (Kiyov); VERKHOGLYADOVA, T.S. (Kiyov)

Preparing rare-earth metal silicides by arc melting. Izv. AN  
SSSR. Mat. no.6:62-68 E-D '65. (MIRA 19:1)

1. Submitted May 4, 1964.

L 40333-66 EWP(k)/EWT(m)/EWP(t)/ETI IJP(c) JD/JO  
ACC NR: AP6011111 (A) SOURCE CODE: UR/0370/65/000/006/0062/0068

AUTHORS: Dvorina, L. A. (Kiev); Verkhoglyadova, T. S. (Kiev)

32  
29  
B

ORG: none

TITLE: Producing silicides of rare metals by arc smelting

SOURCE: AN SSSR. Izvestiya. Metally, no. 6, 1965, 62-68

TOPIC TAGS: silicide, rare metal alloy, silicon alloy, scandium, yttrium, cerium, praseodymium, neodymium, lanthanum, alloy, metal chemical analysis, x ray analysis

ABSTRACT: The formation of silicides of rare metals by arc smelting was experimentally investigated by alloying Si(99.9% pure) with Sc(97% pure), Y(95%), La(97.9%), Ce(98%), Pr, and Nd in different ratios and by performing x-ray phase and chemical analyses on the resulting alloys. Tables of the initial compositions and the final phase compositions of the various alloys are presented. It was found that to obtain the pure silicidic phase no excess of either component (over the stoichiometric ratio) was necessary for the Sc-Si system, while a 1.5--2.0% excess of Si was necessary for the Y, Pr, and Nd-Si systems and a 2--3% Si excess for the La and Ce-Si systems. Homogenization of the alloys for 5--7 hours in a high vacuum (10<sup>-5</sup> mm kg) is recommended at 1600K for Sc and Y alloys and at 1370--1570K for

UDC: 669.85/.86

Card 1/2

L 40333-66

ACC NR: AP601111

Ce, La, Pr, and Nd alloys. Several new phases were established and are briefly discussed. <sup>3</sup> Yu. I. Gladyshevskiy of the L'vov State University, Inorganic Chemistry Department (L'vovskiy gosudarstvennyy universitet, kafedra neorganicheskoy khimii) performed the x-ray phase analyses. Orig. art. has: 6 tables and 1 figure.

SUB CODE: 11,20/

SUBM DATE: 04May64/

ORIG REF: 007/

OTH REF: 007

rare earth metals 2?

Card 2/2

ACC NO: APO012715

SOURCE CODE: UR/0226/66/000/004/0069/0013

AUTHORS: Varkho, Lyadova, T. S. (deceased); Vivchar, O. I.; Gladyshevskiy, Ye. I.

ORG: Institute for the Study of Materials, AN UkrSSR (Institut problem materialovedeniya AN UkrSSR); L'vov State University im. I. Franko (L'vovskiy gosudarstvennyy universitet)

TITLE: Solubility of transition metal disilicides in molybdenum and tungsten disilicide

SOURCE: Poroshkovaya metallurgiya, no. 4, 1966, 69-73

TOPIC TAGS: molybdenum compound, tungsten compound, transition element, phase diagram

ABSTRACT: The phase diagrams of the binary systems  $\text{MoSi}_2 - \text{ReSi}_2$  and  $\text{WSi}_2 - \text{ReSi}_2$  and the ternary system  $\text{MoSi}_2 - \text{WSi}_2 - \text{MeSi}_2$  (where Me = Ti, V, Nb, Ta, or Cr) were determined. The nature of the solid phase was determined by x-ray and microstructural methods. The experimental results are presented in graphs and tables (see Fig. 1). The system  $\text{MoSi}_2 - \text{ReSi}_2$  exhibits a continuous series of solid solutions, and the systems  $\text{WSi}_2 - \text{ReSi}_2$  and  $\text{MoSi}_2 - \text{WSi}_2 - \text{ReSi}_2$  show unlimited reciprocal solubility. The systems  $\text{MoSi}_2 - \text{WSi}_2 - \text{MeSi}_2$  show only limited solubility in the solid state. It is concluded that the greater solubility of disilicides in  $\text{WSi}_2$  as compared with

Card 1/2

L. 26027-66

ACC NR: AP601277

0

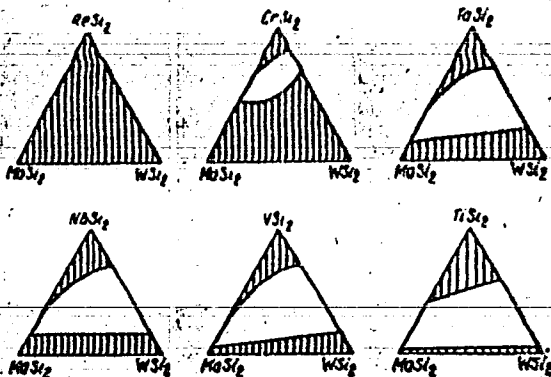


Fig. 1. Regions of solid solution formation in the ternary systems  $MoSi_2$  -  $WSi_2$  -  $MeSi_2$ , temperature 1400C.

$MoSi_2$  is associated with the decreased stability of the d-electronic level in W atoms. Orig. art. has: 1 table and 5 figures.

SUB CODE: 11/      SUBM DATE: 15Jul64/      ORIG REF: 006/      OTH REF: 001

Card 2/2

FB



L 47290-66 ENT(m)/ENP(t)/ETI IJP(c) JD/JG/WB

ACC NR: AP6032271

(A)

SOURCE CODE: UR/0076/66/040/009/2250/2254

AUTHOR: Verkhoglyadova, T. S. (Deceased); Dvorina, L. A.

39  
B

ORG: Kiev Institute of Problems in Material Science (Kiyevskiy Institut Problem materialovedeniya)

TITLE: High-temperature oxidation of some rare earth-metal silicides

SOURCE: Zhurnal fizicheskoy khimii, v. 40, no. 9, 1966, 2250-2254

TOPIC TAGS: rare earth metal, silicide, lanthanum silicide, scandium silicide, yttrium silicide, cerium silicide, silicide oxidation, SCANDIUM, YTTRIUM, LANTHANUM, CERIUM, METAL OXIDATION

ABSTRACT: The oxidation behavior of the scandium, yttrium, lanthanum and cerium silicides in air at 300—1100C has been studied. Silicide specimens 99.9%-pure were prepared by powder-metallurgy methods. Scandium silicides, especially monosilicide (ScSi), were found to be the most oxidation resistant. A dense oxide film on scandium monosilicide begins to form at 500C. The film tightly adheres to the base. Only at 100C does the film lose its protective ability. The lower silicide ScSi<sub>3</sub> and the higher silicide Sc<sub>3</sub>Si<sub>5</sub> behave similarly, but the former begins to oxidize at 300C, the latter at 700C, and the oxide films of both lose protective ability at 900C. The yttrium, lanthanum and cerium silicides have low oxidation resistance. A loosening of oxide films and rapid oxidation in all these silicides begins at 300—700C. Orig. art. has: 2 tables. [DV]

SUB CODE: 11/ SUBM DATE: 19Apr65/ ORIG REP: 008/ ATD PRESS: 5092

GLADYSHEVSKIY, Ye.Ye.; DVORINA, E.A.; KULEKOVA, A.I.; VERKHOSLYANOVA, T.S.

Lanthanum silicides and their crystalline structures. Izv.  
AN SSSR. Neorg. mat. 1 no. 3221-325 Kr 165. (MIRA 18:6)

L. L'vovskiy gosudarstvennyy universitet imeni Franka i Institut  
problem materialovedeniya AN UkrSSR.

DVORINA, I.A.; VERKHOGLYADOVA, T.S.

Vacuum-thermal preparation of rare-earth silicides. Zhur. neorg.  
khim. 10 no.7:1598-1602 J1 '65. (MIRA 18:8)

L 00998-66 EWI(e)/EWT(m)/EWP(1)/EPP(n)-2/EWG(m)/EWP(t)/EWP(t) IJP(c)  
JD/JG/AT/WH

ACCESSION NR: A75018245

UR/0078/65/010/007/1598/1602  
546.65'281

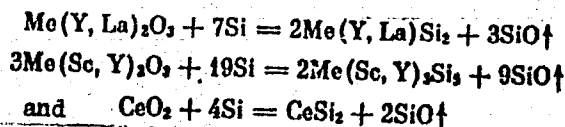
AUTHOR: Dvorina, L. A.; Verkhoglyadova, T. S. 33  
32  
B

TITLE: Synthesis of rare earth metal silicides in vacuum

SOURCE: Zhurnal neorganicheskoy khimii, v. 10, no. 7, 1965, 1598-1602

TOPIC TAGS: scandium, yttrium, lanthanum, cerium, rare earth metal, silicon, silicide, rare earth metal silicide

ABSTRACT: Obtaining scandium, yttrium, lanthanum, and cerium disilicides according to the reactions:



has been investigated. The initial materials were Sc<sub>2</sub>O<sub>3</sub>, Y<sub>2</sub>O<sub>3</sub>, La<sub>2</sub>O<sub>3</sub>, and CeO<sub>2</sub> oxides roasted at 1200K, and high-purity polycrystal silicon. Powders of the initial

Card 1/2

L 00998-66

ACCESSION NR: AP5018245

components ground to 270—300 mesh were mixed for 24—30 hr, pressed into briquets 14 mm in diameter and 5—7 mm high, and heated in a vacuum furnace at 1500—1900K for 1—4 hr. The experiments showed that the optimal conditions for obtaining  $\text{Sc}_3\text{Si}_5$ ,  $\text{Y}_3\text{Si}_5$ , and  $\text{YSi}_2$  are: temperature 1770  $\pm$  30K, holding time 2—3 hr, vacuum  $10^{-4}$ — $10^{-5}$  mm Hg; for  $\text{LaSi}_2$  and  $\text{CeSi}_2$ : temperature 1700—1750K, holding time 1—2 hr, vacuum  $10^{-4}$ — $10^{-5}$  mm Hg. The vacuum  $10^{-4}$ — $10^{-5}$  mm Hg must be maintained to obtain the silicides of reactive purity. The increase of vacuum affects the purity of silicides, and lowers the temperature and holding time. Orig. art. has: 1 figure, and 5 tables. [WW]

ASSOCIATION: none

SUBMITTED: 25feb64

NO REF SOV: 007

ENCL: 00

OTHER: 004

SUB CODE: IC, MM

ATD PRESS: 4069

Card 2/2 DP

L 4188-66 EWT(m)/EWP(w)/EWG(m)/T/EWP(t)/EWP(b) IJP(c) RLA/SD

ACCESSION NR: AP5016536

UR/0126/65/013/006/0939/0941

56  
53  
B

AUTHOR: Samsonov, G. V.; Verkhoglyadova, T. S.; Dvorina, L. A.

TITLE: Hardness of certain rare earth silicides

SOURCE: Fizika metallov i metallovedeniye, v. 19, no. 6, 1965, 939-941

TOPIC TAGS: hardness, lanthanum compound, yttrium compound, scandium compound, cerium compound, praseodymium compound, neodymium compound, silicide

ABSTRACT: The microhardness of silicides of scandium, yttrium, lanthanum, cerium, praseodymium, and neodymium was studied with a PHT-3 instrument. In all the silicide phases studied, a change in microhardness with the load was observed up to a certain value of the load, beyond which the microhardness changed negligibly. This confirmed the dependence of microhardness on load employed which was established earlier. The lowest hardness in each system is displayed by the phases richest in silicon, i. e., phases in which the covalent bond Si-Si is strong and the Me-Si bond weak. The tendency of silicon atoms to form covalent bonds with one another causes such a strong differentiation of groups of metal atoms that bound structural elements of metal and silicon atoms are formed, thereby decreasing

Card 1/2

L 4188-66

ACCESSION NR: APS016538

the hardness of silicides. The marked difference in the nature of Si-Si and Me-Si bonds in higher silicides also accounts for the appearance of semiconducting properties in lanthanum silicide above 500°C and in cerium silicides. The greatest hardness and brittleness is shown by rare earth monosilicides, as a result of the most uniform electron density distribution and a strong influence of the Me-Si bond. In lower silicides ( $Me_5Si_3$ ) of the  $Cr_5B_3$ -type structure, the metal-metal bond predominates, causing their hardness to be greater than that of disilicides. Orig. art. has: 1 figure, 2 tables.

ASSOCIATION: Institut problem materialovedeniya AN UkrSSR (Institute of Problems of Materials Science, AN UkrSSR)

SUBMITTED: 30Jun64

ENCL: 00

SUB CODE: IC, 55

NO REF SOV: 006

OTHER: 003

Card 2/2

L 1613-66 EWP(e)/EWT(m)/EPF(c)/EWP(i)/ETC/EWG(m)/EWP(t)/EWP(b) IJP(c) JD/JG/AT/

WH  
ACCESSION NR: AP5021663

UR/0080/65/038/908/1716/1725  
546.82'281

AUTHOR: Verkhoglyadova, T. S. ; Dvorina, L. A.

25  
6

TITLE: Vacuum thermal method for obtaining titanium silicides

SOURCE: Zhurnal prikladnoy khimii, v. 38, no. 8, 1965, 1716-1725

TOPIC TAGS: titanium compound, silicide, vacuum furnace

ABSTRACT: The article describes the results of an investigation of conditions necessary for obtaining silicide phases of titanium. Starting materials were silicon (99.9%) and titanium dioxide (98.0%). The titanium dioxide was previously calcined in a muffle furnace at 900-1000 C to eliminate volatile contaminants and moisture. Experiments on the reduction of titanium dioxide with silicon with the formation of the silicide phases were carried out in a vacuum furnace at a temperature of 1200-2100 K under a vacuum on the order of  $10^{-2}$  --  $10^{-4}$  mm Hg. After reduction, the samples were subjected to chemical and X-ray phase analysis. X-ray photos showed that up to 1500 K titanium dioxide is reduced to the lower

Card 1/2



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ACCESSION NR: AP5021663

oxides, while at 1500-1550 C there appear lines of a higher titanium silicide. At 1600-1650 K, the silicon and all of the reduced titanium are completely bound in titanium disilicide. The following state, which proceeds fastest at 1720-1780K leads to reduction of titanium oxide and penetration of the reduced titanium into the disilicide, with interlocking of its lattice into the lattice of titanium monosilicide. Further increase in temperature leads to an acceleration of the reaction leading to the formation of  $Ti_5S_3$ . At a vacuum of  $10^{-2}$ - $10^{-3}$  mm Hg,  $Ti_5S_3$  forms at a temperature of 1800-1900 K. The following optimum operating conditions are recommended for obtaining titanium silicides by this method:  $Ti_5S_3$ --1800-1900 C, residence time 1 hour;  $TiSi$ --1750-1800 K, residence time 1.5-2 hours;  $TiS_2$ --1650-1700 K, residence time 1-1.5 hours. Recommended depth of vacuum is identical for all cases -- $10^{-3}$ -- $10^{-4}$  mm Hg. Orig. art. has: 6 figures and 3 tables

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Card 1/2

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Card 2/2

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