32-24-6-32/44

Method for Obtaining Exact Values of the Microhardness by Chemically Removing Solidified Surface Layers

ASSOCIATION: Moskovskiy institut tsvetnykh metallov i zolota im. M. I. Kalinina
(Moscow Institute of Non-Ferrous Metals and Gold imeni M. I. Kalinin)

1. Metals--Mechanical properties 2. Hardness--Determination
3. Metals--Test methods 4. Metals--Surface properties

Card 3/3

AUTHORS: Glazov, V. M., Vigdorovich, V. N. 20-118-5-21/59

TITLE: On the Problem of Diffusion-Free Crystallization of Metal Alloys (K voprosu o bezdiffuzionnoy kristallizatsii metallicheskikh splavov)

PERIODICAL: Doklady Akademii Nauk SSSR, 1958, Vol. 118, Nr 5, pp. 924-927 (USSR)

ABSTRACT: A. A. Popov (Ref. 12) on the basis of the theory of diffusion-free transformations (References 9,10,11) developped ideas on a possibility in principle of the diffusion-free crystallization of alloys. Based on these ideas the present paper investigates the simultaneous influence of the cooling speed and the composition of the alloy on the degree of the ramification of the dendrite forms during the growth of the crystals. Two possible types of interaction between the components are taken into consideration here. Then it is briefly reported on the behaviour of the alloys during an undercooling. The dependence of the degree of ramification of the dendrites of the cooling speed in the crystallization has a maximum which corresponds to the critical cooling speed for a given alloy. The modification of composition of the

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alloy in a given cooling speed has an influence on the ramification of the dendrite forms of the growth of the crystals of the following kind: An amplification of the content of the second component in all crystallizing alloys lowers the degree of undercooling of the crystallizing alloys of different composition. In the alloys of undercritical cooling speed an amplification of the content of the second component must lower the ramification of the dendrites as a consequence of the lowered degree of undercooling. The peak of the curve representing the dependence of the degree of ramification of the dendrites on the cooling speed in an amplification of the content of the second component in the alloy must move towards a higher cooling speed. Then the increase of the temperature stability of the developping solid solution is discussed. The most important conclusion from the present paper is the following: The microheterogeneity of the crystals of the solid solution of two-phase alloys must have a maximum at certain medium cooling speeds (which correspond to the critical cooling speeds). This final conclusion is of importance for the development of processes for the crystallization of heat-resisting alloys. There are 3 figures and 21 references, 20 of which are Soviet.

On the Problem of Diffusion-Free Crystallization of Metal Alloys 20-118-5-21/59

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR (Institute for Metallurgy imeni A. A. Baykov of the AS USSR) Moskovskiy institut tsvetnykh metallov i zolota im. M. I. Kalinina (Moscow Institute for Nonferrous Metals and Gold imeni M. I. Kalinin)

PRESENTED: August 20, 1957, by G. V. Kurdyumov, Member, Academy of Sciences, USSR

SUBMITTED: August 14, 1957

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SOV/20-120-5-27/67

AUTHOR: Vigdorovich, V. N.

TITLE: The Construction of Conodes in Two-Phase Domains of the Phase Diagrams of Metal Systems by Means of the Microhardness Method (Postroyeniye konnod v dvukhfaznykh oblastyakh diagramm sostoyaniya metallicheskikh sistem metodom mikrotverdosti)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol. 120, Nr 5, pp. 1027-1030 (USSR)

ABSTRACT: The determination of the position of the conodes is one of the most complicated and tiresome operations in physico-chemical analyses. A good knowledge of the chemical composition of the individual phases is indispensable and its determination represents the main difficulty. However, this problem can be solved if the mentioned method is used. The previous papers (Refs 1, 2) showed that the experimentally constructed microhardness isothermal lines depend mainly on the orientation of the cross-sections to be investigated with respect to the conodes. It is the object of the present communication to prove the possibility of use mentioned in the title. The majority of solid binary solutions of metal

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The Construction of Conodes in Two-Phase Domains of the Phase Diagrams of Metal Systems by Means of the Microhardness Method

systems exhibit an increase of microhardness proportional to the concentration of the solution. Often an identical dependence is found for ternary solutions (Fig 1 a). This dependence may be used for the determination of the position of the conodes. One of the characteristic features of the conjugated points of the conode must, however, be used additionally, since a series of solid solutions may have an arbitrary microhardness. The method of geometric construction for this purpose is the most simple. They are given in figure 2. As an example the position of the conodes in the region ... + ... was determined of the phase diagram copper-titanium-aluminum was determined at 500 and 850°. The following data have to serve as initial data: 1) The function of the microhardness of the solid solution versus the concentration in the corresponding 3-component system has to be known. 2) The common solubility of the two components at temperatures at which the position of the conodes is to be determined must be investigated. 3) Further more data must be available on the microhardness of the solid solution in the two-phase region for which the position of the conodes is investigated. 4) According to the known measured

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SOV/-20-120-5-27/61

The Construction of Conodes in Two-Phase Domains of the Phase Diagrams of Metal Systems by Means of the Microhardness Method

microhardness value of the solid solution in the 2-phase region a line of the same values of microhardness (isoscleric lines) are drawn. Obviously the direction of all isoscleric lines in the concerning 3-component system will be parallel This slope is to be determined above all. Figure 2 shows the construction of the conodes at 500° according to the known variation of the microhardness in the system copper-titanium and at 850° for copper-aluminum. The isoscleric line is drawn up to the intersection with the corresponding solubility isothermal line. The point of intersection represents the point of the concentration triangle which corresponds to a solid solution of highest concentration, the microhardness and therefore the concentration of which as well are the same as those of a solid solution of a chosen alloy in the two-phase domain. Then the direction of one of the conodes may be determined at the given temperature. For this purpose the point of intersection of the isoscleric line is connected with the point for which the microhardness of the solid solution was measured. All these points are indicated by small circles in

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SOV/20-120-5-27/67

The Construction of Conodes in Two-Phase Domains of the Phase Diagrams of Metal Systems by Means of the Microhardness Method

figure [illegible]. There are [illegible] figures and 15 references which are Soviet.

ASSOCIATION: Moskovskiy institut tsvetnykh metallov i zolota im. M. I. Kalinina (Moscow Institute of Non-ferrous Metals and Gold imeni M. I. Kalinin)

PRESENTED: February 8, 1958, by A. A. Bochvarov, Member, Academy of Sciences, USSR

SUBMITTED: February 28, 1958

1. Metals--Phase studies 2. Metals--Mechanical properties
3. Hardness--Determination

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SOV/26-59-7-4/55

9(4)

AUTHOR: Vigdorovich, V.N.

TITLE: New Methods of Producing Semiconductors

PERIODICAL: Priroda, 1959, Nr 7, pp 27-32 (USSR)

ABSTRACT: The article discusses several new methods to produce semiconductors by fractional crystallization. It names the following crystallization methods: 1) the method of regularly-directed crystallization; 2) the method of obtaining semiconductor specimens of variable composition by drawing them out of the molten mass (Chokhral'skiy's method); 3) the method of zonal smelting (considered best). The following scientists are cited for early research in this field: I.V. Obreimov, L.V. Shubnikov, P.L. Kapitsa, V. de-Gaaz, V.I. Likhtman, and B.M. Maslennikov. V.D. Kuznetsov, whose monograph "Kristally i kristallizatsiya" (Crystals and Crystallization), Gostekhteoretizdat, was published in 1954 is also mentioned. There are 3 diagrams and

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SOV/26-59-7-4/55

New Methods of Producing Semiconductors

5 references, 2 of which are American and 3 Soviet.

ASSOCIATION: Moskovskiy institut tsvetnykh metallov i zolota imeni M.I. Kalinina (Moscow Institute of Non-Ferrous Metals and Gold Imeni M.I. Kalinin)

Card 2/2

MAL'TSEV, Mikhail Vasil'yevich; DOBATKIN, V.I., prof., doktor tekhn. nauk, retsenzent; AL'TMAN, M.B., doktor tekhn. nauk, retsenzent; VIGDOROVICH, V.N., red.

[Modifying the structure of metals and alloys] Modifitsirovanie struktury metallov i splavov. Moskva, Izd-vo "Metallurgiia," 1964. 212 p. (MIRA 17:6)

SOV/78-4-7-26/44

5(2), 18(4), 18(7)

AUTHORS: Glazov, V. M., Vigdorovich, V. N., Korol'kov, G. A.

TITLE: Investigation of the Interaction Between Aluminum and Niobium (Issledovaniye vzaimodeystviya alyuminiya s niobiyem)

PERIODICAL: Zhurnal neorganicheskoy khimii, 1959, Vol 4, Nr 7, pp 1620-1624 (USSR)

ABSTRACT: Although Al-Nb- alloys have been known for a long time, the phase diagram has been little investigated. Because of the great difference in the melting temperatures of the two metals, Nb was dissolved in liquid aluminum overheated up to 1500-1600°. As a results of the analysis carried out in the chemical laboratory of the Institute, mentioned first under the heading of Association, the initial alloy contained 10.1% Nb. Alloys with a niobium content of between 0.04 and 5 weight% Nb were produced. An investigation of the macrostructure of the alloys showed that, with an addition of more than 0.15 weight% Nb, the size of the grain is considerably reduced (Fig 1). This point of the diagram corresponds to the beginning of the separation of primary crystals of the compound $NbAl_3$. Investigation of microstructure showed the existence of $NbAl_3$-crystals

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Investigation of the Interaction Between Aluminum and Niobium

in the alloys which were homogenized at 640° and containing more than 0.25 weight% Nb, and that the quantity of these crystals increases with increasing Nb-content (Fig 2). An investigation of microhardness (Fig 3a) showed a temperature-dependent limited solubility of Nb in Al (Fig 3b, Table 2), which amounts to 0.22 weight% at 668° and to 0.08 weight% at 20°. Thermal analysis showed a thermal effect at 668.5° in the case of all alloys beginning with 0.20 weight% Nb and more, which indicates a non-variant character of the conversion. The Al-corner of the phase diagram Al-Nb is shown by figure 5. At 668.5° peritectic equilibrium is established: $L + NbAl_3 \longrightarrow \alpha$. The behavior of the Al-Nb-alloys proves a far-reaching analogy of the chemical behaviors of niobium and tantalum. There are 5 figures, 1 table, and 4 references, 3 of which are Soviet.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR (Institute for Metallurgy imeni A. A. Baykov of the Academy of Sciences, USSR) Moskovskiy institut tsvetnykh metallov i zolota im. M. I. Kalinina (Moscow Institute for Non-ferrous

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SOV/78-4-7-26/44

Investigation of the Interaction Between Aluminum and Niobium

Metals and Gold imeni M. I. Kalinin)

SUBMITTED: April 14, 1958

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L 22626-65 EWT(m)/EPR/EWP(t)/EWP(b) Ps-4 IJP(c) JD

S/0279/64/000/006/0089/0096

ACCESSION NR: AP5001612

AUTHOR: Vinderovich, V. N. (Moscow); Chernonorukh, [illegible] F. (Moscow); Marychev, V. V. (Moscow)

TITLE: The use of cascades in zone refining

SOURCE: AN SSSR. Izvestiya. Metallurgiya i gornoye delo, no. 6, 1964, 89-96

TOPIC TAGS: aluminum, high purity aluminum, zone refining, multistage zone refining, cascade zone refining

ABSTRACT: Specimens of 99.997 and 99.96% pure Al, and Al contaminated with Fe, Cu, or Si (to study behavior of impurities) were zone refined by the so-called "cascade" method to determine the effect of process conditions on the yield and purity of the final product. [illegible] passes of the molten zone 55--60 mm [illegible] the first stage refining [illegible] wide lowered the copper [illegible] mm), to [illegible]% in the starting part of the [illegible] in the middle part (L_2 = 250 mm), and increased it to 0.0032% in the end part (L_3 = 130 mm). An analogous distribution pattern was observed

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ACCESSION NR: AP5001612

for Fe and Si. For the second stage refining, composite ingots were used consisting of three L_1, two L_2, or four L_3. After second stage refining with 10 passes, the impurity content decreased below the sensitivity of spectral analysis, and was determined from the electrical conductivity. Aluminum with the lowest resistivity, $1.55-1.74 \cdot 10^{-10}$ and 1.8 [illegible], was obtained from ingots composed of $4L_1$ or $3L_2$ [illegible], respectively. [illegible] ments, conventional [illegible] [illegible] [illegible] [illegible] [illegible] with a resi[illegible] [illegible] of [illegible] asses [illegible] not increase [illegible] The use of the cascade method yielded [illegible] kg, i.e., [illegible] of high-purity aluminum. Orig. art. has: 6 figures and 2 tables. [MS]

ASSOCIATION: none

SUBMITTED: 12Dec63 ENCL: 00 SUB CODE: MM

NO REF SOV: 007 OTHER: 008 ATD PRESS: 3172

Card 2/2

5(2),18(7)

AUTHORS: Vigdorovich, V. N., Nashel'skiy, A. Ya. SOV/78-4-9-17/44

TITLE: The Investigation of the Interaction Between Lead and Calcium

PERIODICAL: Zhurnal neorganicheskoy khimii, 1959, Vol 4, Nr 9, pp 2034-2038 (USSR)

ABSTRACT: No publications have appeared on the system of Pb-Ca alloys since 1933. Only the alloys in the interval pure lead - Pb_3Ca compound are of industrial interest (anti-friction, cabel, accumulator alloys etc.). The authors investigated the character of the non-variant transition and solubility of Ca in solid lead at various temperatures in a series of alloys containing 0.10 to 0.01 wt% Ca. The Ca content was determined according to a method by Ts. A. Meshnikova (Ref 7). As the Ca addition produces only a slight change in melting point, the method of zone melting, originally proposed for the system Al - Mn by D. A. Petrov and A. A. Bukhanova (Refs 8, 9, Fig 2) was applied: a melting zone, produced by a high frequency inductor, was led over a 70 mm long sample of the alloy at a rate of 0.175 mm/min. This zone melting process was carried out in a vacuum. Microsection surfaces were

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then prepared and examined microscopically. The micro-hardness was also determined (Fig 4), and proved to be constant with the exception of the initial (lower hardness) and the terminal sector (greater hardness). The calcium content of the initial sector had been lowered by the zone melting process, and that of the terminal sector raised (Fig 3). Thermal analysis according to Kurnakov (Fig 5) gave a eutectic point at 326.1° at a calcium content of approximately 0.08 wt %. The solubility of Ca was determined for the temperatures 50, 150, 200, 250 and 300° by examining the micro structure and the micro hardness (Fig 6). The maximum saturation was found at 0.07 wt % Ca.

The Investigation of the Interaction Between Lead and Calcium SOV/78-4-9-17/44

A new variant of the phase diagram Pb - Ca is therefore proposed (Fig 7), which deviates from the data given by E. E. Schumacher and G. M. Bouton (Ref 5). There are 7 figures and 15 references, 9 of which are Soviet.

ASSOCIATION: Krasnoyarskiy institut tsvetnykh metallov im. M. I. Kalinina (Krasnoyarsk Institute for Nonferrous Metals imeni M. I. Kalinin)

SUBMITTED: May 19, 1958

KRESTOVNIKOV, A.N.; VIGDOROVICH, V.N.

Experiments demonstrating the basic laws of chemical reaction velocities. Khim.v shkole 14 no.3:72-74 My-Je '59. (MIRA 12:9)

1. Institut tsvetnykh metallov i zolota im. Kalinina, g.Moskva. (Chemistry--Experiments) (Chemistry--Study and teaching) (Chemical reaction, Rate of)

GLAZOV, V.M.; VIGDOROVICH, V.N.

Colloidal state of a solid solution in two-phase alloys of metallic systems. Koll.zhur. 21 no.1:18-24 Ja-F '59. (MIRA 12:5)

1. Institut metallurgii AN SSSR im. A.A.Baykova i Moskovskiy institut tsvetnykh metallov i zolota im. M.I.Kalinina.
(Solutions, Solid)

· 5(4) SOV/69-21-4-6/22

AUTHOR: Vigdorovich, V.N. and Glazov, V.M.

TITLE: Kinetic Study of the Transition of the Crystals of Two-Phase Binary Solid Solution Alloys From the Colloidal to the True Homogeneous State

PERIODICAL: Kolloidnyy zhurnal, 1959, Vol XXI, Nr 4, pp 405-412 (USSR)

ABSTRACT: This is an experimental study of the transition of two-phase systems of binary solid solution alloys from a heterogeneous to a homogeneous state. The authors investigated the systems copper-titanium and copper-zirconium, in the crystals of which the intermetallic compounds Cu_3Ti and Cu_3Zr appear as a heterogenizing element. The authors' investigation is divided into three parts comprising: 1) study of the kinetics of homogenization; 2) determination of a constant relation between the energy of activation of the transition and the heat of solution of the second phase; and 3) an appreciation of the mechanism of the transition process on the basis of the obtained results. The authors star-

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SOV/69-21-4-6/22

Kinetic Study of the Transition of the Crystals of Two-Phase Binary Solid Solution Alloys From the Colloidal to the True Homogeneous State

ted from the assumption that the mentioned intermetallic compounds(second phase) considerably affect the hardness of the crystals of the solid solution. The measuring of the hardness of the crystals therefore, served as the basis of the investigation of the kinetics of the transition. The experiments were carried out at temperatures of 850, 825, 800, 700 and 600°C and with shorter (graphs 1 and 2) and prolonged (up to 600 hours)tempering periods. Only prolonged tempering at temperatures of 850, 825 and 800° C resulted, through the obtaining of stable values for the hardness of the crystals, i.e. the elimination of the second phase, in a true homogenization of the solid solution (graph 3). Graph 4 shows the dependence of the hardness of the crystals on the time of tempering at various temperatures in a generalized form. As to the latter, the authors assume two periods, one qualified as aggregational and the other as kinetic with reference to the hardness of the crystals. The first is characterized by a re-

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Kinetic Study of the Transition of the Crystals of Two-Phase Binary Solid Solution Alloys From the Colloidal to the True Homogeneous State

laxing of the inner stresses in the layers which surround the particles of the colloid solution of the second phase and by a dissolving process of the less resistant particles of the second phase. The second period is characterized by diffusion processes, as a result of which the boundaries between the phases in the crystals of the solid solution disappear. On the basis of an equation obtained for the rate of diffusion, the authors found exact values for the energy of activation of the transition of the concerned systems from a heterogeneous to a homogeneous state. These values are 147.500 and 261.300 cal/gram atom for the system copper-titanium and copper - zirconium, respectively. Table 2 and the following equation show the close relations between the energy of activation of the systems and the heat of solution of the respective second components (Ti and Zr). The first is directly proportional to the second. On the basis of the obtained results, the authors conclude that in the heterogenized crystals two processes can be observed: the levelling of chemical hetero-

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Kinetic Study of the Transition of the Crystals of Two-Phase Binary Solid Solution Alloys From the Colloidal to the True Homogeneous State

geneity by diffusion and the appearance of a new heterogeneity due to the varying solubility of the second component in the layers which surround particles of different size. Both these processes lead to the dissolving of the smaller, and the growth of the larger particles. In this way the transition of heterogeneous crystals of the solid solution to a homogeneous state is accomplished by maximum diffusional distribution of the atoms of the second component through dissolving and settling processes. There are 6 graphs, 2 tables and 10 Soviet references.

ASSOCIATION: Institut tsvetnykh metallov imeni M.I.Kalinina (Institute of Non-Ferrous Metals imeni M.I.Kalinin)
Institut metallurgii AN SSSR imeni A,A.Baykova, Moskva (Institute of Metallurgy of the AS USSR imeni A.A. Baykov, Moscow)

SUBMITTED: 29 March, 1958

Card 4/4

GLAZOV, V.M.; VIGDOROVICH, V.N.

Applying the method of microhardness for plotting conodes in two-phase areas of three-component phase diagrams. Zav. lab. 25 no.1: 57-62 '59. (MIRA 12:1)

1. Institut metallurgii imeni A.A. Baykova AN SSSR i Moskovskiy institut tsvetnykh metallov i zolota imeni M.I. Kalinina.
(Nonferrous metals--Metallography)

KRESTOVNIKOV, A.N.; VIGDOROVICH, V.N.

Contribution to the theory of the formation of solid solutions of metal systems [with summary in English]. Zhur. fiz. khim. 33 no.1:78-82 Ja '59. (MIRA 12:3)

1. Institut tsvetnykh metallov i zolota im. M.I. Kalinina. (Solutions, Solid)

05810

SOV/76-33-10-8/45

5(4), 18(7)

AUTHORS: Glazov, V. M., Vigdorovich, V. N.

TITLE: A Contribution to the Invastigation of the Kinetics of Dissociation and Formation of Intermetallic Compounds in Melts by the Method of Viscosity Measurement

PERIODICAL: Zhurnal fizicheskoy khimii, 1959, Vol 33, Nr 10, pp 2164-2168 (USSR)

ABSTRACT: The formation and dissociation of intermetallic compounds have not yet been investigated since there are no methods available for determining the concentration of the substances during the reaction. For this purpose it is, however, possible to use the measurement of the melt viscosity. The applicability of the viscosity method is exemplified by investigating the kinetics of chemical reactions of the first, second, third, and n-th order under neglection of the chemical reactions occurring in the solution. On the basis of the Arrhenius equation (1) some theoretical conditions are discussed, and the authors refer to publications by Kendall, Monroe and Wright (Refs 4, 5) and D. A. Pospekhov (Ref 6), etc. Further, corresponding equations are derived for the four afore-mentioned reaction orders. Experiments were made with the help of the formation of aluminum antimonide. Viscosity was checked at 1090, 1120, 1150 and

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A Contribution to the Investigation of the Kinetics of Dissociation and Formation of Intermetallic Compounds in Melts by the Method of Viscosity Measurement

1200 C as a function of time. Interpretation of the resultant data has shown that the reaction under discussion was of second order and could be represented by Al + Sb → AlSb. Further, the authors calculated the constant of reaction rate for the afore-mentioned temperatures (Table) and found that the dependence of the logarithm of the constant on the reciprocal temperature value corresponded to the above Arrhenius equation. The resultant activation energy of aluminum antimonide formation amounts to 91,500 ± 200 cal/mol. There are 1 table and 8 references, 4 of which are Soviet.

ASSOCIATION: Akademiya nauk SSSR, Institut metallurgii im. A. A. Baykova. Institut tsvetnykh metallov i zolota im. M. I. Kalinina (Academy of Sciences of the USSR, Institute of Metallurgy imeni A. A. Baykov. Institute for Nonferrous Metals and Gold imeni M. I. Kalinin)

SUBMITTED: March 12, 1958

Card 2/2

S/180/60/000/01/005/027
E071/E135

AUTHORS: Vigdorovich, V.N., Ivleva, V.S. and Krol', L.Ya. (Moscow)

TITLE: On the Purification of Antimony by the Method of Zonal Recrystallization

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, Nr 1, pp 44-49 (USSR)

ABSTRACT: The results are given of an evaluation and classification of admixtures present in antimony from the point of view of the nature of their interaction with antimony. Furthermore, the results are reported of qualitative and quantitative analyses of the admixtures present in the starting and purified product. On the basis of analysis of available equilibrium diagrams characterising the interaction of antimony with corresponding admixtures, the latter were classified according to the ease with which they can be removed by zonal recrystallization. Admixtures of elements, the solubility of which in antimony in the solid state is low, are classified as easily removable. Admixtures of elements which are better soluble in solid antimony are considered as being

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On the Purification of Antimony by the Method of Zonal Recrystallization

difficult to remove and classified according to their partition coefficients (Fig 2). The behaviour of admixtures in antimony during zonal recrystallization was experimentally tested at various speeds of the melting zone: 4, 2 and 1 mm/min during 3, 5, 8, 10,15 and 20 passes. The width of the melting zone was 2 to 3 cm, the length of ingots 300 mm. The ingots were kept in graphite boats in an atmosphere of argon. The contents of As, Fe, Si, S and P were determined chemically; of other elements spectroscopically. A specially developed method combining chemical enrichment followed by spectroscopic analysis (no details given) was used for the determination of Pb, Cu, Ni, Co, In, Al and Cd. The method of radioactive analysis was used for Ni, Co, Tl, As (the method was developed by A.I. Kulak, Ref 13) and Mn, Se, Cu, Zn, Ga, As, P and Cr (the method was developed by E.Ye. Rakovskiy and Yu.V. Yakovlev). Flame photometry was used for the determination of Na, K and Ca. The method of radioactive isotopes was used for iron due to the fact that some of

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On the Purification of Antimony by the Method of Zonal Recrystallization

the reagents used in the analyses were contaminated by this element. The data on the conditions of the starting antimony and the purified product are given in Table 1 and Fig 3. The most objective method of determining the purity of the metal is by measuring its residual electrical resistance at temperatures of liquid helium and hydrogen. The experimental results are shown in Table 2. These confirmed that a high purity antimony was obtained.

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There are 3 figures, 2 tables and 13 references, of which 7 are Soviet, 5 English and 1 German.

ASSOCIATION: Institut tsvetnykh metallov
(Institute of Non-Ferrous Metals)
Gosudarstvennyy nauchno-issledovatel'skiy i proyektnyy institut redkometallicheskoy promyshlennosti (Giredmet)
(State Scientific Research and Design Institute of the Rare Metals Industry (Giredmet))

SUBMITTED: July 5, 1959

VIGDOROVICH, V.N.; GLAZOV, V.M.; GLAGOLEVA, N.N.

Investigating the solubility of chromium, molybdenum, and tungsten in aluminum by the microhardness method. Izv.vys.ucheb. zav.; tsvet.met. 3 no.2:143-146 '60. (MIRA 15:4)

1. Krasnoyarskiy institut tsvetnykh metallov, kafedra fizicheskoy khimii i kafedra metallovedeniya.
(Nonferrous metals--Testing) (Solubility)

VIGDOROVICH, V.N.; VOL'PYAN, A. Ye.

Preparation of high purity nonferrous metals by the method of zonal melting. Izv. vys. ucheb. zav.; tsvet. met. 3 no.3:125-135 '60. (MIRA 14:3)

1. Krasnoyarskiy institut tsvetnykh metallov. Rekomendovana nauchno-tekhnicheskim Sovetom problemnoy laboratorii chistykh metallov, metallicheskikh soyedineniy i poluprovodnikovykh materialov. (Nonferrous metals—Metallurgy)

82621

S/180/60/000/004/016/027
E193/E483

18.3100

AUTHORS: Vigdorovich, V.N., Krapukhin, V.V. and Chernomordin, I.F. (Moscow)

TITLE: Preparation of High Purity Aluminium by the Zone Melting Technique

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, No.4, pp.99-105

TEXT: In the first chapter of the present paper its authors deal with the theoretical aspects of zone refining of aluminium, discuss the characteristics of the systems formed by aluminium and other metals and classify these metals according to the magnitude of the distribution coefficient, K, by which the behaviour of a given impurity during zone refining is determined. In the next chapters, the results of experimental work carried out on aluminium grade AV000 are reported. The ingots, 580 mm long, with trapezoid cross section (height - 18 mm, bases - 16 and 20 mm), placed in a graphite boat, were refined in vacuum of 7.5×10^{-5} mm Hg. The length of the molten zone was 25 to 30 mm, the experimentally determined optimum rate of transfer and number of passes being 0.526 to 1.25 mm/min and 12 to 15 respectively. Particular

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E193/E483

Preparation of High Purity Aluminium by the Zone Melting Technique

attention was paid to the purity of graphite and the temperature of the molten zone was maintained at 750°C to minimize the risk of aluminium reacting with graphite. The impurity content in the zone-refined material was determined by spectrographic analysis (Fe, Cu, Si), colorimetric analysis (Fe, Cu, Si, Mg and Zn) and by the radio-active tracer technique (Cu, W, Mn, Na). The degree of purity attained was, in general, quite satisfactory. Thus, for instance, the Fe and Si contents were reduced by 3 and 4 areas of magnitude respectively; however, the decrease in the Fe, Cu and Mg content was considerably lower. The degree of purity of the zone-refined aluminium was also determined by measuring its electrical resistivity ρ_o at 4.2°K which was found to be 3.5×10^{-10} ohms cm against 4.0×10^{-9} ohms cm of the starting material. Having determined an empirical relationship $\rho_o = 6.5 \times 10^{-7}$ C, where C is the total impurity content, the present authors calculated that, as a result of the zone refining, C of aluminium was reduced from 6.65×10^{-3} to 5.04×10^{-4}%. The mechanical properties of the zone-refined metal were

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82621

S/180/60/000/004/016/027
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Preparation of High Purity Aluminium by the Zone Melting Technique

U.T.S. = 2.8 to 2.6 kg/mm2, elongation δ = 72 to 84% and Brinell bardness H_B = 6.6 to 6.4 kg/mm2, as compared with U.T.S. = 5.0 to 3.8 kg/mm2, δ = 45 to 52% and H_B = 10 to 15 kg/mm2 of the starting material. The zone-refined aluminium, when used in the manufacture of silicon power rectifiers, was found to improve their characteristics. There are 4 figures, 4 tables and 17 references: 12 Soviet, 3 English and 2 German.

SUBMITTED: July 10, 1959

Card 3/3

VIGDOROVICH, V.N.

82442

S/149/60/000/004/005/009

18.7100

AUTHORS: Krapukhin, V.V., Vigdorovich, V.N.

TITLE: Operating Conditions of a Heater on a Zone Recrystallization Furnace

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Tsvetnaya metallurgiya, 1960, No. 4, pp. 122-130

TEXT: The basic condition to ensure the effective distribution of impurities of an ingot subjected to zone recrystallization, is the constant length of the molten zone during the whole process. This factor is the basic criterion for maintaining the constant molten of the crystallization front and the crystallization cooling rate. Therefore it is necessary to determine the conditions of changing power consumption of the heater. To control the operating conditions of the heater, the heat transfer in locally heated rods is investigated and the results obtained are used to calculate the consumption of heat energy in zone recrystallization. Conditions of zone recrystallization are investigated and it is established that the highest power must be supplied to the heater when producing the molten zone at the initial section of the ingot. The power is reduced when the length of the molten zone increases until the motion of the molten-solid boundary is equal to the motion speed of the heater. As soon as crystals begin to form behind the molten

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82442

S/149/60/000/004/005/009

Operating Conditions of a Heater on a Zone Recrystallization Furnace

zone, the power remains almost constant and increases slightly when the heater moves along the ingot. When the molten zone reaches the end of the ingot the power is reduced to ensure the oriented crystallization and then slightly increases. The established notions were employed to set up the operational conditions of heaters in furnaces of zone recrystallization of aluminum and antimony. The design of a heater (shown in Fig. 3) meets the following requirements: 1) the emanated heat is sufficient to melt a given section of the material subjected to zone recrystallization, 2) the heat flow is focused in a maximum degree to obtain the shortest possible molten zone. The heater consists of five ЭИ 626 (EI626)-alloy wire windings (2.0 mm in diameter) mounted in foamy chamotte. The leads are made through porcelain insulators. Three windings of water-cooled copper coil (5 mm in diameter) are located at each side of the heater. The water flow is 2 l/min. The cooling capacity is 3.5 kcal/min. Air cooled condensers are used for antimony because of its different heat conductivity. Graph 6 shows the temperature curve of an aluminum ingot of 1.5 cm^2 cross section. The power of the heater is 625 watt, the molten speed is 0.526 mm/min at the center of the ingot. The temperature of the molten zone of 15 mm length is 750°C at its center. This amount of superheat must ensure the satisfactory distribution of impurities in the zone. The cooling rate of crystallization is determined from the motion speed of the heater and the

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S/149/60/000/004/005/009

Operating Conditions of a Heater on a Z. ne Recrystallization Furnace

magnitude of the temperature gradient, which must be sufficiently high to prevent any considerable changes in the length of the molten zone. If this length is not constant, the distribution of impurities deviates from the regular values. Values of the individual components of the total energy of the heater are given. The established conditions ensure the uniform and regular distribution of impurities. The theoretical (554 kcal/hr) and practical (562 kcal/hr on the average) values of the heater power are in a satisfactory agreement and prove the correctness of the established data. (Editor's note: Inscriptions under Figs. 6 and 7 do not correspond to the text: Al and Sb are interchanged). There are 4 diagrams, 5 graphs and 5 references: 4 Soviet and 1 English.

ASSOCIATION: Krasnoyarskiy institut tsvetnykh metallov (Krasnoyarsk Institute of Non-Ferrous Metals) Problemnaya laboratoriya chistykh metallov, metallicheskikh soyedineniy i poluprovodnikovykh materialov (The Experimental Laboratory of Pure Metals, Metallic Compounds and Semi-conductor Materials)

SUBMITTED: July 9, 1959

Card 3/3

KRESTOVNIKOV, A.N.; VIGDOROVICH, V.N.

Equating the liquidus and solidus of ideal systems. Izv.vys. ucheb.zav.; chern.met. no.5:5-7 '60. (MIRA 13:6)

1. Krasnoyarskiy institut tsvetnykh metallov.
(Phase rule and equilibrium)

86696

S/180/60/000/006/006/030
E201/E335

18.7500 1413 1555

AUTHORS: Vigdorovich, V.N. and Ivleva, V.S. (Moscow)

TITLE: An Approximate Method for Graphical Determination of the Effective Distribution Coefficients in Zone Recrystallisation

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1960, No. 6, pp. 51 - 55

TEXT: The paper begins with a brief survey of existing approximate methods (Ref. 1) of calculating the effective distribution coefficient (K) in purification by zone melting. The authors propose a graphical method for calculation of K, assuming perfect mixing in the molten zone, absence of diffusion equalisation in the solid phase, and independence of the distribution coefficient of temperature. These assumptions lead to

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S/180/60/000/006/006/030
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An Approximate Method for Graphical Determination of the Effective Distribution Coefficients in Zone Recrystallisation

$$C = C_0 \left[1 - (1 - K)e^{-K\ell/b} \right] \qquad (4)$$

where C is the impurity concentration at a distance ℓ from that end of a sample where zone recrystallisation started, C_0 is the initial impurity concentration, b is the length of the molten zone. The value of K can be found by plotting

$$x = f(K) = \frac{1}{1 - K}\left(1 - \frac{C}{C_0}\right) \qquad (6)$$

and

$$y = \varphi(K) = e^{-aK} \qquad (7)$$

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An Approximate Method for Graphical Determination of the Effective Distribution Coefficients in Zone Recrystallisation

(here $a = \ell/b$). The point of intersection of the two functions given by Eqs. (6) and (7) gives the value of K; the two functions are shown in Figs. 1 and 2, respectively. The proposed method is illustrated by a calculation of the distribution coefficient of silver, silicon, manganese and chromium impurities in copper (Fig. 3 and Table 1), of copper, silver and nickel impurities in antimony (Fig. 4a and Table 2) and of lead, bismuth and tin impurities in antimony (Fig. 4b and Table 3). The continuous and dashed curves in Fig. 4 denote, respectively, zone recrystallisation with and without magnetic stirring. There are 4 figures, 3 tables and 5 references: 1 Soviet and 4 non-Soviet.

SUBMITTED: December 3, 1959

Card 3/3

S/026/60/000/009/010/010
A166/A029

AUTHOR: Vigdorovich, V.N., Candidate of Technical Sciences

TITLE: Pure Matter

PERIODICAL: Priroda, 1960, No. 9, pp. 88 - 90

TEXT: The author discusses the problems of obtaining pure substance and illustrates the progress which has been achieved in this field. It is now possible to obtain aluminum with only 0.091% impurities. More accurate purity control methods have shown that, apart from the known impurities of iron, silicon and copper, 99.99% aluminum also contained 15 other impurities in amounts varying from 0.001 - 0.0001%. Mass spectrometric analysis of aluminum obtained after zonal recrystallization revealed the presence of about 34 admixtures. A search is now being made for superfine methods of measuring the purity of substance. The original method of measuring the purity of zinc and aluminum, devised by Yu.D. Chistyakov and V.B. Zernov, consisted in measuring the electrical resistance of the metal at very low temperatures, which cancelled out the effect of resistance due to temperature.

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Pure Matter S/026/60/000/009/010/010
A166/A029

ASSOCIATION: Problemnaya laboratoriya chistykh metallov, metallicheskikh soyedineniy i poluprovodnikovykh materialov (Problem Laboratory of Pure Metals, Metallic Compounds and Semi-Conductor Materials), Moscow

Card 2/2

S/076/60/034/009/011/022
B015/B056

AUTHORS: Vigdorovich, V. N. and Krestovnikov, A. N.

TITLE: The Relative Position of the Lines of Phase Equilibria in the Phase Diagram of Binary Systems

PERIODICAL: Zhurnal fizicheskoy khimii, 1960, Vol. 34, No. 9, pp. 1991-1995

TEXT: The rule which says that a relative mutual position of phase-equilibrium lines is not possible if the extensions of the lines lie in the single-phase region of the phase diagram is mentioned in publications dealing with this subject. The present article shows that this rule is applicable only in a number of special cases, and is thus not of general validity. In order to provide a strictly objective proof of the rule of the relative position of phase-equilibrium lines in the phase diagram, the method of geometrical thermodynamics may be applied (Ref. 8). The authors recommend applying this method in each individual case and, as an example, they give the phase diagrams of a binary system of eutectic (Fig. 1) and peritectic type (Fig. 2). (Table, values for the stable

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The Relative Position of the Lines of Phase Equilibria in the Phase Diagram of Binary Systems

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B015/B056

and metastable phase equilibria). It is shown by the various types of two-phase diagrams that the solubility in the metastable state always exceeds that in the stable state. K. P. Bunin and F. K. Tkachenko, and V. F. Zubarev are mentioned. There are 6 figures, 1 table, and 9 references: 5 Soviet, 4 US, and 1 British.

ASSOCIATION: Institut tsvetnykh metallov im. M. I. Kalinina (Institute of Non-ferrous Metals imeni M. I. Kalinin)

SUBMITTED: December 20, 1958

Card 2/2

VIGDOROVICH, V.N., kand.tekhn.nauk

Pure matter. Priroda 49 no.9:88-90 S '60. (MIRA 13:10)

1. Problemnaya laboratoriya chistykh metallov, metallurgicheskikh soyedineniy i poluprovodnikovykh materialov, Moskva.
(Matter--Properties)

KRESTOVNIKOV, A.N.; VIGDOROVICH, V.N.

Connection between the temperature of melting of chemical elements with the shortest interatomic distance in their crystal lattices. Sbor. nauch. trud. GINTSVETMET no.33: 421-430 '60. (MIRA 15:3)
(Crystal lattices) (Chemical elements--Thermal properties)

KRESTOVNIKOV, Aleksandr Nikolayevich; VIGDOROVICH, Vilenin Naumovich; BELYAYEV, A.I., retsenzent; LEVITSKIY, M.V., kand.khim.nauk, retsenzent; BURTSEVA, K.G., kand.khim.nauk, retsenzent; SAVAL'SKIY, S.L., starshiy prepodavatel', retsenzent; CHERNOV, A.N., red.; KURDOVA, Ye.I., red.izd-va; VAYNSHTEYN, Ye.B., tekhn.red.

[Chemical thermodynamics; selected articles for pyrometallurgists] Khimicheskaia termodinamika; izbrannye glavy dlia pirometallurgov. Moskva, Gos.nauchno-tekhn.izd-vo lit-ry po chernoi i tsvetnoi metallurgii, 1961. 280 p. (MIRA 14:3)

1. Chlen-korrespondent AN SSSR (for Belyayev). 2. Kafedra obshchey i fizicheskoy khimii Severo-Kavkazskogo gorno-metallurgicheskogo instituta (for Levitskiy, Burtseva, Saval'skiy).
(Thermodynamics) (Chemistry, Physical and theoretical)

S/180/61/000/002/004/012
E071/E435

AUTHORS: Vigdorovich, V.N., Ivleva, V.S. and Krol', L.Ya. (Moscow)

TITLE: On the Interaction of Admixtures During Zonal Recrystallization of Antimony

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1961, No.2, pp.72-76

TEXT: The problem of interaction of admixtures during purification of materials by recrystallization methods has been little studied. Therefore, the authors investigated the interaction of admixtures in the range of concentrations of 10^{-2} to 10^{-5} wt.% during zonal recrystallization of antimony. Two kinds of antimony, non-purified and purified by zonal recrystallization, were used for the experiment. Into the purified antimony additions of tin and bismuth, in the form of 4 to 5% alloys, were made. Samples were analysed for admixtures of copper, silver, nickel, iron, lead, tin, bismuth and arsenic by the spectroscopic method. The experiments were carried out in boats from purified graphite 300 mm long. The length of the

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molten zone was about 30 mm. The process of zonal recrystallization was carried out in an argon atmosphere at a velocity of 2 mm/min. The distribution of admixtures of tin and bismuth was studied after 10 and 20 passes. The initial content (wt.%) of admixtures is given in table 1 and the distribution of tin and bismuth along the length of the ingots (about 300 g) after zonal recrystallization is plotted in the figure. Although ingots with identical contents of tin and bismuth were not obtained (due to difficulties in precise alloying) yet the relative positions of the distribution curves indicate that the purification of ingot 1 containing about 0.2% of admixtures was more difficult than that of ingots 2 and 3 containing less (about 0.005%). Effective coefficients K of the admixtures distribution of tin and bismuth were calculated (Table 2). The calculation was done on the basis of analytical results obtained for the part of the ingot situated about 30 mm from the starting end (ℓ about 10% of the total length of the ingots). This part of the ingots was not affected by the dirty ends. After 10 passes there was no substantial difference in the effective distribution coefficients for tin in pure and contaminated antimony, however, the difference appeared after 20 passes. In the case of bismuth, the difference in the effective distribution coefficients in pure and contaminated antimony was established after 10 passes; after 20 passes the removal of bismuth from the pure ingot was so effective that its content was beyond the sensitivity of the analytical method used (6×10^{-5}%), therefore the distribution coefficient was only roughly evaluated. It was established in a previous experimental work (Ref.6) on the purification of antimony from admixtures that lead, tin, bismuths and arsenic represent a group of admixtures which are the most difficult to remove. The results obtained in the present work confirmed this conclusion but they also indicated that the removal of tin and particularly bismuth is more difficult in the presence of other admixtures. In the discussion of results the following alternative explanations of the above phenomenon are offered: a) Assuming a statistically uniform distribution of admixtures, the mean distance between atoms of admixtures in the impure metal would be about 3 to 4 and in the pure metal 300 to 350 Å. Thus in the first case the distances between atoms of the main admixture (Sn or Bi) are similar or larger than distances between atoms of other admixtures. They are also similar to the distances of inter-atomic interaction. Apparently such a ratio of concentrations is beneficial (at least from kinetic considerations) for the appearance of interaction between the main and other admixtures. In the second case the mean distance between atoms of the main admixture is many times smaller than mean distances between other admixtures. Such a ratio of concentrations has less influence on the behaviour of the main admixture during zonal recrystallization. However, it is pointed out that changes of conditions of interaction of admixtures in the diffusion layer are difficult to evaluate. It is possible that during zonal recrystallization an accumulation of admixtures at the crystallization front takes place, whereupon the interaction between the main and other admixtures in this layer may appear earlier than it would be expected on the assumption of their uniform distribution.

b) The experimental data can also be explained on the basis of ideas on the peculiar conditions of crystallization acting in the immediate neighbourhood of the solidification front (Ref.8: Chalmers, B., J.Metals, 1954, v.6, S.1, No.5, pp.519-533).

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E071/E435

On the Interaction ...

It is possible that in the case of crystallization of impure antimony the conditions are more favourable for a more pronounced influence of concentration supercooling and, consequently, conditions for diffusionless crystallization acts are formed, causing irregularities in the solidification front and enclosures of the melt. This should lead to a deterioration in the effect of recrystallization separation, i.e. to values of the effective distribution coefficient closer to unity. B.A.Kolachev is mentioned for his contribution in this field. There are 1 figure, 3 tables and 8 references: 5 Soviet and 3 non-Soviet.

ASSOCIATION: Institut tsvetnykh metallov im. Kalinina "Giredmet" (Institute of Non-Ferrous Metals imeni Kalinin, "Giredmet")

SUBMITTED: June 24, 1960

S/180/61/000/002/004/012
E071/E435

On the Interaction ...

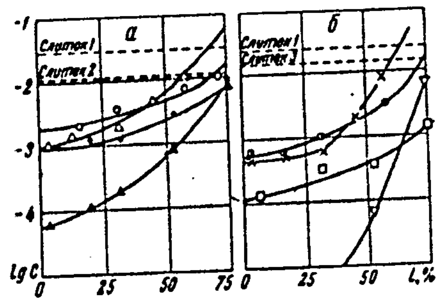
Figure. The distribution of admixtures Sn (Fig.a) and Bi (Fig.b) during zonal recrystallization of antimony.

Fig.a - after 10 passes (o - for ingot 1, ● - for ingot 2)
after 20 passes (Δ - for ingot 1, ▲ - for ingot 2)

Fig.b - after 10 passes (o - for ingot 1, □ - for ingot 3)
after 20 passes (x - for ingot 1, ▽ - for ingot 3)

broken lines indicate the corresponding levels of the starting concentrations of Sn and Bi in ingots.

слиток - ingot



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E071/E435

On the Interaction ...

Table 1. Content of admixtures in ingots of antimony used for zonal recrystallization

1 - ingot No.
2 - Wt.% of admixtures

Таблица 1

Содержание примесей в слитках сурьмы, предназначенных для зонной перекристаллизации

Слиток	Содержание, вес. %							
	Cu	Ag	Ni	Fe	Pb	Sn	Bi	As
1	$3.2\cdot10^{-3}$	$3.4\cdot10^{-3}$	$2.3\cdot10^{-3}$	$7\cdot10^{-3}$	$3\cdot10^{-3}$	$2.7\cdot10^{-3}$	$2.4\cdot10^{-3}$	$1.3\cdot10^{-3}$
2	$9.0\cdot10^{-4}$	$3.0\cdot10^{-5}$	$1.7\cdot10^{-4}$	$6\cdot10^{-4}$	$1\cdot10^{-3}$	$1.1\cdot10^{-3}$	$7.0\cdot10^{-5}$	$5.0\cdot10^{-4}$
3	$8.0\cdot10^{-4}$	$4.0\cdot10^{-5}$	$1.6\cdot10^{-3}$	$6\cdot10^{-4}$	$8\cdot10^{-4}$	$2.0\cdot10^{-4}$	$1.4\cdot10^{-3}$	$5.0\cdot10^{-4}$

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E071/E435

On the Interaction ...

Table 2. Effective coefficients of distribution K of admixtures during zonal recrystallization of antimony (for each admixture: top value - after 10 passes, bottom value - after 20 passes)

1 - admixtures
2 - K in ingots
3 - change in K, %

Таблица 2

Эффективные коэффициенты распределения K примесей при зонной перекристаллизации сурьмы*

Примесь	К в слитках			Изменение К, %
	1	2	3	
Sn	0.60 0.70	0.59 0.60	— —	1.7 16.7
Bi	0.50 0.65	— —	0.43 ~0.40	16.3 62.5

* Для каждой примеси верхняя строчка примеси — при 10 проходах зоны, нижняя — при 20.

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22977

18.3100 1087, 1454, 1208

S/180/61/000/003/005/012
E193/E183

AUTHORS: Darvoyd, T.I., Vigdorovich, V.N., and Iordanskaya, N.A.

TITLE: Purification of thallium by the crystallization methods

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1961, No.3, pp. 55-62

TEXT: Growing demand for high purity thallium in the semiconductor, atomic energy, and optical industries prompted the present author to undertake a systematic study of refining of this metal by the zone melting and crystal pulling techniques. The possibilities of these techniques were first evaluated on the basis of the analysis of the Tl-rich ends of the constitution diagrams of the relevant binary alloy systems. The results of this analysis are presented in Fig.2. Metals with a relatively high solid solubility in Tl are grouped in the left-hand side of the diagram showing their position in the periodic table of the elements; those whose solid solubility in Tl is extremely low are grouped on the right-hand side. Where possible, the distribution coefficients K were determined from the appropriate constitution diagrams and these are quoted under the symbol of the given metal; the numbered

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Purification of thallium by the crystallization methods

arrows indicate groups of metals which (1) form with Tl systems of relatively simple type, (2) are insoluble in liquid Tl, and (3) are characterized by $K > 1$. It was inferred from the results of this analysis that most of the impurities likely to be present in thallium (with the exception of metals that are close neighbours of thallium in the periodic table) should be capable of being removed by the crystallization methods, the object of the experimental work carried out by the present author being to check this prediction. The experiments were conducted on Tl specimens with known impurity content, some of which had been preliminarily refined by the alkaline or electrolytic methods. The crystal pulling experiments were conducted in vacuum (10^{-4} mm Hg); both the crucible and the crystal were rotated (in opposite directions) at 25 and 50 revs/min respectively, the rate of crystal pulling varying between 0.4 and 2 mm/min. The zone refining tests were carried out in O-free, dry nitrogen on bars 150-180 mm long and weighing 20-30 or 150 g. The width of the molten zone was approximately 15 mm, the rates of zone traverse employed being

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Purification of thallium by the crystallization methods

0.5, 1.0 and 2.0 mm/min. Electromagnetic stirring was used in some experiments and the distribution of impurities in the refined bars was determined after 5, 10 and 20 passes; depending on the type of impurity, chemical, spectrographic and radioactive tracer techniques of analysis were used. In the analysis of the results obtained, the behaviour of Cu, Ag, Zn, Sn, Fe, Ni, Mn, S, and Pb is discussed. Some of the typical results are reproduced graphically. Thus, in Fig.4 the Cu concentration ($C \times 10^4$ wt.%) in the zone refined bar of Tl is plotted against the distance (in % of the bar length, l) from the starting end. The four curves relate to bars, examined after 10 (curves 1 and 3) and 20 (curves 2 and 4) passes and refined at the zone traverse rates of 1.0 (curves 1 and 2) or 0.5 (curves 3 and 4) mm/min, the initial Cu content being shown by the broken line - - - -. Fig.6 shows the distribution of sulphur in a bar obtained by the crystal pulling technique (pulling rate 0.5 mm/min); here, the S concentration ($C \times 10^3$ wt.%) is plotted against the distance from the starting end, measured as the ratio, g, of the weight of the analysed to the

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E193/E183

Purification of thallium by the crystallization methods

total length of the bar. Curves 1, 2 and 3 relate to bars obtained after the molten metal had been held at the temperature for 6, 7 and 11 hours respectively. Finally, the effect of electromagnetic stirring is illustrated in Fig.8, showing the distribution of Cu in a zone-refined bar. Here, log C is plotted against the distance (% 1) from the starting end of the bar, obtained with (curves 1 and 2) or without (curves 3 and 4) the application of stirring, at the zone traverse rates of 0.5 (curves 1 and 3) and 1.0 (curves 2 and 4) mm/min. The initial Cu concentration is shown by the broken line. It was concluded that in many cases the zone refining and/or crystal pulling experiments yielded results better than those predicted from the theoretical considerations. This improvement in the segregation coefficient was attributed to the effect of secondary factors. Thus, for instance, the removal of Cd, Hg, and S was assisted by volatilization, that of Cu and Sn by oxydation. Iron which is insoluble in Tl cannot be separated by the methods studied, and filtration has to be used in this case. This is quite an effective method, as has been shown by the results of

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Purification of thallium by the crystallization methods

experiments in which the thallium samples, containing 1.8×10^{-4} and $> 10^{-3}$ % Fe, were filtered through porous graphite, after which the Fe concentration was reduced to less than 5×10^{-5} and 10^{-4} %. The concentration of lead in thallium cannot be reduced by the zone refining techniques, and this metal has to be removed by other (alkaline, electrolytic) methods. The effectiveness of zone refining of thallium is greatly increased by the application of electromagnetic stirring.
A.A. Il'inskaya, I.M. Blokh, N.P. Men'shova, V.G. Goryushina, M.A. Notkina, Ye.Ya. Biryukova, V.A. Nazarenko, B.S. Tsivina, N.K. Davidovich and L.I. Gosteva are mentioned for their contributions.
There are 8 figures and 13 references: 10 Soviet and 3 non-Soviet.
The English language references read as follows:

Ref.6: K.D. Alexopoulos. Acta crystallogr., 1955, V.8, part 4, p.235
Ref.8: M. Hansen, L. Anderko. Constitution of binary alloys. McGraw-Hill Publishing Company, N.Y. - Toronto - London, 1958.

Card 5/9

22977

S/180/61/000/003/005/012

Purification of thallium by the E193/E183

Ref.9: J.L. Haughton, A. Prince. The constitutional diagrams of alloys: a bibliography. The Institute of Metals, London, 1956.

ASSOCIATION: Giredmet/In-t tsvetnykh metallov im. Kalinina (Giredmet/Institute of Non-ferrous Metals imeni Kalinin)

SUBMITTED: October 8, 1960

Card 6/9

VIGDOROVICH, V.N.; ADLER, Yu.P.; MARYCHEV, V.V.

Methods of calculating the actual distribution ration in directional crystallization. Izv. vys. ucheb. zav.; tsvet. met. 4 no.3:108-114 '61. (MIRA 15:1)

1. Krasnoyarskiy institut tsvetnykh metallov. Problemnaya laboratoriya chistykh metallov metallicheskikh soyedineniy i poluprovodnikovykh materialov.

(Metallography)
(Crystallization)

28866
S/180/61/000/004/002/020
E073/E535

18.3200

AUTHORS: Vigdorovich, V.N., Ivleva, V.S. and Krol', L.Ya.
(Moscow)

TITLE: Distribution of admixtures of arsenic and selenium in the zone refining of antimony

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1961, No.4, pp.29-30

TEXT: In an earlier paper (Ref.1: Izv.AN SSSR, OTN, Metallurgiya i toplivo, 1960, No.1) the authors studied the behaviour of numerous admixtures in zone refining of antimony. In this paper further information is given on the behaviour of arsenic and selenium and the influence of initial concentration on the effectiveness of eliminating these elements during refining is studied. The initial material contained the following admixtures (%): Cu, Pb, Ni - 10^{-3} to 10^{-4}, Ag - 10^{-4} to 10^{-5}, Sn - 10^{-4}, Fe $\sim 10^{-3}$, Bi - 10^{-5}, Zn, In, Ga, Al $< 10^{-4}$, B $< 3 \cdot 10^{-5}$. Arsenic was introduced in the form of a 2% alloy. The ingots were 150 mm long and the length of the molten zone was 15 mm. After zone refining (10 passes at a speed of 2 mm/min), the ingot was cut

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longitudinally into four equal parts which were then crushed in a porcelain mortar, the powder was mixed and chemically analysed for arsenic content. The selenium was introduced in the form of the isotope Se^{75}. The experiments were carried out on ingots 280-300 mm long, with a molten zone of about 30 mm (10 passes at a speed of 2 mm/min). The obtained results are plotted in Figs.1 and 2, which give the logarithm of the concentration (lg C) of the admixed arsenic (Fig.1) and selenium (Fig.2) along the length of the antimony ingot ℓ; the dashed lines indicate the initial concentrations which, in %, amounted to: 1 - $6\cdot10^{-1}$, 2 - $8\cdot10^{-2}$, 3 - $9\cdot10^{-3}$ (Fig.1) and 1 - $2.5\cdot10^{-3}$, 2 - $7.5\cdot10^{-4}$, 3 - $4.5\cdot10^{-4}$ (Fig.2). The effective distribution coefficients were determined by an approximate graphical method and the obtained results were as follows: a) for arsenic: concentration $6\cdot10^{-1}$% - 0.82, $8\cdot10^{-2}$% - 0.78 and 9.10^{-3}% - 0.82; b) for selenium: concentration $2.5\cdot10^{-3}$% - 0.57, $7.5\cdot10^{-4}$% - 0.52, $4.5\cdot10^{-4}$% - 0.59. The distribution coefficient of arsenic ($K = 0.8\pm0.1$) is unfavourable from the point of view of purifying antimony; the value calculated from the phase diagram

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is K_o = 0.64. The phase diagram of selenium and antimony is of the monotectic type and has a more favourable effective distribution coefficient (K = 0.55±0.10) from the point of view of zone refining. Within the concentration range of 10^{-1} to 10^{-4}% both admixtures have a constant distribution coefficient as far as could be judged from the sensitivity of the methods used. There are 2 figures and 6 references: 3 Soviet and 3 non-Soviet. The two English-language references read as follows: Ref.4: Thurmond, C.D., Struthers, J.D. J.Phys.Chem., 1953, v.57, p.831; Hansen, M., Anderko, K. Constitution of binary alloys. N.Y.-Toronto -London, 1958.

SUBMITTED: December 3, 1960

32654

S/126/61/012/005/013/028
E193/E383

18.9500

AUTHORS: Vigdorovich, V.N. and Marychev, V.V.

TITLE: A study of impurity distribution in aluminium single crystals

PERIODICAL: Fizika metallov i metallovedeniye, v. 12, no. 5, 1961, 722 - 727

TEXT: A large number (> 100) of Al single crystals were prepared by the pulling-out technique. By varying the pulling rate (0.5 - 15 mm/min) and the rate of rotation of the seed crystal and crucible (1 - 100 r.p.m.), single crystals of various shapes were obtained, 100 - 200 mm long, 20 - 5 mm in diameter and 80 - 130 g in weight. X-ray diffraction analysis showed that when a polycrystalline seed was used the crystal axis was in most cases parallel to the [111] direction; specimens grown with the aid of single-crystal seeds had the orientation of the seed. The distribution of Fe, Cu and Si in crystals prepared in this manner was determined by chemical and spectrographic analyses. Typical results are shown in Fig. 4, where -log C (C being the impurity concentration) is plotted

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against the distance from the pure end of a crystal, grown at a pulling-out rate of 1 mm/min; the broken lines show the concentration of each impurity in the starting material (0.0008% Fe, 0.008% Cu and 0.002% Si). From the analytical data, the effective distribution coefficients K were calculated by the method described in Ref. 10 (the authors and team - Izv. vuzov, Tsvetnaya metallurgiya, 1961, no. 3, 79). These calculations were made for crystals prepared at various pulling rates v , so that the equilibrium distribution coefficients could be determined by extrapolating to v - 0 . The results are reproduced in Fig. 5, where $\log\left(\frac{1}{k} - 1\right)$ is plotted against v (mm/min) for the impurity indicated by each curve. In the next series of experiments, the distribution of impurities along single-crystal specimens was determined by measuring the electrical resistance ρ_o at liquid helium temperature. The results are reproduced in Fig. 6, where $-\log \rho_o (\times 10^{-10})$ is plotted against the distance from the pure

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end of the crystal, expressed (as in Fig. 4) in terms of a fraction of the total weight, g ; graphs a and b relate to specimens with the total impurity concentration of 0.0009 and 0.004 wt.%. respectively. Using these results and a method described in Ref. 10, the present authors calculated the effective distribution coefficients K , which were found to be 0.78 in the former and 0.28 in the latter case. In the final stage of the investigation the existence of a radial impurity concentration gradient in single-crystal specimens was established by spectrographic analysis. It was found that in a specimen with a total impurity content of 0.0025%, the impurity concentration at the crystal axis was 0.0011%, increasing to 0.0019% and 0.0028% at a distance of, respectively, 4 and 6 mm from the axis. G.V. Indenbaum, B.M. Lipshits, A.G. Dvortsan and V.B. Zernovyy carried out the analyses. There are 7 figures and 13 references: 10 Soviet-bloc and 3 non-Soviet-bloc. The three English-language references mentioned are: Ref. 1: W.D. Lawsen, S. Nilsen - Preparation of Single Crystals - Butterworths Scient. Publ., London, 1958; Ref. 6: M. Hansen, K. Anderko - Constitution of Binary Alloys, McGraw-Hill Publ., N.Y.-Toronto-London, 1958;

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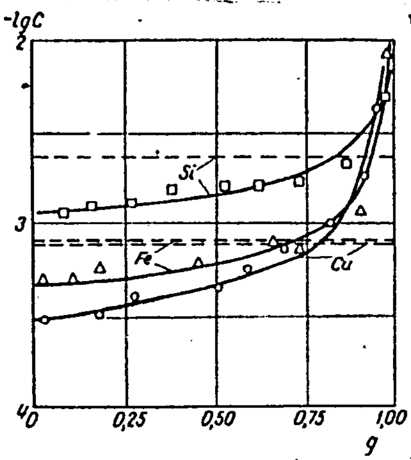
Ref. 7: L. Mondolfo - Metallography of Aluminium Alloys - Inst. of Met., London, 1943.

ASSOCIATION: Institut tsvetnykh metallov im. M.I. Kalinina (Institute of Non-ferrous Metals im. M.I. Kalinin)

SUBMITTED: March 3, 1961

Fig. 4:



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33176
S/180/61/000/006/006/020
E111/E335

18.3100 1208 1454 1521

AUTHORS: Rozin, K.M., Vigdorovich, V.N. and Krestovnikov, A.N. (Moscow)

TITLE: Method of continuous zone recrystallization

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Metallurgiya i toplivo, no. 6, 1961, 56 - 73

TEXT: The authors point out that existing methods of zone-refining are discontinuous and inefficient since "dirty" ends are produced. Suggestions for continuous processes (Ref. 1: W.G. Pfann - J. Metals, 1954, v.7, no.2, p. 297; Ref. 2: W.G. Pfann - Zone Melting, New York-London, 1958) have evidently not been followed by realization, probably for theoretical rather than practical reasons. Other proposed methods for improving the ordinary process by removing the contaminated melted zone after its first passage through the ingot (Ref. 4: Aleksandrov, B.N., Verkin, B.I., Lifshits, I.M. and Stepanova, G.I. - FMM, 1956, v.2, no. 1, p.105; Ref. 5: H. Henker - Z.Erzbergbau und Metallhüttenwesen, 1960, v.13, no. 9, p.450) do not solve the problem of intensifying the

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APPROVED FOR RELEASE: 09/01/2001 CIA-RDP86-00513R001859720006-3"

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process. The authors describe their method for continuous zone recrystallization, which both effectively separates the compounds and has a high productivity. These characteristics are obtained by diluting the melted zone at the last section of the separating part of the column, with simultaneous removal of the melted zone at the end of each pass through a special opening in the column. The vertical column is topped by a feeder supplying material of the initial composition to the receiver part of the column. Below this is the separating part of the column, where the material has undergone one or more purifying cycles in the usual manner. This part ends in an outlet. The basic equation for the region of the last fused zone is:

$$C = C_o - (C_o - kC_1)\left(\frac{H - x}{\ell}\right)^k \qquad (2)$$

where x is the distance of the point considered from the outlet,
H the height of the separating part,
C the impurity concentration at point x,

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c_o the impurity in the initial material,

k the distribution coefficient,

l the length of the fused zone (length equivalent to volume with the constant cross-sectional area assumed).

For n passes the distribution of impurities is given by:

$$c_m^{(n+1)} = k \sum_{i=1}^{m} \bar{c}_i^n (1 - k)^{m-i} \quad (1 \leqslant m \leqslant p) \qquad (3)$$

where p is the whole number of lengths l in the ingot,

c^{n+1} is the impurity concentration in the m-th section of the ingot after the (n+1)-th pass (m being the serial number of the section in the direction of movement of the zone),

$\bar{c}_i^{(n)}$ is the average concentration in the i-th section after n passes of the melted zone.

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Fig. 4 shows the C/C_o ratio as a function of x for various values of n for the indicated values of the parameters (Π is the length of the empty "plug" in the column). The wavy nature of the limiting curve, (i.e. the curve pertaining to high values of n) is due to the specific nature of the continuous process. Variations in k and Π have the greatest effect on impurity distribution but the more efficient purification obtained by increasing Π leads to a corresponding decrease in productivity. Even without allowing for this effect of "dirty ends" in the ordinary process, its effectiveness is greatly exceeded by that of the proposed continuous process (e.g. by a factor of 35 for n = 16). The productivity W is defined by:

$$W = \frac{vpS}{1 + H/\Pi} \qquad (7)$$

where v is the crystallization velocity,
s the column cross-sectional area.

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The useful yield of purified material η is expressed by:

$$\eta = \frac{1}{1 + \ell/\Pi} \quad . \qquad (8)$$

The authors recommend the following procedure (purification coefficient K_2 and the ℓ/Π value associated with the yield of purified product) for designing a continuous-zone refining column: 1) calculate or find empirically the purification coefficient K_1 for any column with the required k and ℓ values; 2) find H_2/Π_2 from:

$$\frac{H_2}{\Pi_2} = \frac{H_1 \lg K_2}{\Pi_1 \lg K_1} \quad ; \qquad (9)$$

3) find Π_2 from the ℓ/Π ratio; 4) find H_2 (the height

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of the separating part) from H_2/Π_2 ; 5) find the receiver height $(\Pi_2 + \ell)$; 6) from design considerations choose the number of heaters p ; 7) select, from experimental data, v and s to determine productivity. In practice, the column could be of many forms including (since some inclination is permissible) simple and complex spirals. The target of the slope of a turn must be greater than $d/2\ell$ for spirals, where d is the diameter or vertical dimension of the cross-section. Heater design is important and many types are possible; good control is obtained with rotating heaters, and heat-exchangers can be used. The authors studied the process with naphthalene in the simplest type of column - Fig. 8 (1 - vertical support; 2 - cantilever; 3 - column; 4-6 - movable heaters; 7 - support; 8 - cable; 9 - pulleys; 10 - drum; 11 - motor; 12 - reduction gear; 13 - bearing; 14 - opening for removing the melted zone; 15 - outlet). A magnetic clutch was incorporated, facilitating complete automation. The transparent column (molybdenum glass) enabled following the behaviour of the added impurities

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(0.2 - 0.5 wt.% alizarin, methyl-red or methylene blue). The feeder was 30 - 80 mm in diameter, 50 - 100 mm high, the corresponding figures for the separating part being 10 - 15 and 200 - 500 mm. The best outlet diameter was 7 - 9 mm. The three column heaters and those on the feeder and the tube from the opening 14 were controlled independently. No separation of components occurred at crystallization velocities over 24 mm/hour; below 6 mm/hour completely colourless naphthalene, mainly in the form of unstable single crystals, was obtained in a single pass. The higher limit is due to bending of isotherms, leading to a funnel-shaped crystallization front; improvement is possible. The cooling velocity largely determines the approach of the transformation to equilibrium and is given by the product of crystallization velocity and the axial temperature gradient. These conceptions are capable of extension to any cases of crystallization. The form of the melting front forming the upper boundary of the "plug" is also closely related to the effects considered and plays the part of a criterion of the homogeneity of the material in the column. Longitudinal

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temperature distribution in the region of the zone was measured with a copper-constantan thermocouple of 30 μ diameter, Fig. 11. There is appreciable mixing in the continuous process due to the kinetic energy of drops falling through the "plug" from the melting front. Mixing can be increased by rotation of the column about its own axis through 5 - 15°, stopping it sharply. Another feature of the process is that, when the crystallization front is horizontal, there will be no concentration gradient along the front, even with a considerable axial concentration gradient. The crystallization front was found to be little affected by changes in conditions, being protected by the melted zone which acted to damp-out the effects. The authors point out that their process is suitable for in-line use in production processes and complete automation. Its applicability can be extended by addition of "third components", which can alter the distribution coefficient and by the use of several continuous columns arranged to form a cascade. The continuous zone-

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recrystallization method can also be used in physicochemical research, particularly to study reaction of components by determining distribution coefficients and investigation of phase composition and sequence of phase changes in the crystallization of binary and more complex systems.
There are 12 figures, 1 table and 5 references: 1 Soviet-bloc and 4 non-Soviet-bloc. The three English-language references mentioned are: Refs. 1-2 (quoted in text); Ref. 3: H. Reiss - J. Metals, v.6, no.9, 1954, 1053.

ASSOCIATION: Institut tsvetnykh metallov im. M.I. Kalinina
Institute of Non-ferrous Metals im. M.I. Kalinin)

SUBMITTED: March 16, 1961

Card 9/9

VIGDOROVICH, V.N.; VOL'PYAN, A.Ye. (Moscow)

Relation between distribution coefficients expressed through the concentrations of the various components. Zhur. fiz. khim. 35 no.3:643-646 Mr '61. (MIRA 14:3)

1. Institut tsvetnykh metallov im. M. I. Kalinina.
(Phase rule and equilbrium)
(Solution(Chemistry))

26543
S/076/61/035/008/006/016
B101/B218

24.7300 also 1413, 1418

AUTHORS: Vigdorovich, V. N., Rozin, K. M., and Krestovnikov, A. N.

TITLE: Study of the rate (intensity) of phase transformations

PERIODICAL: Zhurnal fizicheskoy khimii, v. 35, no. 8, 1961, 1752-1758

TEXT: The term "rate (or intensity) of crystallization" is defined as increase in crystals of the solid phase g referred to the temperature change. Thus, it holds for the intensity $i = -dg/dt$ (1). This relation may be applied to any phase transformation taking place in a temperature interval. The authors start from a phase transformation $\beta \rightarrow \alpha$ in a phase diagram, the heterogeneous domain of which is limited by the lines $L_1(t)$ and $L_2(t)$ (Fig. 1). For the portion of phase α at t'' and t' they derive: $g'' = b''d''/a''b''$, and $g' = b'd'/a'b'$. The following fundamental equation is found for the intensity of phase transformations:

$$i = -\frac{c[L_2'(t) - L_1'(t)] + L_2(t)L_1'(t) - L_2'(t)L_1(t)}{[L_2(t) - L_1(t)]^2}, \quad (2).$$

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Here, c denotes the concentration of the second component in the melt, $L_1'(t)$ and $L_2'(t)$ are the temperature-differential quotients of the lines that limit the heterogeneous domain. The applicability of Eq. (2) to several special cases is illustrated: a) For a phase diagram with a simple eutectic, it holds: $i = -cL'(t)/L^2(t)$ (3). For a straight liquidus: $L(t) = -kt + b$ (4), and $i = kc/(b - kt)^2$ (5). On the liquidus line along the straight $L(t) = -kt + b$, it holds for the intensity function: $i_L = k/c$ (6), since in this case $c = -kt + b$. Based on these equations, the authors discuss the change of intensity which occurs with a change in temperature of the melt and a change in concentration of its second phase. It follows from Eq. (6) that for $c \to 0$ it holds: $i_L \to \infty$. b) In the case of a concave course of the curve of the phase transformation, $L''(t) > 0$, the "iso-rate line" $\varphi(t)$ is calculated, which touches the line L(t) of the phase equilibrium: $\varphi(t) = L(t)$; $\varphi'(t) = L'(t)$ (7). By substituting Eq. (7) into Eq. (3), and based on $\varphi(t) = -iL^2(t)/L'(t)$, the authors obtain for the minimum intensity on the boundary of the phase equilibrium: $L(t)'' = [L'(t)]^2/L''(t)$ (8). For c = constant, the changes of i are derived

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as a function of temperature. c) For a phase diagram that represents the equilibrium of two solutions, the authors write down: $L(t) = \alpha(1 - \beta t)/[\alpha + (1 - \alpha)\beta t]$ (12), where α is a parameter determining position and shape of the curve, and β is a scale factor. If coefficient α_1 corresponds to the curve $L_1(t)$, and coefficient α_2 to the curve $L_2(t)$, then it holds:

$$i = -\beta \frac{c[\alpha_1\alpha_2(1-\beta t)^2 - (\beta t)^2] - \alpha_1\alpha_2(1-\beta t)^2}{(\alpha_2-\alpha_1)(\beta t)^2(1-\beta t)^2}. \qquad (13).$$

This function becomes discontinuous for $t = 0$, $t = 1/\beta$, and $\alpha_1 = \alpha_2$. The course of the intensity function is discussed for several values of α_1 and α_2. The analytic method developed is suggested for solving practical tasks in connection with crystallization processes, physico-chemical studies, material cleaning etc. There are 6 figures and 5 references: 4 Soviet-bloc and 1 non-Soviet-bloc.

ASSOCIATION: Institut tsvetnykh metallov im. M. I. Kalinina, Kafedra fizicheskoy khimii (Institute of Nonferrous Metals imeni M. I. Kalinin, Department of Physical Chemistry)

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S/180/62/000/002/005/018
E021/E635

AUTHORS: Vigdorovich, V.N. and Rozin, K.M. (Moscow)

TITLE: A method of determining the effective coefficients of distribution during zone refining

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Metallurgiya i toplivo no. 2, 1962, 63 - 65

TEXT: Several methods of determining the effective coefficients of distribution during zone refining have been proposed up to the present time. These methods take into account the initial part of the ingot and in these sections the real distributions obtained do not correspond to the theoretical values. Also, these methods are not accurate enough. In the present paper a method for determination of the effective coefficient of distribution is proposed using the end section of the ingot and based on a large number of experimental determinations of the concentration along the length of the ingot after zone refining. With a large number of passes of the molten zone, the change in concentration of

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impurities along the length of the ingot approaches the so-called limit distribution, which obeys the exponential relationship given by W. G. Pfann, ("Zone melting", New York - London, 1958):

$$C(x) = Ae^{Bx}$$

where C - impurity concentration at the distance x from the beginning of the ingot, C_o - initial concentration B tangent of the angle of the plot representing the function $\ln C(x)$. The coefficient of the distribution can be determined from the ratio

$$k = B\ell / (e^{B\ell} - 1)$$

where ℓ is the width of the molten zone. If the coefficient B is determined experimentally the distribution coefficient k can be calculated. It was found that the function $k = B\ell$, if plotted in the co-ordinates lgk - $B\ell$ is only slightly curved and within certain intervals can be considered linear. On the

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basis of piece-wise linear approximation calculations can be carried out with the error being of the order of 4 - 5%. Furthermore k can be determined from a graph expressing k as a function of $B\ell$. The proposed method was used for quantitative estimation of the influence of preliminary filtration and degassing on the purification of aluminium by zone melting. After zone refining aluminium ingots subjected to filtration showed more effective purification. The calculated value of the effective distribution coefficient was 0.78 in the experiment without filtration and 0.56 in the experiment with filtration.

For degassed aluminium the removal of impurities by zone refining was somewhat worse. Experimental curves of the distribution confirm that for the end part of the ingot a linear relationship applies in accordance with Eq. (1). The behaviour of admixtures of silicon, copper and magnesium which was also studied, was found to be similar. The limit

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distribution is attained the faster the smaller k and the shorter the ingot. The described method permits determining k from results of analysis of the end portion only, where analysis for the impurities is simpler.

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VIGDOROVICI, V.N. [Vigdorovich, V.N.]; VOLPIAN, A.E. [Vol'pyan, A.Ye.]

Applying the crystallization methods to physicochemical analysis. Analele chimie 17 no.4:113-121 O-D '62.

S/137/62/000/006/088/163
A160/A101

AUTHORS: Krestovnikov, A. N., Vigdorovich, V. N.

TITLE: The realtion between the smelting points of chemical elements and the shortest interatomic distance in their crystalline lattices

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 6, 1962, 1 - 2, abstract 6I11 ("Sb. nauchn. tr. In-t tsvetn. met. im. M. I. Kalinina", v. 33, 1960, 421 - 430)

TEXT: The graphical dependence of the smelting points of elements on their atomic number is presented. New relations between the point of smelting T_{smelt} and the shortest distance between the atoms a were found within individual groups of a periodical system. Four schemes of changing T_{smelt} in relation to the magnitude of a are proposed. It is shown that in monovalent and bivalent metals (bond due to the collectivization of s electrons) the T_{smelt} decreases in proportion to an increase of a. For elements of transition groups (bond due to the excitation and collectivization of s, p and d electrons) T_{smelt} rises with increasing a. An increase of a leads to a decrease of T_{smelt} for elements with

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covalent bonds (collectivization of the pairs of s and p electrons). A raising of a corresponds to an increase of T_{smelt} for elements forming molecular lattices (bond due to the van der Waals forces). Discussed are cases deviating from the formulated schemes and with no striking differences between the various types of bonds.

A. Babad-Zakhryapin

[Abstracter's note: Complete translation]

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GLAZOV, Vasiliy Mikhaylovich; VIGDOROVICH, Vilenin Naumovich; KHRUSHCHEV, M.M., prof., doktor tekhn. nauk, retsenzent; NOVIKOV, I.I., dots., kand. tekhn. nauk, retsenzent; ARKHANGEL'SKAYA, M.S., red. izd-va; MIKHAYLOVA, V.V., tekhn. red.

[Microhardness of metals] Mikrotverdost' metallov. Moskva, Gos. nauchno-tekhn.izd-vo lit-ry po chernoi i tsvetnoi metallurgii, 1962. 224 p. (MIRA 15:2)
(Metals—Testing) (Hardness)

S/080/62/035/010/004/012
D204/D307

AUTHORS: Vigdorovich, V.N., Darvoyd, T.I., Iordanskaya, N.A. and Lamayev, Yu.U.

TITLE: A study of the distribution of Ag admixtures in the crystallization methods of the purification of thallium

PERIODICAL: Zhurnal prikladnoy khimii, v. 35, no. 10, 1962, 2165-2170

TEXT: The above subject was investigated in continuation of earlier work concerned with the study of phenomena associated with the purification of Tl from various metallic admixtures by crystallization methods, to determine the effectiveness of purification in relation to the initial concentration of the impurity and to the rate of purification, the amounts of Ag being varied between 0.25 and 5 x 10^{-6}%. The Tl crystals were extracted from the melt, contained in a graphite crucible, under a pressure of 10^{-4} mm Hg, and were 100 - 200 mm long and 8 - 10 mm in diameter. The rates of

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A study of the distribution ... S/080/62/035/010/004/012
D204/D307

extraction, f, were made 0.5, 1.0, and 2.0 mm/min, the crucible being revolved at 25 rpm and the extracting wire at 50 rpm in the opposite direction. The metallic rods were zone-crystallized, under O_2-free, dry N_2, and the distributions of Ag along the rods were determined after 5 passes, chemically (for $< 10^{-3}$% Ag) and by an isotope method (for $\geqslant 10^{-3}$% Ag). L.A. Radushkevich and I.V. Vlasovaya assisted in these determinations. Effective distribution coefficients, k, (defined by $k = C/C_0 (1 - g)^{k-1}$, where C_0 is the initial concentration of Ag and C is that at a distance g from the point at which crystallization front was started) calculated from data obtained by these 2 methods, were in fair agreement. The results are discussed, showing that k decreased with decreasing C_0, and was lower for higher values of f. The effect of f on k also became greater with decreasing C_0. In practice, complete purification of Tl from Ag admixtures, by extracting a crystal from the melt and zone-purification, is only effective when C_0 is low, ($\leqslant 10^{-4}$% Ag); the efficiency of the process may be increased by lowering the rate of crystallization, e.g. to 0.5 mm/min. There are 4 figures and 1 table.

SUBMITTED: April 24, 1961

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VIGDOROVICH, V.N.; VOL'PYAN, A.Ye. (Moscow)

Application of crystallization methods in physicochemical analysis. Zhur. fiz. khim. 36 no.3:429-436 Mr '62.
(MIRA 17:8)

1. Institut tsvetnykh metallov imeni Kalinina.

NISEL'SON, L.A.; VIGDOROVICH, V.N.; SERYAKOV, G.V.

Interphase distribution of components in the low concentration region. Zhur. fiz. khim. 36 no.4:697-702 Ap '62. (MIRA 15:6)

1. Gosudarstvennyy nauchno-issledovatel'skiy i proyektnyy institut redkometallicheskoy promyshlennosti i Institut tsvetnykh metallov imeni M.I.Kalinina.
(Systems (Chemistry)) (Phase rule and equilibrium)

S/020/62/144/001/023/024
B124/B101

AUTHORS: Vigdorovich, V. N., and Nashel'skiy, A. Ya.

TITLE: Synthesis of compounds containing a volatile component

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 144, no. 1, 1962, 182-185

TEXT: An attempt is described to use directional crystallization in the synthesis of indium phosphide from its elements, as an example for the synthesis of compounds exhibiting high dissociation pressure at their melting points. According to theoretical analyses (J. van der Boomgard, see below), the quaternary point in the equilibrium diagram of the system consisting of the non-volatile component A (solid), the volatile component B (vapor), the solution of B in A (liquid), and the compound AB (solid) in pressure-temperature-composition coordinates is found to correspond to low pressures (1 to 4 at) and to a low percentage of component B (in the melt) at temperatures near the melting point of component A. Thus, not only can the compound be synthesized, but also crystallization can take place from highly dilute melts at temperatures below the melting point of the compound when both pressure and temperature are only slightly

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increased. Single crystals are obtained by incongruent crystal growth. Two basic techniques of directional crystallization are feasible: either by building up a temperature gradient (normal directional crystallization or extraction from melt), or by building up and shifting the high-temperature zone (synthesis by zone crystallization). In the former case, the crystallization front advanced 3 mm/hr toward higher temperatures, whereas in the latter case, rates up to 25 mm/hr were obtained. Coarse-grained semiconducting bars with a resistivity ρ = 0.05 ohm·cm and a Hall constant R_x = 300 cm^3/coul were prepared. Microhardness values of 463 (with 20 g load), 372 (with 40 g load), 348 (with 70 g load), and 315 kg/mm^2 (with 100 g load) were obtained with mean arithmetic deviations of 26, 10, 9.5, and 8.5 kg/mm^2, respectively. The method described may also be used for purifying InP by zone recrystallization. The most important English-language reference is: J. van der Boomgard, K. Schol, Philips Res. Rep., 12, 127 (1957).

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