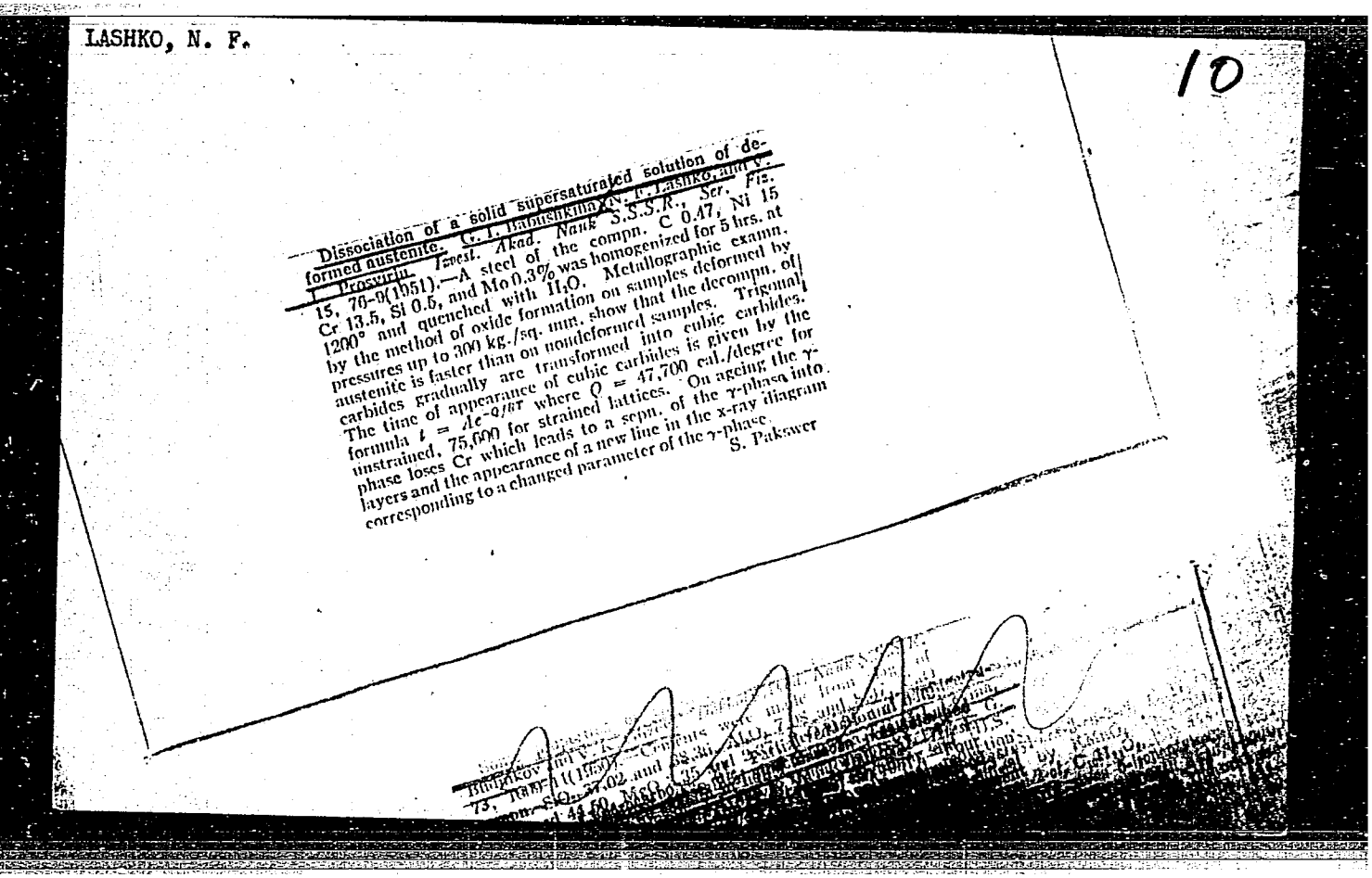


LASHKO, N. F.

10

Dissociation of a solid supersaturated solution of deformed austenite. G. I. Babushkina, N. F. Lashko, and V. Prosvirin. *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* 15, 76–9(1951).—A steel of the compn. C 0.47, Ni 15 Cr 13.5, Si 0.5, and Mo 0.3% was homogenized for 5 hrs. at 1200° and quenched with H_2O. Metallographic examn. by the method of oxide formation on samples deformed by pressures up to 300 kg./sq. mm. show that the decompn. of austenite is faster than on nondeformed samples. Trisonal carbides gradually are transformed into cubic carbides. The time of appearance of cubic carbides is given by the formula $t = Ae^{-Q/RT}$ where Q = 47,700 cal./degree for unstrained, 75,600 for strained lattices. On ageing the γ-phase loses Cr which leads to a segn. of the γ-phase into layers and the appearance of a new line in the x-ray diagram corresponding to a changed parameter of the γ-phase.

S. Paksuer

V, 184/1110(OT 1318) 621.791.5 :669.715.018.62

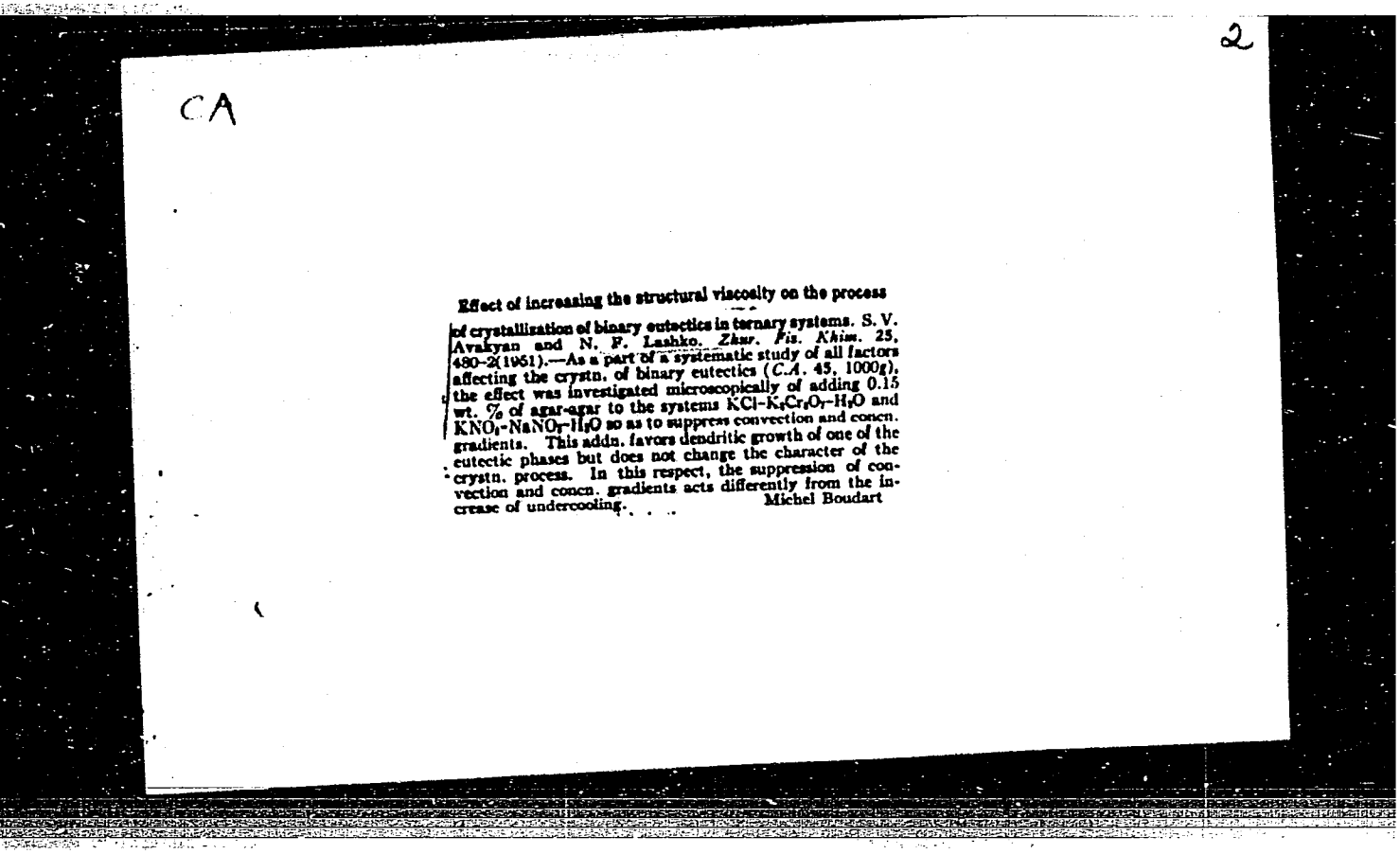
The Effect of Chemical Composition of Some Binary Aluminium Alloys on their Cracking Tendency in Gas Welding

S.V. Avakyan, N.F. Lashko

Avto.Delo. 22(10) 1951 MG U.S.S.R.

The examination of Al-base alloy systems resulted in the conclusions that Solidification Cracks are avoided under the following conditions: (i) a small melting point difference between the Al and the eutectic; (ii) a small amount of second phase in the eutectic, distributed as separate inclusions along the solid solution grain boundaries; (iii) when the alloy contains sufficient eutectic, allowing the solidification cracks to "heal" up. (Bibl.2)

(B.S.A. Transl., 10pp.)



2

CA

Effect of increasing the structural viscosity on the process of crystallization of binary eutectics in ternary systems. S. V. Avakyan and N. F. Lashko. *Zhur. Fiz. Khim.* 25, 480-2(1951).—As a part of a systematic study of all factors affecting the crystn. of binary eutectics (*C.A.* 45, 1000g), the effect was investigated microscopically of adding 0.15 wt. % of agar-agar to the systems KCl-$K_2Cr_2O_7$-H_2O and KNO_3-$NaNO_3$-H_2O so as to suppress convection and concn. gradients. This addn. favors dendritic growth of one of the eutectic phases but does not change the character of the crystn. process. In this respect, the suppression of convection and concn. gradients acts differently from the increase of undercooling. Michel Boudart

CA

2

Crystallization of binary eutectics in ternary systems. S. V. Avakyan and N. F. Lashko. *Zhur. Fiz. Khim.* 25, 1085–91(1951).—A microscopic investigation of the systems $KCl-K_2Cr_2O_7-H_2O$, $KNO_3-NaNO_3-H_2O$, Al–Si–Sn, Ag–Cu–Bi, Cd–Sn–Bi, and Cd–Zn–Sn leads to the conclusion that the mechanism of formation of binary eutectic structures in ternary systems is very similar to that governing eutectic formation in binary systems. Special features are due to the fact that in ternary systems, eutectic crystn. takes place within a given range of temp. and concn. During crystn. the compn. of the liquid changes and approaches the compn. of the ternary eutectic. This ought to affect the linear velocity of crystn. of the binary eutectic (Tammann). The presence of the third component ought to decrease the no. of grains of the binary eutectic, since crystn. takes place in a larger sp. vol. In a ternary system, the grains should be bounded preferentially by curves instead of by plane surfaces, since the third component decreases the anisotropy of cryst. growth.

Michel Boudart

1952

LASHKO, N. F.

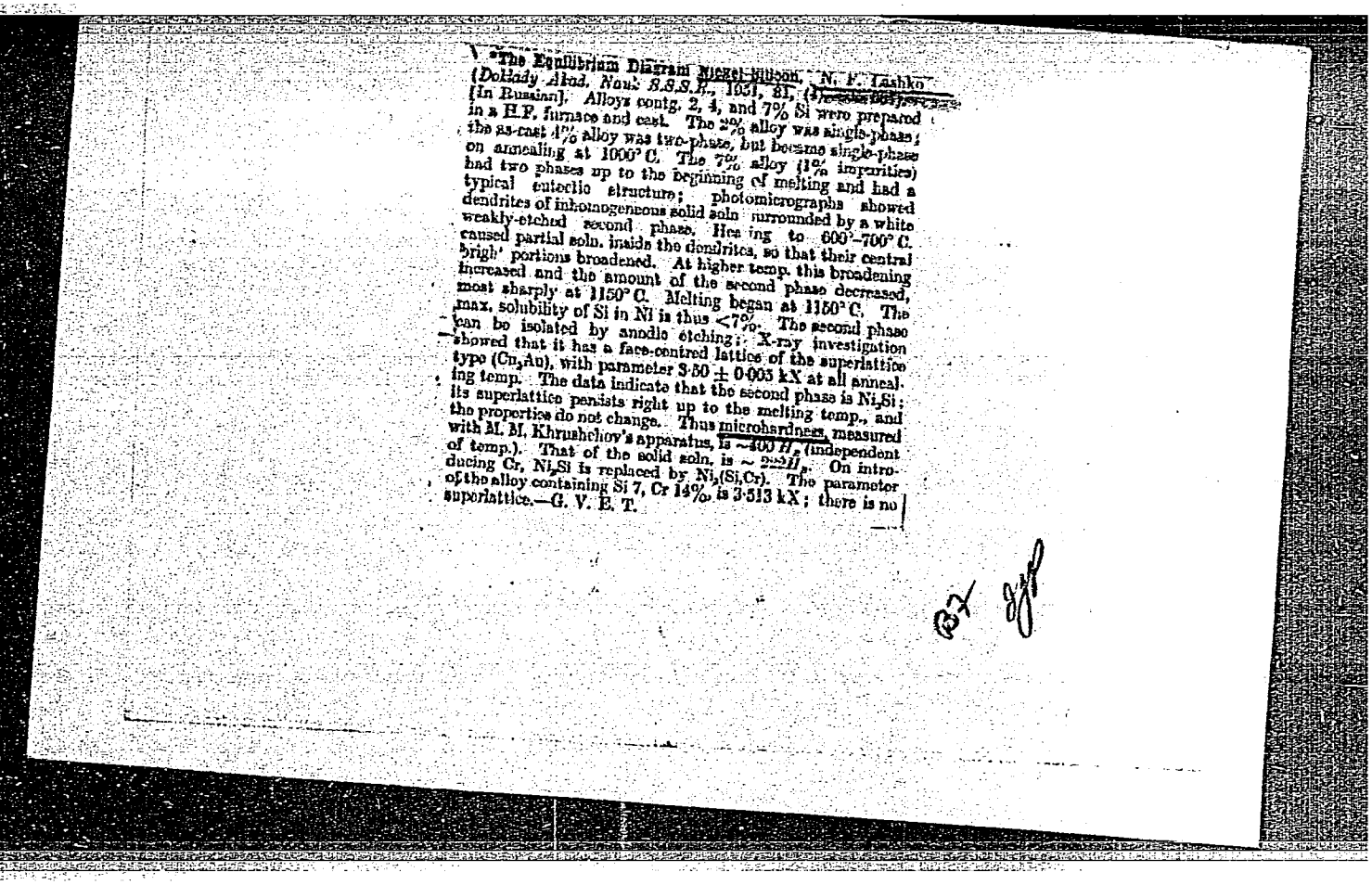
USSR/Chemistry - Metallurgy 21 Nov 51

"A New Intermetallic Compound in the Binary System Fe - Mo," R. P. Zaletayeva, N. F. Lashko, M. D. Nesterova, S. A. Yuganova

"Dok Ak Nauk SSSR" Vol LXXXI, No 3, pp 415, 416

The similarity between wolfram and molybdenum led the authors to believe that a compd analogous to Fe_2W should exist. They were successful in finding the new phase Fe_2 - Mo in chromium-nickel-molybdenem austenite steels contg a small amt of carbon.

214T16



*The Equilibrium Diagram Nickel-Silicon. N. F. Tashko (Doklady Akad. Nauk S.S.S.R., 1951, 81, [illegible]) [In Russian]. Alloys contg. 2, 4, and 7% Si were prepared in a H.F. furnace and cast. The 2% alloy was single-phase; the as-cast 4% alloy was two-phase, but became single-phase on annealing at 1000° C. The 7% alloy (1% impurities) had two phases up to the beginning of melting and had a typical eutectic structure; photomicrographs showed dendrites of inhomogeneous solid soln surrounded by a white weakly-etched second phase. Heating to 600°–700° C. caused partial soln. inside the dendrites, so that their central 'bright' portions broadened. At higher temp. this broadening increased and the amount of the second phase decreased, most sharply at 1150° C. Melting began at 1150° C. The max. solubility of Si in Ni is thus <7%. The second phase can be isolated by anodic etching; X-ray investigation showed that it has a face-centred lattice of the superlattice type (Cu_3Au), with parameter 3·50 ± 0·005 kX at all annealing temp. The data indicate that the second phase is Ni_3Si; its superlattice persists right up to the melting temp., and the properties do not change. Thus microhardness, measured with M. M. Khrushchov's apparatus, is ~400 H_μ (independent of temp.). That of the solid soln. is ~ 200 H_μ. On introducing Cr, Ni_3Si is replaced by $Ni_3(Si,Cr)$. The parameter of the alloy containing Si 7, Cr 14% is 3·513 kX; there is no superlattice.—G. V. E. T.

LASHKO, N. F.

USSR/Engineering - Welding Jan 52

"Concerning the Weldability of Metals," S.V. Avakyan, N.F. Lashko, Candidates Tech Sci

"Avtogen Delo" No 1, pp 29-32

Discusses definition of metals' weldability and outlines conditions required for realization of welding process which is considered as interatomic cohesion by diffusion. Analyzes welding process discussing crystn of welded joint and changes in properties of base metal under effect of welding heat. Shows microstructure of Bi welded with admixt of Cd and Sn in 3 micrographs and discusses welding of unlike metals.

212T18

LASHKO, N. F.

PA 233T43

USSR/Metallurgy - Welding, Crystallization   Jul 52

"On Discontinuous Crystallization in the Welding Process," S.V. Avakyan, N.F. Lashko, Candidates Tech Sci

"Avtogen Delo" No 7, pp 25-28

Briefly reviews Soviet tech literature on subject and disputes periodicity of crystn in welded joints accepted as an established factor by some investigators. Concludes that discontinuity of crystn during welding is conditioned by (1) balance between heat delivered to boundary

233T43

of solid and liquid phases and (2) heat loss. Substantiates this assumption by crystn of salol under conditions similar to those of welding.

233T43

LASHKO N.F.

Nonequilibrium crystallization of phases formed in the equilibrium state of a continuous series of solid solutions. N. F. Lashko, M. D. Nesterova, and S. A. Yagnenova. *Fiz.-Khim. Issledovan. Metal.* (Moscow: Gosudarst. Nauch.-Tekh. Izdatel. Mashinostroitel. Lit.) 1953, 105-9; *Referat. Zhur., Fiz.* 1954, Abstr. No. 4912.—General concepts are presented about the conditions for the formation of metastable states that det. the retarding action of diffusion processes. The x-ray phase analysis was made on the products of the anode soln. of 3 Cr-Ni steels that contain Ti, C, and N or Zr, C, and N. The x-ray diagrams of the deposits from the Ti steel exhibit 2 systems of lines that correspond to Ti carbide and Ti nitride. The parameters for these compds. are close to the values for these substances in pure form. Analogous results were obtained for the Zr steel. On the basis of the fact that in 3-component systems metal-C-N the carbides and nitrides in the equil. state form a continuous series of solid solns. a conclusion is drawn about the nonequil. crystn. of the carbides and nitrides in the solidification of Cr-Ni steels from melts. J. Roytar Leach

Distr: 4E3d/4E2c

Lashko, N.F.

Transformation of carbidic and carbonitridic phases in chrome-nickel-molybdenum steels. N. F. Lashko, M. D. Nesterova, and S. A. Yuganova. *Fiz.-Khim. Issledovaniya metal.* (Metallurgizdat, Moscow) 1953, 110-17; *Referat. Zhur., Khim.* 1954, No. 43743.—The transformation as affected by N content is analyzed. Two steels of the EI 385 type contg. 0.3 and 0.16% N were studied. Both hardened and annealed specimens were investigated: the hardening was from 1200° in water, the anneal (aging) was at 800-850°. Electrolytically obtained ppts. from both steels were analyzed röntgenographically by the powder method in GFTI cameras of 57.3 mm. diam. Depending on the type of the studied phase, röntgenograms were obtained with Fe, Cr, or Cu radiation. Upon aging, in the steel contg. 0.03% N from the solid soln. the cubical carbide $M_{23}C_6$ sepd. out with a predominant content of Cr and the double FeMo carbide $M_xM'_yC$ (where x is 2 or 3) having a parameter of 10.94-11.03 A. depending on the conditions of aging. Upon aging both carbides appeared simultaneously. By increasing the duration and temp. of aging the carbide $M_{23}C_6$ could not be detected röntgenographically. The parameter of the double carbide cryst. lattice increased with increasing duration of isothermal aging and with increasing temp. of aging. In the steel contg. 0.16% N the carbide phase consisted only of the double carbonitride $M_xM'_y(C,N)$ having a cryst. lattice with a parameter of 10.68-10.88 A. The parameter of the cryst. lattice of the double carbonitride increased with increasing duration of aging. In a steel of the EI 395 type contg. 0.25% N and the other elements in the same quantities as the previous two, upon aging at 850°, sepd. out a cubical carbonitride $M_2(C,N)_1$ with a parameter 10.6± A. A chem. analysis of the carbonitride $M_2(C,N)_1$ showed a N content of 4 wt. %. It is concluded that in the presence of N and at an increasing content of it the double carbide seems to transform into a cubical carbonitride. M. Hosch

(2)

LASHKO, N.F.

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Metastable phases in chrome-nickel steels. N. F. Lashko, A. F. Likina, M. D. Nesterova, and S. A. Yuzhakova. *Fiz.-Khim. Issledovaniya Metal.*, Mashgiz (Moscow) 1953, 118-29; *Referat. Zhur., Khim.* 1954, No. 45363.—The formation of metastable phases in Fe-Cr-Ti-C and Fe-Cr-Ni-Al-Ti alloys hardened in water at 1200-1250° and annealed at 600-900° was studied by x-ray methods and by analyzing the residue after anodic soln. in 10% HCl or in a soln. of $CuSO_4$ + H_2SO_4. In the ferritic alloy of the system Fe-Cr-Ti-C after 20 hrs. annealing at 600 and 700° Ti carbide and nitride were also found with a phase of unknown compn. having a γ-lattice. After 100 hrs. at 700° $Cr_{23}C_6$ began to sep. and the metastable phase with the γ-lattice disappeared. After 200 hrs. at 900° $Cr_{23}C_6$ dissolved and on the röntgenogram appeared lines of a new phase the lattice symmetry of which could not be detd. In austenitic alloys of the system Fe-Cr-Ni-Al-Ti contg. 15-20% Cr, approx. 0.5% Al, 1-2.5% Ti, and a variable amt. of Ni, the phase compn. in aging was detd. by the Ni content. In alloys with 20% Ni the metastable phase appearing first in aging was the α-phase of the binary Ni-Al system having a slightly enlarged lattice period. It was observed after 1500 hrs. annealing at 700°, and it persisted up to 800°. At 900° the α-phase dissolved and a more stable phase of variable compn. $(Fe, Ni)_3Ti$ appeared. In alloys with 25-30% Ni the first metastable phase to appear was also the α-phase and it was followed by a more stable X-phase of unknown compn., possibly a ternary compd., and Ni_3Ti. The X-phase appeared after annealing 100 hrs. at 800° or 50 hrs. at 900°. After 200 hrs. at 900° the X-phase disappeared and a Ni_3Ti phase appeared. The appearance of metastable phases is attributed to less work in the formation of nuclei of these phases, since their structure is similar to that of a solid soln.

M. Hosch

LASHKO, N.F.

LASHKO, N.F.; LASHKO-AVAKYAN, S.V.; POGODIN-ALEKSEYEV, G.I., doktor tekhnicheskikh nauk, professor, redaktor; POPOVA, S.M., tekhnicheskiy redaktor

[Metallography of welding; some problems] Metallovedenie svarki; nekotorye voprosy. Pod red. G.I.Pogodina-Alekseeva. Moskva, Gos. nauchno-tekhn. izd-vo mashinostroitel'noi lit-ry, 1954. 270 p.
(Welding) (Metallography) (MLRA 8:4)

LASHKO, N.F.

Phase transformation in steel in the region of thermal influence of welding. N. N. Il'in and N. F. Lashko. *Avtomat. Svarka* 7, No. 1 (Whole No. 34), 28-36(1954).—The authors have investigated the structure and kinetics of formation of the carbide phases in the zone of thermal influence in the electro-arc welding of alloy steels, including Mark 30KhGSA (C 0.32, Cr 1.02, Mn 0.90), Mark 12Kh-5MA (C 0.12, Cr 4.01, Mn 0.38, Ni 0.16, Mo 0.46), and 18-4 (C 0.11, Cr 17.35, Mn 0.34, Ni 3.60%). Charts, tables, and photomicrographs are presented to illustrate structure variations from the weld to distances of 5 mm. and 10 mm. from the weld. The relation between carbide formations and the loss of corrosion stability in the vicinity of the weld is discussed. J. R. Behrman

LASHKO, N. F.

112

*On the Theory of Recovery of Metals in the Process of Plastic Deformation. I.—Recovery of a Pure Metal [Aluminium]. II.—Recovery of an Aged Aluminium Alloy. I. I. Bolygin and N. F. Lashko (Zhur. Tekhn. Fiziki, 1954, 24, (2), 231–240; 241–249).—[In Russian]. [I.—] The process of "block formation" which L. proposed (see, e.g., *ibid.*, 1950, 20, 1025) as part of the mechanism of breakdown of metals during creep is compared with the process of fragmentation due to Wood and with polygonisation. All are recognized to be phenomenologically the same. Experiments are described on a polycryst. specimen (grain-size ~0·2–0·4 mm.) of Al deformed by creep at 300° C. under a stress of 0·3 kg./mm.², At various stages in the test the specimen was examined by microscopy and by back-reflection Laue photographs from single grains. Up to ~0·1% strain (1 hr.), deformation is by slip on one or at most two slip systems. In the period 1–20 hr. (~1% strain) most grains show 2 or 3 slip systems operating. Thereafter the surface becomes apparently folded and slip lines cease to be straight. From 30 to 100 hr. (~2–5% strain) the folds form an intersecting pattern dividing the former grain into blocks with curved boundaries. In further deformation the grain breaks into smaller blocks, the boundaries of some of which are straighter and directly traceable to slip lines. With still larger deformation (>5%), a further system of folds appears, having no apparent crystallographic orientation and able to pass from grain to grain. X-ray Laue photographs from single grains show the development of asterism up to ~1% strain. As strain increases the asterisms become less intense, and a pattern of sharp spots develops, showing that the original grain has broken up into a large number of almost perfect crystallites with orientations scattered over a range of several degrees. Experiments at higher speeds of deformation and other temp. give similar qualitative results. The dimensions of the blocks, however, increase with increasing temp. of deformation and decrease with increasing speed of deformation. [II.—] Results on pure Al are summed up as follows: recovery takes place in creep by conversion of the grains into blocks, the boundaries of which are either former slip bands or former kinks. In either case some process of diffusion is necessary. Thus it is interesting to study the

(cont.)

processes of recovery in alloys where diffusion may proceed either more or less readily than in pure metals. In particular, it is interesting to see what happens in supersaturated solid soln. where the diffusion processes are accompanied by pptn. The age-hardening alloy AK4 was used. This has 3 precipitate phases: Mg_2Si (small particles), Al_2CuMg, which is precipitated after plastic deformation in the form of rods, and $FeNiAl_9$, which is preferentially precipitated on the boundaries of grains and blocks. The specimen was quenched from 515° C. and aged for 10 hr. at 170° C. Extensive series of experiments were carried out: (1) at 200° C. with a stress of 20 kg./mm.², and (2) at 300° C. with a stress of 4·5 kg./mm.². In both series the extension/time curve was linear up to 40 hr., after which creep accelerated markedly. At 200° C. there were no visible signs of deformation up to 40 hr. (~1% extension), and then slip lines appeared. Up to 70 hr. (~5% extension) deformation was still only by slip on two systems. The temp. was too low for visible pptn. At 70 hr. fracture occurred by necking; in the neck hardness was much reduced, but in the rest of the specimen the hardness was unchanged from the start. At 300° C. there were no visible signs of slip, &c., until nearly 40 hr. (~0·4% extension), although the hardness as measured with a ball indenter had fallen >20%. Thereafter up to ~60 hr. deformation was by slip, which divided the specimen into regularly shaped regions, the boundaries of which became sites for selective pptn. At 60–80 hr. (0·7–1·2% extension) a transition from slip to block deformation took place; the boundaries of the blocks became irregular and heavily marked by pptn. Fracture occurred at 85 hr. (1·4% extension), by which time the hardness had fallen to one-third its initial value in the region of necking. In subsidiary experiments a specimen aged 100 hr. at 300° C. without applied stress broke after 1 hr. at 200° C. and 17 kg./mm.². Deformation was of the regular block type, although the extension was ~10%. Another specimen aged under the same conditions but under a stress of 4 kg./mm.² extended 20% in 1 hr. at 200° C. and 17 kg./mm.² before breaking. In this case deformation was by irregular blocks, the boundaries being heavily outlined by precipitate. In general, raising the temp. of deformation speeded up the change from slip to block deformation. At sufficiently high temp. the form of deformation passed directly from slipless flow to irregular blocks without the intervention of a period of normal slip. Conclusions are: (1) The absence of enhanced pptn. in the "slipless flow" range shows that such deformation is not, as has been suggested elsewhere, a diffusion process but involves slip too fine to be resolved by the microscope. (2) Some of these fine slips will grow to "critical size", which is defined as the size such that further slip on that plane results in a decrease of free energy. These slips then grow to be visible slip lines. (3) The transition from deformation by intersecting systems of slip lines to block-formation requires diffusion (it did not, e.g. occur in deformation at 200° C.). (4) Kinks are not a feature of deformation of the Al alloy.—A. F. B.

B7

FD 363

USSR/Physics - Alloys, Fatigue

Card 1/1

Author : Lashko, N. F. and Radetskaya, E. M.

Title : Fatigue processes of deterioration in alloys with "annealing twins"

Periodical : Zhur. tekh. fiz. 24, 417-424, Mar 1954

Abstract : Discusses nature and formation of annealing twin crystals and their effect on fatigue failure of alloys. Studies behavior of steels EI-437 and EI-395 in fatigue testing, concluding that not always and not in all alloys annealing twins cause fatigue cracks. Nine references; 8 USSR 1939-1953. Photomicrographs.

Institution :

Submitted : October 17, 1953

Lashko, N. F.

USSR/Metals - Austenite residue

Card 1/1 Pub. 153-17/28 FD-577

Author : Lashko, N. F.

Title : Variations in concentration in residual austenite

Periodical : Zhur. tekh. fiz. 24, 884-888, May 1954

Abstract : Discusses the problem of the decomposition of austenite during the cooling of steels. Describes his experiments on the determination of the nature and composition of the so-called "residual austenite". Come to conclusions that contradict the "universally accepted" concept of residual austenite, as held by A. A. Popov and V. D. Sadovskiy.

Institution :

Submitted : March 27, 1953

LASHKO-AVAKYAN, S.V., kandidat tekhnicheskikh nauk; LASHKO, N.F., kandidat tekhnicheskikh nauk; ORLOVA, V.V., inzhener.

Intercrystalline cracks in aluminum alloy weldings. Svar.proizv. no.1:13-18 Ja '55. (MLRA 9:4)
(Aluminum alloys--Welding)

LASHKO, N.F.

951. Phase analysis of aluminium-base alloys. N. I. Blok, O. A. Dobovitskaya-Khromova and N. F. Lashko. *Zavod. Lab.*, 1955, **21** (8), 894–899.—In the usual electrolytic method for separating phases in aluminium alloys with aqueous electrolytes the phase $CuAl_2$ is destroyed. A new method, based on the use of non-aqueous electrolytes, 2 g of LiCl in 1200 ml of methanol, 2 g of KSCN and 6 g of citric acid in 1200 ml of methanol, 2 g of ammonium acetate in 1200 ml of methanol, etc., is described. A membrane of cellulose acetate is used. To prevent ageing, the alloy with 4·85 per cent. Cu is rapidly cooled from 540° C, first in ice and salt and then in acetone. During electrolysis small portions of liquid N are introduced from time to time to maintain the surface of the sample below −7° C.

G. S. SMITH

LASHKO, N. F.

Effect of composition and interaction of phases on the stress relaxation of pearlitic steel. N. F. Lashko and V. Z. Tsiffin. *Vopросы Metalloved. Kontrolya Svoistv Materialov* 1955, No. 71, 250–81.—Compn. and amt. of carbide phases were detd. in steels contg. C 0.28–0.30 and either (1) Cr 0.9 and 1.81, (2) Mo 0.24 and 1.0, (3) V 0.3 and 0.84, (4) Ti 0.27 and 0.60, or (5) Cr 0.84 and 1.73 plus Mo 0.25 and 0.30%, resp., which had been tested for stress relaxation at 450, 500, and 550° for periods up to 2000 hrs. Factors which decreased stress relaxation were (1) slow coagulation of carbide phase, (2) high alloy content of steel if carbides of variable compn. were pptd. on heating, (3) high alloy content of solid soln., and (4) thermal stability of solid soln. and carbide phase. H. W. Rathmann

PERIODICAL ABSTRACTS

Sub.: USSR/Engineering AID 4183 - P

LASHKO-AVAKYAN, S. V., N. F. LASHKO, and V. V. ORLOVA. MEZHKRISTALITNYYE TRESHCHINY V SVARNYKH SOYEDINENIYAKH IZ ALYUMINEVYKH SPLAVOV (Inter-crystal Fissures in Welded Junctions of Aluminum Alloys). Svarochnoye proizvodstvo, no. 1, Ja 1956: 13-18.

These authors present results of their research and the experiments of other scientists on causes of crystallization and occurence of fissures in welded junctions of aluminum alloys. They describe two devices for determination of the deformations occuring in metals and alloys resistance to crystallization. Results obtained in these delicate experimentations are analysed and practical suggestions made. Two sketches, 5 graphs and 6 microphotographs ("Fractographs"). 7 Russian, 4 non-Russian references.

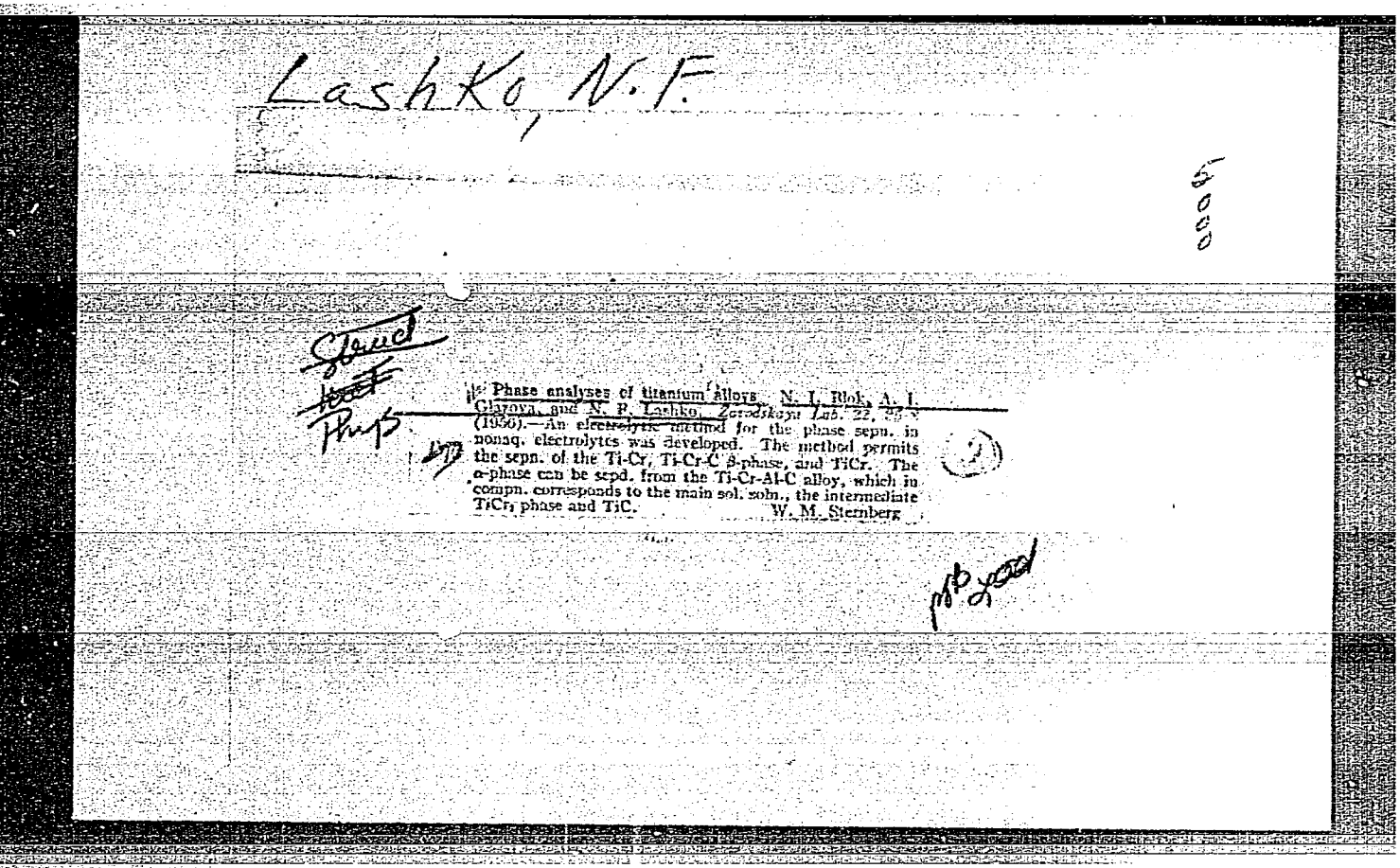
LASHKO, N.F., kandidat tekhnicheskikh nauk; LASHKO-AVAKYAN, S.V., [redacted] tekhnicheskikh nauk.

Summary of the conference on hot cracks in welded joints, castings and ingots. Lit.proizv. no.10:30-31 O '56. (MLRA 9:11)
(Founding--Quality control)

LASHKO, N. F.

Secondary hardness in steels alloyed with vanadium, molybdenum, and titanium. L. V. Zhilavskaya, S. T. Kishkin, N. F. Lashko, A. P. Platonova, N. M. Popova, and M. F. Rytova. *Izvest. Akad. Nauk S.S.R., Ser. Fiz.* 20, 684–8(1956).—An increase in hardness in V, Mo, and Ti steels annealed at 550–650° is called secondary hardness. This phenomenon is usually attributed to carbide formation. Two methods of differential carbide analysis were used in this paper. (1) The carbide residue was boiled in HCl; this dissolved cementite but left VC, Mo_2C, and TiC undissolved. (2) An alc. soln. of H_2O_2 left cementite undissolved and dissolved VC, Mo_2C, and also TiC if P salts were added. The investigated steels contained C 0.1–0.8, V 1–2.5, and Ti 0.3–0.5 or Mo 1.7%. They were annealed in A at 300, 400, 450, 500, 550, 600, or 700°. The carbides were obtained by anodic soln. in *N* KCl and 0.5*N* citric acid. The largest amt. of VC and TiC is formed at anneal temps. which give secondary hardness (in Mo_2C for low-C content only). Cementite disappeared if enough V, Mo, or Ti was present to bind all C. Metastable cementite is a necessary ingredient for the development of secondary hardness. VC and TiC do not contain Fe. VC can dissolve up to 50% Cr, loosing secondary hardness. An x-ray investigation revealed a coagulation of cementite above ~450°.

S. Paksver



Lashko, N. F.

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Phase analyses of titanium alloys. N. I. Blok, A. I. Glyanova, and N. P. Lashko. *Zavodskaya Lab.* 22, [illegible] (1956).—An electrolytic method for the phase sepn. in nonaq. electrolytes was developed. The method permits the sepn. of the Ti-Cr, Ti-Cr-C β-phase, and TiCr. The α-phase can be sepd. from the Ti-Cr-Al-C alloy, which in compn. corresponds to the main sol. soln., the intermediate $TiCr_2$ phase and TiC. W. M. Sternberg

LASHKO, Nikolay Fedorovich; Yeremin, Nikolay Ivanovich; RAKHSHTADT, A.G., kandidat tekhnicheskikh nauk, dotsent, retsenzent; GOL'DSHTEYN, A.A., inzhener, redaktor; SHENTURINA, Ye.A., redaktor izdatel'stva; SALAZKOV, N.P., tekhnicheskiy redaktor; MATVEYEVA, Ye.N., tekhnicheskiy redaktor

[Phase analysis and structure of austenitic steels] Fazovyi analiz i struktura austenitnykh stalei. Moskva, Gos.nauchno-tekhn.izd-vo mashinostroit.lit-ry, 1957. 234 p. (MLRA 10:10)
(Steel)

LASHKO, N.F.

137-58-2-3920

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 2, p 235 (USSR)

AUTHOR: Lashko, N. F.

TITLE: Phase Transitions in Precipitation Processes in Alloys (Fazovyye perekhody pri diffuzionnykh protsessakh v splavakh)

PERIODICAL: V sb.: Fiz.-khim. issled. austenitn. splavov. Moscow, Mashgiz, 1957, pp 69-74

ABSTRACT: A number of variants of structural changes in alloys, which occur when the alloys are transferred from one isothermic medium to another, are examined. These changes occur in accordance with the $\alpha+\beta=\alpha+\gamma$ pattern, where α, a solid solution, changes in composition with time, β is a metastable phase in a second medium, and γ is a phase in a stable equilibrium with the solid solution. It is shown that for transition processes from the β to the γ phase the difference in the bonds of the elements in the precipitating phase and in the solid solution, and also the presence of a concentration gradient of the elements, is of major significance. The major shortcomings of the existing methods of analysis of phase transformations, based on use of the Thomson equation, are

Card 1/2

137-58-2-3920

Phase Transitions in Precipitation Processes in Alloys

analyzed. On the basis of the general conception of the critical size of the nucleus, problems of growth of the metastable β phase are analyzed.

V. R.

1. Alloys--Phase transitions 2. Alloys--Precipitation--Phase transitions

Card 2/2

LASHKO, N.F.

137-58-2-3939

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 2, p 237 (USSR)

AUTHORS: Yeremin, N.I., Lashko, N.F., Lebedyanskaya, N.I.

TITLE: Phase Transofrmations in Austenitic Steels During Plastic Deformation (Fazovyye prevrashcheniya v austenitnykh stalyakh, proizkhodyashchiye pri plasticheskoy deformatsii)

PERIODICAL: V sb.: Fiz.-khim. issled. austenit. splavov. Moscow, Mashgiz, 1957, pp 91-106

ABSTRACT: Magnetic microanalysis was employed to investigate phase transformation occurring during cold plastic deformation in the following austenitic steels: EI505, 1Kh19N9T, EI434, 4Kh74N14V2M, 19-9, EM405, EI407, Kh18N11B, 16-33-3, EI388. It is shown that softening occurring on deformation facilitates the $\gamma \rightarrow \alpha_2$ transition. Phase stresses are particularly great in the case of precipitation of the α_2 phase along the boundaries of highly deformed grains. The process of slip is accompanied by lattice distortion, and shear stress results in viscous slip along the grain boundaries. Decomposition of γ with formation of α_2 on the grain boundaries occurs only in instances of slow deformation. In the event of signifi-

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137-58-2-3939

Phase Transformations in Austenitic Steels During Plastic (cont.)

cant deformation, the $\gamma \rightarrow \alpha_2$ transition appears along the boundaries of twins. The rate of transition increases rapidly as temperature drops, and precipitation of the α_2 phase results in hardening. The $\gamma \rightarrow \alpha_2$ transition is reversible. The temperature interval of reversible transition is below the temperature of crystallization. Ni, Cr, Mn, Mo, and C stimulate formation of an α_2 phase to different degrees. The solid γ-solution becomes less stable on precipitation of a carbide phase $(Me, Cr)_{23}C_6$ during aging. Metallographic and x-ray analysis of structure yielded concordant results.
Bibliography: 18 references.

V. R.

1. Austenitic steels—Phase transitions—Effects of deformation 2. Austenitic steels—Deformation 3. Austenitic steels—Phase transitions—Magnetic analysis

Card 2/2

Lashko, N.F.

137-58-3-6251

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 3, p 259 (USSR)

AUTHOR: Lashko, N.F.

TITLE: The Effect of Manganese and Nickel Contained in Some Austenite Steels on Their Phase Composition (Vliyaniye margantsa i nikelya v nekotorykh austenitnykh stalyakh na ikh fazovyy sostav)

PERIODICAL: V sb.: Fiz.-khim. issled. austenitn. splavov. Moscow, Mashgiz, 1957, pp 126-130

ABSTRACT: When Ni enters the crystalline structure of Fe, it increases the parameter of the α Fe lattice and reduces that of the γ Fe lattice. The effect of Ni on the phase composition of alloys containing 0.2 percent C, 20 percent Cr, 2 percent Mo, and 1 percent W was studied by means of experimental melts containing 10, 20, 40, and 70 percent of Ni. Ingots thus obtained were forged into rods from which experimental specimens were made. These specimens were tempered in accordance with the following two procedures: 1) heating to 1150°C, followed by two hours of cooling in oil and 50 hours of aging at a temperature of 800°; 2) heating to 1180° followed by two hours of cooling in water and 200 hours of aging at 800°. An electrolyte containing 300 g/ℓ KCl, 50 g/ℓ

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The Effect of Manganese and Nickel Contained in Some Austenite Steels (cont.)

sodium citrate, and 50 cc of concentrated HCl, was employed in a process of anodic dissolution at a D of 1 amp/cm^2. Precipitates obtained after the anodic dissolution of metal exhibited a comparatively homogeneous chemical composition. According to data from x-ray analysis of alloys containing 10.8 percent, 21 percent, and 39.0 percent of Ni, these precipitates are composed of cubic carbide of the type $Me_{23}C_6$. The precipitates of the alloy containing 72.7 percent Ni consist of trigonal carbide of the Me_7C_3 type. The effect of the variable Mn content on the phase composition of Cr-Ni steel of type 20-20 was established with the aid of three experimental smeltings. The Mn in the anodic deposits appears only in the carbide phase of the $Me_{23}C_6$ type. Consequently, as a carbide-forming element, the Mn is more active than Ni. Investigations have also shown that Cr is a considerably more active carbide-forming agent than Mn.

V.N.

LASHKO, N.F.

137-58-2-3942

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 2, p 238 (USSR)

AUTHORS: Yeremin, N.I., Lashko, N.F.

TITLE: On the Distribution of Nitrogen Between Solid Solution and Second Phases in Austenitic Steels (O raspredelenii azota mezhdu tverdym rastvorom i vtorymi fazami v austenitnykh stalyakh)

PERIODICAL: V sb.: Fiz.-khim. issled. austenitn. splavov. Moscow, Mashgiz, 1957, pp 131-136

ABSTRACT: The effect of N on the stabilization of austenite and the distribution of N between the solid solution and the precipitation phases in EI572 steel was investigated, wherein the N concentration attained 0.26%. To distinguish the effect of N on the suppression of an α phase of various types, a melt with a higher Cr concentration, facilitating formation of δ ferrite even at high N content (0.165%), was smelted. The specimens were subjected to a special form of heat treatment (Prosvirin, V.I., Saverina, I.A. V sb.: Voprosy metallovedeniya austenitnykh staley. Moscow, Mashgiz, 1952). A precipitate was obtained by electrochemical separation of the

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137-58-2-3942

On the Distribution of Nitrogen (cont.)

phases. The carbide phase $Me_{23}C_6$ was separated from the carbide and carbonitride phases MeC and Me(CN) and the α phase by boiling in HCl. The precipitate was subjected to x-ray and microstructural analysis. N_2 introduced into EI572 steel remains in solid solution for the most part. Grade 19-9 steel tends to formation of δ ferrite yielding a σ phase on aging, when it contains ferrite formers. The presence of N_2 eliminates δ ferrite and the formation of a metastable δ phase arising on plastic deformation.

V. R.

1. Steel—Transformations—Nitrogen distribution 2. Austenite—Stabilization —Effects of Nitrogen

Card 2/2

LASHKO, N.F.

137-58-2-3943

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 2, p 238 (USSR)

AUTHORS: Yeremin, N.N., Lashko, N.F., Lebedyanskaya, N.I.

TITLE: Phase Transformations in EI572 Steel During Forging (Fazovyye izmeneniya v stali EI572 pri kovke)

PERIODICAL: V sb.: Fiz.-khim. issled. austenit. splavov. Moscow, Mashgiz, 1957, pp 137-159

ABSTRACT: The changes in the phase composition of EI572 austenitic steel (19% Cr, 9% Ni, 0.26-0.36% C) were investigated with the object of determining optimum conditions for heating and cooling after forging. The processes of formation and change in δ ferrite, ferrite in the vicinity of the carbide phase, and ferrite arising as a result of plastic deformation, were also studied. Separation of the carbide phases was performed by making use of the selective solubility of carbides of the $Mo_{23}C_6$ type in hot HCl. The type of carbide was determined by x-ray structural analysis. Ferromagnetic phases were identified by magnetic analysis of the microstructure. It was shown that δ ferrite develops as a result of nonhomogeneous dendritic crystallization; its amount may be reduced by homo-

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137-58-2-3943

Phase Transformations in EI572 Steel During Forging

genation at 1250°. To avoid formation of δ ferrite, the final stage of heating and forging of the bars should be conducted at a temperature $\leq$ 1150°. The major ferrite formers are C, Cr, Mo, and Ti. The maximum amount of metastable α ferrite is formed on slow cooling to 850° and depends upon the rate of diffusion of the alloying elements around the carbide inclusions. The change in the structure of the steel in the process of aging at 650° is attributable to the formation and growth of carbides of the $Mo_{23}C_6$ type. EI572 steel becomes less stable in the course of the aging process and acquires a tendency to formation of α ferrite. Aging of the steel consists of the precipitation of a carbide phase (Nb, Ti)C and $(Cr, Ni, Fe, Mo, W)_{23}C_6$, and sometimes due to formation of a σ phase of the (Cr, Mo)Fe type.

V. R.

1. Steel—Transformations—Effects of forging 2. Steel—Deformation

Card 2/2

LASHKO, N.F.

137-58-2-4078

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 2, p 259 (USSR)

AUTHORS: Lashko, N.F., Tseytlin, V.Z.

TITLE: Certain Peculiarities of Medium-carbon Chrome-molybdenum Pearlitic Steel (Nekotoryye osobennosti sredneuglerodistoy khromomolibdenovoy perlitnoy stali)

PERIODICAL: V sb.: Fiz.-khim. issled. austenitn. splavov. Moscow, Mashgiz, 1957, pp 167-171

ABSTRACT: A study was made of two types of chrome-molybdenum steel containing 2 percent Cr and 0.9 percent Mo, one with an 0.5 percent V content and one with no V content. The steel was fused in a high-frequency furnace with a capacity of 12 kg. The ingots were forged into rods which were normalized at 1000°C and tempered for 6-10 hours at 650-740° and for 100 hours at 650°. The phase composition of the steel was investigated by means of a comprehensive physicochemical analysis which involved separating out the surplus phases by chemical means, a chemical analysis of the residue, and a differential X-ray and chemical study of the residue phases. After normalization and tempering at 650° for 10 hours the steel with no V in it was found to

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137-58-2-4078

Certain Peculiarities of Medium-carbon Chrome-molybdenum Pearlitic Steel

possess three phases of varying composition $(Fe, Cr, Mo)_3C$, $(Mo, Cr)_2C$, and $(Fe, Cr, Mo)_{23}C_6$; the steel with the 0.5 percent V content was found to have two phases $(Cr, Fe, Mo, V)_7C_3$ and (V, Mo, Cr)C. In the steel with no V the $(Fe, Cr, Mo)_3C$ phase was not in evidence after a 100-hour tempering at 650°, which suggests that this phase is metastable. The composition of a stable phase in the steel with no V was not ascertained. In the V-based MeC phase of a V-containing carbon steel the Fe was practically insoluble, the Cr was not very soluble, but a relatively large quantity of Mo could be dissolved therein. A small quantity of V ($\sim$0.5 percent), which was almost wholly combined with the vanadium carbide, exhibited great influence on the phase composition of the steel. Because a significant quantity of the Mo combined with the vanadium carbide, the possibility of formation of Mo_2C was excluded. The remaining C combined in the phase Me_7C_3.

T.F.

1. Steel--Phase studies

Card 2/2

PA - 2160

AUTHOR: LASHKO,N.F., LASHKO-AVAKYAN,S.Y.

TITLE: The Technological Strength of a Welded Joint in the Crystallization Process. (Tekhnologicheskaya prochnost' svarnogo soyedineniya v protsesse kristallizatsii, Russian)

PERIODICAL: Izvestiia Akad.Nauk SSSR, Otdel.Tekhn. 1957, Vol , Nr 1, pp 103-114 (U.S.S.R.)

Received: 3 / 1957 Reviewed: 4 / 1957

ABSTRACT: The technological strength of a welded joint during a welding process is investigated. It is shown that, for explaining mechanical characteristics of a body cooling down in the solid-liquid state, it is sufficient, in the case of not high deformation velocities, to proceed from the properties of the solid crystalline body, while the resistance of the liquid phase against elongation may be neglected. In the case of welding by melting the peculiarities of crystallization must be taken into account. In the course of crystallization also the section of the melt to be welded in the zone of thermal influence participates in the process. The change of the strength of the melt occurs spontaneously without any exterior action. Destruction of the welding seam in solid-liquid form takes place with the participation of deformations by elongation. Experiments showed that, in the case of melts of the eutectic type, the width of the interval of crystallization depends essentially on the composition

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PA - 2160

The Technological Strength of a Welded Joint in the Crystallization Process.

of the melt and on the velocity of crystallization. In melt-systems with the formation of inconstant chemical compounds, peritectic reaction cannot develop to the end if cooling is rapid, and crystallization ends by the formation of a small quantity of a labile eutectic. The occurrence of the latter and the drop of temperature on the occasion of the joining of the dendrites on the occasion of the crystallization of these melts is the reason for their pronounced tendency to form a crystallization gap. It may be assumed that part of the melts of the system under investigation undergoes peritectic reaction. (8 illustrations and 2 tables).

ASSOCIATION: Not given
PRESENTED BY:
SUBMITTED: 22. 6. 1956
AVAILABLE: Library of Congress

Card 2/2

LASHKO, N.F.

KOZLOVA, M.N.; LASHKO, N.F.

Binary carbides containing silicon. Zhur. neorg. khim. 2 no.11: 2517-2519 N '57. (MIRA 11:3)
(Carbides) (Silicon) (Alloys)

LASHKO, N. F.

"Concerning the Increase of the Strength of Spot Welded Joints of MA8 Alloy," by Candidate of Technical Sciences N. Kh. Andreyev and N. F. Lashko, Metallovedeniye i Obrabotka Metallov, No 3, Mar 57, pp 50-55

The strength of spot welded joints of the magnesium alloy, MA8, with a thickness of 3 mm, under static, repeated-static, and vibrational loadings is studied. The welded joints with working and joining points, and also similar riveted joints, were subjected to comparative tests. The test pieces were welded by the most favorable means on a machine (MTPS-600) with a direct current impulse. The diameter of the fused core of the spot consisted on the average of about 10.5 mm, and the depth of the fusion was held within the limits of 50-60%. The welded and riveted test pieces were approximately statistically of equal strength.

It was found that the strength of the welded joints (especially with working points) is considerably below the strength of the basic metal. The breakdown of the welded joints with the working points occurs at the border of the fused core or in the zone of transition. The single type riveted joint broke down at the section weakened by the hole.

SUM. 1360

LASHKO, N. F.

For increasing the strength of the welded joints, the weld spots were subjected to single and multiple pressures in the interval above the elastic limit and the conditional yield point of the alloy. The pressures were exerted by steel dies with an operating surface slightly larger than the surface of the electrodes.

Thus there exists a real possibility of increasing the vibrational strength of the welded points of joints in MA8 alloy by means of treatment of the welded points with static pressure relatively low load. (U)

SuM-1360

Lashko, N. F.

AUTHORS: Lashko, N. F., and Rodina, Ye. Ya. 126-2-11/35

TITLE: Distribution of alloying elements in austenitic chromium-tungsten steels and alloys with variable nickel contents. (Raspredeleniye legiruyushchikh elementov v austenitnykh khromovol'framovykh stalyakh i splavakh s peremennym soderzhaniyem nikelya).

PERIODICAL: Fizika Metallov i Metallovedeniye, 1957, Vol.5, No.2, pp. 261-267 (USSR)

ABSTRACT: Nickel is one of the main elements contained in austenitic steel which brings about a thermally stable austenitic base of the solid solution. The nickel and the iron possess differing carbide forming abilities and, therefore, different quantitative combinations of nickel and iron in steel should have a predominant influence on the solubility of carbide forming elements in the solid solution. In this paper the results are given of the phase analysis of austenitic steels and alloys. The steel and alloy specimens chosen contained the following: 0.2% C, 18% Cr, 9% W, 1 to 4% V, 1 to 4% Nb and, respectively, 24, 42 and 58% Ni. The alloys were cast into ingots weighing 4 kg and the specimens cut out from these ingots were all heated at 1100°C for five hours,

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Distribution of alloying elements in austenitic chromium-tungsten steels and alloys with variable nickel contents.

quenched in oil and then aged for fifty hours at 800°C. The anodic precipitates, separated from the alloys in the electrolyte were subjected to X-ray and chemical analysis. The electrolyte consisted of a solution of 300 g KCl + 10 cm^3 HCl per one litre of water; the electrolytic decomposition of the precipitates was effected at room temperature using a current density of 1 A/cm^2. Almost the whole of the nickel content in all the three types of alloys was in the solid solution and only very small quantities of it were detected in the precipitates (from 0.02 to 0.1% of the dissolved metal). The results of phase analysis are compared with the results obtained for long duration strength. It was found that an increase of the nickel content in the steels and alloys reduces the carbon solubility in them and, accordingly, brings about a change of the solid solution, of the composition of the separated out phases and of the heat resistance. In alloys not containing W, V and Nb (0.2% C; 18.5% Cr and a variable Ni content) only one carbide forms, namely $(Cr, Fe, Ni)_{23} C_6$. Addition of V

 or Nb to such alloys brings about formation of special

Distribution of alloying elements in austenitic chromium-tungsten steels and alloys with variable nickel contents.

carbides of the type MeC (VC,NbC) containing a certain quantity of Cr. The graphs Fig.1 show the influence of Nb on the chemical composition of the carbide precipitates of cast alloys containing respectively 18, 24, 9% W; 20, 40, 9% W; 20, 60, 9% W. The graphs Fig.2 show the influence of V on the chemical composition of the carbide precipitates of cast alloys of the same types as Fig.1. The Tables contain numerical results of the phase analysis, of the changes in long duration strength of heat treated alloys with various Ni contents, of the phase composition of the residues separated out from heat treated alloys containing various quantities of Ni, Nb and V as well as the results of X-ray structural analysis of the Me_2C phase for an alloy containing 58% Ni and various quantities of V and data on the influence of Nb and V on the long duration strength of steels at 800°C. In alloys containing 20% Cr, 60% Ni, 9% W addition of 1 to 4% V brought about formation of the primary carbide of the type Me_2C based on the metastable carbide Cr_2C containing V and W. It can be seen from the graph, Fig.2, that the quantity of V entering into the solid solution increases

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126-2-11/35

Distribution of alloying elements in austenitic chromium-tungsten steels and alloys with variable nickel contents.

continuously with increasing V content in the alloy and this brings about an increase in the thermal stability of the solid solution. The total quantity of the elements entering into the graphite phase changes relatively little. However, with increasing V content in the steel the relative quantity of binary carbides increases and these are more stable than the cubic carbide of chromium. An increased hardening of the solid solution with increasing V content in the steel and also formation of thermally more stable carbides leads to a gradual increase of the long duration strength of the steel. There are 2 figures and 10 tables.

SUBMITTED: June 21, 1956.
ASSOCIATION: All-Union Scientific Institute for Aviation Materials. (Vsesoyuznyy nauchno-issledovatel'skiy institut aviatsionnykh materialov).
AVAILABLE: Library of Congress.
Card 4/4

БЛОК, Н.И.

AUTHORS: Blok, N.I., Lashko, N.F., Sorokina, K.P., Khimushin, F.F. 32-8-3/61

TITLE: The Phase Analysis of Chromium-Nickel-Titanium Steels with Intermetallic Binding. (Fazovyy analiz khromonikeltitanovykh staley s intermetallidnym uprochneniyem.)

PERIODICAL: Zavodskaya Laboratoriya, 1957, Vol. 23, Nr 8, pp.901-903 (USSR)

ABSTRACT: In the paper a new method of the electrolytical distribution of phases in steel types with intermetallic binding is shown. A typical kind of steel (0,05% C; 19,45 % Ni; 2,53 % Ti; 11,65 % Cr; 0,85 % Al; 0,02 % B) was used as testing object. The action of the pH of the solution, temperature and current density were investigated. The following best suitable electrolysis conditions for the separation of quantitative anode precipitations were determined: current density 0,05 a/dm^2, temperature of the tank $< 10°$, pH from 2,2 to 4,9. In order to avoid oxygen separation on the anode 10% CH_3OH was added to the tank. The concentration of copper sulfate should not exceed 5 % because of the increase in acid development. For buffering the solution 8 % triply substituted ammonium citrate is added. The

CARD 1/2

Lash Ko,N.F.

AUTHOR: BLOK,N.I., KOZLOVA,M.N., LASHKO,N.F., and SHPUNT,K.YA. PA - 2743

TITLE: On the Ni_3B Compound in Nickel-Boron Alloys.
(O soyedinenii Ni_3B v splavakh nikel-bor, Russian).

PERIODICAL: Doklady Akademii Nauk SSSR, 1957, Vol 113, Nr 4, pp 811 - 812
(U.S.S.R.)

Received: 6 / 1957 Reviewed: 6 / 1957

ABSTRACT: The double diagram of the state Ni-B (up to 20 % B) was constructed for the first time by GIEBELSHAUSEN, who found that the compound with the highest content of nickel is Ni_2B. KIESSLING mentiones also the high content of nickel of the alloy Ni_3B without giving its characteristics. The authors investigated the structure and the phase composition of Ni-B alloys, which contain 0,01 - 2,5 % B. Metallographically they found that a uniformly etchable zone is separated at the boundaries of granulation which forms an eutectic with nickel. The alloy with 2,5 B is pre-eutectic. This phase was insulated chemically as well as electrolytically in aqueous (10 g $(NH_4)_2SO_4$ and 30 g hydrochloric hydroxylamin per 1200 ml water) and non-aqueous (50 ml HCl per 1150 ml methanol) electrolyt. From the data contained in tables 1 - 3 it may be seen that on the occasion of the electrolytic separation of phases a considerable part of nickel is dissolved borically. The major part is conserved when the alloy is treated with sulphuric acid. In any caseprecipitation shown one and the same phase, i.e. Ni_3B.

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On the Ni_3B Compound in Nickel-Boron Alloys. PA - 2743

It is a black, solid substance, insoluble in sulphoric acid (1:2 solution) and solvable after prolonged heating in concentrated sulphuric acid (1,84). Thus it may be said that in the double system Ni-B there exists a chemical compound Ni_2B which forms an eutectic with a solid solution on a nickel basis.
(2 illustrations and 3 tables)

ASSOCIATION: All-Union Scientific Research Institute for Aircraft Material
PRESENTED BY: S.I.VOLFKOVICH, Member of the Academy
SUBMITTED:
AVAILABLE: Library of Congress

Card 2/2

LASHKO, N.F.

PHASE I BOOK EXPLOITATION SOV/3711

Lashko-Avakyan, Sof'ya Vasil'yevna, Candidate of Technical Sciences, and Nikolay Fedotovich Lashko, Candidate of Technical Sciences

Payka alyuminiyevykh splavov (Soldering of Aluminum Alloys) Moscow, 1958. 25 p. (Series: Peredovoy opyt proizvodstva. Seriya "Mashinostroyeniye," vyp. 14) 5,000 copies printed.

Sponsoring Agencies: Moskovskiy Dom nauchno-tekhnicheskoy propagandy imeni F.E. Dzerzhinskogo; Obshchestvo po rasprostraneniyu politicheskikh i nauchnykh znaniy RSFSR.

Ed.: S.P. Filippova; Tech. Ed.: R.A. Sukhareva.

PURPOSE: This book is for solderers.

COVERAGE: The book discusses the difficulties in soldering aluminum, the methods of soldering and various solders for aluminum alloys for soldering in the temperature range up to 400°C and from 400 to 620°C. There are 12 references: 3 Soviet, 6 English, 1 German, and 2 French.

Card 1/2

Soldering of Aluminum Alloys SOV/3711

TABLE OF CONTENTS: None given [book divided as follows]:

AVAILABLE: Library of Congress

Card 2/2

VK/mg
6-8-60

AUTHOR: Lashko, N.F., Candidate of Technical Sciences 125-58-6-10/1

TITLE: To the Problem of the Effect of Niobium on the Structure of Welds on Austenitic 18-8 Grade Steel (K voprosu o vliyanii niobiya na strukturu svarnykh shvov na austenitnoy stali tipa 18-8)

PERIODICAL: Avtomaticheskaya Svarka, 1958, Nr 6, pp 84 - 87 (USSR)

ABSTRACT: The author discusses the effect of niobium in welds on "18-8" steel as indicated by literature (Guterman, Binder) and obtained by his own experiments. He investigated statements on the phase-composition of such steel alloyed with niobium, made by G.G. Mukhin and N.Yu. Pal'chuk [Ref. 3], who claimed to have discovered an inter-metallide "N-phase". This theory is refuted. There is 1 table and 5 references, 3 of which are Soviet, and 2 English.

SUBMITTED: June 26, 1957
AVAILABLE: Library of Congress
Card 1/1
1. Steel-Welding 2. Niobium-Effectiveness

AUTHORS: Lashko, N.F., and Lashko-Avakyan, S.V. SOV-125-58-9-14/14

TITLE: The Role of Carbide Phases and Initial Ferrite in the Formation of Crystallization Cracks While Welding Austenitic Steels (O roli karbidnykh faz i pervichnogo ferrita v obrazovanii kristallizatsionnykh treshchin pri svarke austenitnykh staley)

PERIODICAL: Avtomaticheskaya svarka, 1958, Nr 9, pp 98-110 (USSR)

ABSTRACT: The effect of alloying on the proneness to crystallization cracks in welded austenitic steels is discussed. Basic factors determining such proneness of weld joints, connected with alloying of the seams, include the effects of alloying elements on: 1) changes in the crystallization interval of austenitic steels; 2) formation of a non-equilibrium fusible eutectic between the dendrite axes and at the grain borders; 3) shrinkage phenomena in crystallization; 4) the initial grain size, forming during crystallization; 5) δ - ferrite formation in crystallization of austenitic steels. The effect of carbon, chromium, nickel, silicon, tungsten, molybdenum, titanium, vanadium and niobium on proneness to crystallization cracks in austenitic steel is analyzed. It is stated that intermetallic phases, formed in the case of a considerable content of alloying elements (such as tungsten,

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The Role of Carbide Phases and Initial Ferrite in the Formation of Crystallization Cracks While Welding Austenitic Steels

titanium, niobium and aluminum) do not have a substantial effect on crystallization crack formation, whereas carbide and boride phases are of basic importance. In pure austenitic steels, in particular in the case of a columnar structure, vanadium, titanium and niobium can increase proneness to crystallization cracks; in the case of a bi-phase structure ($\gamma + \delta$) created by these or other ferrite-forming elements, such as chromium, molybdenum, tungsten and silicon, proneness to crystallization cracks can be depressed. The positive effect of an initial ferrite phase in austenitic steels on their sensitivity to crystallization cracks is explained by taking into account the effect of the ferrite phase, on the aforementioned basic factors.

There are 5 microphotos, and 13 references, 11 of which are Soviet and 2 English.

SUBMITTED: June 14, 1957

1. Steels---Fracture 2. Welding---Metallurgical effects 3. Steel---Crystallization 4. Steel---Properties

Card 2/2

USCOMM-DD-55674

SOV/24-58-12-15/27

AUTHORS: Blok, N.I., Glazova, A.I., Lashko, N.F. and Yakimova, A.M. (Moscow)

TITLE: Influence of Hydrogen on Structural Transformations in Titanium Alloys (Vliyaniye vodoroda na strukturnyye prevrashcheniya v titanovykh splavakh)

PERIODICAL: Izvestiya Akademii Nauk, Otdeleniye Tekhnicheskikh Nauk, 1958, Nr 12, pp 96-99 (USSR)

ABSTRACT: The influence of hydrogen on the plastic properties of titanium alloys, which has recently been widely studied, varies with the form of the titanium in the alloy. The object of the work described was to investigate the influence of hydrogen on structural transformations in alloys with an $\alpha + \beta$ solid solution structure. Alloys VT3 and VT3-1, were studied, their respective compositions being: 0.04, 0.04% C; 2.78, 11.93% Cr; 4.9, 4.6% Al; - , 1.5% Mo; 0.20, 0.24% Fe; 0.04, 0.027% Si; 0.10, 0.11% O; 0.028, 0.042% N. The method used consisted of the non-aqueous electrolytic separation of phases, whose structures were then investigated with X-rays. The alloys were also studied metallographically. Saturation with hydrogen was effected by sealing the

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Influence of Hydrogen on Structural Transformations in Titanium Alloys

cylindrical specimen and titanium hydride in an evacuated quartz tube and heating to 700°C for 10 hours. Specimens with 0.005, 0.015, 0.025, 0.035, 0.05 and 0.12 wt.% hydrogen were obtained. They were subjected to differing heat treatments. It was found that in the VT3 alloy containing 0.015-0.035% hydrogen the eutectoidal reaction $\beta \rightarrow \alpha + TiC_{\gamma 2}$ is faster than in the hydrogen-free alloy; with 0.05-0.06% hydrogen the β-phase forms titanium hydride on heating; with 0.12% hydrogen the residual β-phase is stabilized and there is no eutectoidal reaction either on cooling after annealing or on heating for 100 hours at 400-450°C. In the VT3-1 alloy containing molybdenum the residual β-phase did not decompose after annealing and heating at 400 and 450°C for 100 hours irrespective of the hydrogen content in the range studied. In both types of alloy the β-phase unit cell parameter increases with hydrogen content (Fig.1 shows this effect for the VT3-1 alloy heat-treated in various ways). During the heating

Influence of Hydrogen on Structural Transformations in Titanium Alloys

of both alloys at 400-450°C the residual β-phase is enriched in chromium and molybdenum and, possibly, loses hydrogen. There are 3 figures, 3 tables and 6 references of which 5 are English and 1 Soviet.

SUBMITTED: 8th August 1957.

LASHKO, N.F.

AUTHORS: Blok, N. I., Glazova, A. I., Kokhova, G. M. 32-2-6/60
Lashko, N. F.

TITLE: The Phase Analysis of Complex Titanium Alloys
(Fazovyy analiz slozhnolegirovannykh titanovykh splavov)

PERIODICAL: Zavodskaya Laboratoriya, 1958, Vol. 24, Nr 2, pp. 141-145
(USSR)

ABSTRACT: In an earlier work various technical titanium alloys containing aluminium, chromium, molybdenum and changing amounts of hydrogen were already investigated, as was the phase composition of azoticized titanium. For the separation of phases a method of the anodic decomposition of alloys was developed. The authors worked with potassium rhodanide, citric acid, glycerin and methanol, at a current density of 0,013 A/cm^2, a terminal voltage of 30 V, at from -7° - -10°C. After the electrolysis the anode precipitates were investigated chemically as well as radiographically. In earlier works the Ti-alloys had been smelted in graphite crucibles, the carbon disturbing further investigations; therefore the authors smelted two-to threetimes in arc

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furnaces (till homogenization occured). The radiograms of heat after-treated (1, 10, 50 hours at 500°C) anode deposits showed the metal stable α-phase while the ω-phase was not observed. The changes in the aging process of the β-phase of two technical alloys (5,08% Al, 3,06% Cr and 4.7% Al, 1.86% Cr, 1.55 % Mo) were put down in a table and the authors noted that after an aging at 450°C only the β-phase is observed while the eutectoid reaction $\beta - \alpha + Cr_2Ti$ did not take place. Titanium hydride was isolated for the first time and the authors found that hydrogen dissolves mainly in the β-phase (this was found in collaboration with A. T. Yakimova), if, however, there is no such phase the excess hydrogen then forms the titanium hydrides. According to radiographic structural analyses the Ti-hydride was of crystalline structure of the NaCl-type, while the neutron-diffraction showed a tetragonal structure. The analyses of the anode precipitates treated in a nitrogen current at high temperatures showed that they consist of one or two phases, the wellknown finely grained TiN and in lower layers the second nitride Ti_nN. The latter is of tetragonal structure. The investigations

of Palty, Margolin and Nielsen concerning the Ti-N system in the ε -phase showed a similar structure, the difference however, between the radiograms found by them and the radiograms of the present work, is considerable.
There are 5 tables, and 3 references, 1 of which is Slavic

AVAILABLE: Library of Congress

1. Titanium alloys-Phase studies

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18(3), 5(4)
AUTHORS: Blok, N. I., Kozlova, M. N., Lashko, N. F., SOV/32-24-11-4/37
Andreyeva, A. G.

TITLE: Phase Analysis of Nitrided Steels (Fazovyy analiz azotirovannykh staley)

PERIODICAL: Zavodskaya Laboratoriya, 1958, Vol 24, Nr 11, pp 1315 - 1319 (USSR)

ABSTRACT: To study the many kinds of corrosion resistance of nitrided surfaces of rust-resistant steels an analytical method was developed, and the phases and the distribution of the alloyed elements were investigated. The experiments were carried out on 25Kh18N8V2 steel, with the participation of N.M.Rudneva, chief engineer. X-ray structural analysis showed two phases on the surface of the nitrided layers: the Fe_2N type with a hexagonal crystal lattice and the CrN type with a cubic lattice. The phases could best be separated with an electrolyte consisting of 50 ml. HCl (d= 1.19) and 1150 ml methanol, at a current density of 0,025 Ampere/cm^2, a temperature of -5^o to -10^o, and over a duration

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of 20-30 minutes. The anodic deposition consisted of iron carbon nitride, chromium nitride, and chromium carbide. The separation of the chromium nitride from the iron carbon nitride was carried out using the method of N.M.Popova (Ref 2). The nitrided samples dissolved in the anodic dissolution up to 0,035 mm deep. Up to a depth of 0,17 mm the nitrided layer consisted of three phases: the carbon nitride of the iron and chromium $(Fe,Cr)_2(N,C)$, the chromium nitride CrN, and the solid solution enriched with nitrogen and nickel. This layer possessed a positive electrode potential and was highly resistant to corrosion. The nitrides occurred at a depth of 0,17 to 0,22 mm and the layer consisted of Fe_4N, CrN, $Cr_{23}C_6$, and the solid solution. The nitrogen concentration was 0,3 - 0,4%, the electrode potential negative, and the corrosion resistance decreased. In the still deeper layers the chromium content was 15% with only 3% present as the $Cr_{23}C_6$. It showed a positive electrode potential and a high resistance to

Phase Analysis of Nitrided Steels

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corrosion. Investigations on nitrided Armco iron showed that the nitride phase up to a depth of 0,025 mm consists of Fe_2N and up to a depth of 0,06 mm of Fe_4N. The general content in the nitride phase was 18-36%, while the rest was a solid solution. There are 1 figure, 5 tables, and 1 reference, which is Soviet.

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L 42137-66 EWT(m)/T/EWP(t)/ETI IJP(c) JD/HW/JG

ACC NR: AP6027787 SOURCE CODE: UR/0126/66/022/001/0066/0072

AUTHOR: Lashko, N. F.; Sorokina, K. P.

ORG: none

TITLE: Characteristic features of the phase composition of heat-resistant steels and alloys of the Fe-Ni-Cr-Ti-Mo-W-B system

SOURCE: Fizika metallov i metallovedeniye, v. 22, no. 1, 1966, 66-72

TOPIC TAGS: heat resistant steel, alloy steel, heat resistant alloy, nickel chromium alloy, molybdenum containing alloy, tungsten containing alloy, boron containing alloy, alloy aging, phase composition

ABSTRACT: The phase composition of heat-resistant EI696, EI696M, and EI787 steels has been investigated. Electrolytically isolated precipitates were found to consist of TiC carbide, TiB$_2$ and Me_3B_2 borides, Fe_2Ti and Fe_2 (Ti, Mo) compounds, and β-Ni_3Ti phase in amounts depending on steel type and temperature and duration of aging. The β-Ni_3Ti phase precipitates in a cubic shape at temperatures above 750—800C. However, lamellar particles of this phase precipitated at grain boundaries in EI696M steel after aging at 750C for 2000 hr or in EI787 steel after aging for 6000 hr. With prolonged aging, β-Ni_3Ti phase of EI696M steel becomes richer in iron. Precipitation of

Card 1/2 UDC: 669.14.018.45:620.181.4

L 42137-66

ACC NR: AP6027787

the Fe_2Ti phase in EI696 steel occurs at a lower temperature, about 800C, and in larger quantities than in EI696M steel. Precipitation of the Fe_2Ti phase in the latter steel occurs only after aging at 900C for 100 hr or at 750C for 2000 hr. The phase composition of EI787 steel generally is similar to that of EI696M steel, except that in the former, Ni_3 (Ti, Al) replaces β-Ni_3Ti phase. The tendency of β-Ni_3Ti phase and Ni_3 (Ti, Al) phase to transform from globular to lamellar form at high temperatures or after prolonged aging is typical for many Ni-Fe-Cr-Al system alloys. Orig. art. has: 1 figure and 7 tables.

[TD]

SUB CODE: 11/ SUBM DATE: 03Aug64/ ORIG REF: 006/ ATD PRESS: 5062

Card 2/2

LASHKO, N.F.

25(1); 18(5) PHASE I BOOK EXPLOITATION SOV/2859

Akademiya nauk SSSR. Institut metallurgii

Goryachiye treshchiny v svarnykh soyedineniyakh slitkakh i otlivkakh (Hot Cracks in Welds, Ingots, and Castings) Moscow, Izd-vo AN SSSR, 1959. 163 p. 2,700 copies printed.

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

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

COVERAGE: This is a collection of scientific papers dealing with the formation of hot cracks in ingots, castings, and welded products. Some papers are concerned mainly with the nature or mechanism of the phenomenon; others examine the effect of factors such as steelmaking procedure. Sufficient evidence is presented to identify some of the causes of hot cracks. Various means of investigating and preventing the phenomenon are described. A number of references, both Soviet and non-Soviet, accompany the papers. ~~For further coverage~~

Prokhorov, N. N. Intergranular Strength of Metals 108

The author points out that hot cracks are one of the main causes of rejection of welded and cast products. To solve the problem he suggests intensive study of the hot strength of metals, using several different approaches: 1) investigation of deformations caused by welding and casting processes, accompanied by development of computational methods of determining deformations and their concentration at high temperatures; 2) study of the mechanical properties of metals during crystallization and cooling; 3) development of a single working hypothesis of intergranular strength of metals which would guide investigators and manufacturers in solving theoretical and practical problems connected with hot-crack formation (in this connection the author suggests the utility of his own hypothesis, based on a comparison of the numerical values of the deformation and plasticity of metals within a definite temperature range of brittleness); development of unified methods of testing metals for susceptibility to hot-crack formation in welding and casting; 5) development of quantitative methods of determining the effect of the shape of the product, as required by manufacturing and constructional considerations, on intergranular strength of welded and cast products; 6) systematic adoption of new scientific methods by manufacturers.

Lashko-Avakyan, S. V., and N. F. Lashko. Intergranular Crystallization Cracks in the Casting and Welding of Aluminum Alloys 131

According to the author, certain alloys ordinarily subject to the formation of crystallization cracks after welding can be rendered resistant to such cracks by the use of an added metal (alloy) which satisfies the following conditions: (a) the weld metal must not be subject to crack formation after welding; (b) the liquidus temperature of the weld metal must not be higher than that of the parent metal; (c) the weld metal must not contain components that in penetrating the base metal along the boundaries of fused grains in the heat-affected zone would form alloys with significantly lower eutectic temperatures than that of the base metal.

25(1) PHASE I BOOK EXPLOITATION SOV/2212

Lashko, Nikolay Fedorovich, and Sof'ya Vasil'yevna Lashko-Avakyan

Payka metallov (Brazing and Soldering of Metals) Moscow, Mashgiz, 1959. 442 p. 10,000 copies printed.

Ed.: S. L. Martens, Engineer; Tech. Eds.: A.F. Uvarova and V.D. El'kind; Managing Ed. for Literature on Heavy Machine Building (Mashgiz): S. Ya. Golovin, Engineer.

PURPOSE: This book is intended for scientists, engineers, and technicians concerned with the development and application of metal soldering in the machine-building industry.

COVERAGE: The authors discuss the basic physical and chemical processes and structural transformations occuring during metal soldering and brazing, the constructional characteristics of soldered joints, and the preparation of parts for soldering. They also give information on fluxes and solders and describe methods for manual and mechanized soldering of alloys of different bases. No personalities are mentioned. References follow each chapter.

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Brazing and Soldering of Metals (Cont.) SOV/2212

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Brazing and Soldering of Metals (Cont.) SOV/2212

AVAILABLE: Library of Congress

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GO/fal
10-12-59

5(2), 18(6), 18(7) SOV/78-4-7-24/44

AUTHORS: Lashko, N. F., Sorokina, K. P.

TITLE: The Phase-analysis of the Copper Corner of the System Copper - Nickel - Silicon (Fazovyy analiz mednogo ugla sistemy med' - nikel' - kremniy)

PERIODICAL: Zhurnal neorganicheskoy khimii, 1959, Vol 4, Nr 7, pp 1613-1615 (USSR)

ABSTRACT: The phase composition of the copper corner in the Cu - Ni - Si system and in industrial Ni-Si-bronzes has not yet been explained. References 1-4 contain contradictory data. In order to explain these contradictions, alloys with 1.5% Si and 3, 7, 12 and 20% Ni as well as 1.5-5% Si and 20-25% Ni were produced (Fig 1). The electrolytic phase separation was carried out in electrolytes consisting of aqueous solutions of copper sulfate and ammonium citrate. Current density amounted to 0.05 a/cm^2. Table 1 shows the X-ray structural analysis by means of K_2-radiation of copper for the precipitates obtained from alloys containing 1.5% Si. In alloys with 1.5-5% Si and 20-25% Ni the phases Ni_3Si and Ni_5Si_2 were found. Chemical analyses of the precipitates of alloys with 1.5% Si and 7, 12, and 20% Ni after

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The Phase-analysis of the Copper Corner of the System Copper - Nickel - Silicon

various thermal treatments are given in table 2. The precipitates consisted of the phases Ni_5Si_2, Ni_3Si and ∂-Ni_2Si. All phases were free from copper. In alloys of up to 7% Ni the solid solution is in equilibrium with the phase ∂-Ni_2Si. In alloys with 12% Ni the equilibrium phase was Ni_5Si_2 at 500-700°, and in alloys with 20-25% Ni it was the phases Ni_5Si_2 and Ni_3Si. There are 1 figure, 2 tables, and 5 references, 3 of which are Soviet.

SUBMITTED: April 12, 1958

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SOV/129-59-5-12/17

AUTHORS: M.F. Alekseyenko, N.F. Lashko, N.M. Popova, G.N. Orekhov

TITLE: Phase Analysis of Heat Resistant Constructional Steels (Fazovyy analiz teplostoykikh konstruktsionnykh staley)

PERIODICAL: Metallovedeniye i Termicheskaya Obrabotka Metallov, 1959, Nr 5, pp 52-54 (USSR)

ABSTRACT: The authors investigated the phase composition and the mechanical properties of the steels 30Kh3VA, 30Kh2N2VA (i.e. with differing vanadium contents) and of the steel EI415. The results of the strength tests after heat treatment (quenching in oil followed by tempering) for each of these steels are entered in a table on page 52. The carbide analysis was effected on 12 mm diameter, 60 mm long specimens which served as anodes and dissolved in an electrolyte for a duration of 5 hours with a current density of 0.2 A/cm^2, following which the solution was cooled to 0°C. The Fe, Cr, Mn, W, V and Mo contents of the carbide precipitates were determined. In Fig 1 the influence is graphed of the tempering time at 500 °C of the steels 30Kh2N2VA (curves 1 and 2) and 30Kh3VA (curves 3 and 4) on the contents of individual elements which are combined in the carbides. In Figs 2 and 3 the

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Phase Analysis of Heat Resistant Constructional Steels

influence is graphed of the tempering time at 600 °C of the steels 30Kh2N2VA and 30Kh3VA respectively on the contents of Cr and Fe which are combined in the cementite and trigonal chromium carbide; the effect of vanadium additions on the mechanical properties and the sustained strength of 30Kh2N2VA steel is graphed in Figs 4 and 5. The results of analysis of phase composition of 30Kh2N2VA steels with various vanadium contents enabled explaining their behaviour in tests for sustained strength at 550 °C. The sustained strength is determined by the hardening of the solid solution, its thermal stability and also its interaction with the rejected phases. The hardening effect of the rejected phases on the steel depends on their degree of dispersion and the proneness to diffusion interaction with the solid solution; the lower the speed of formation and the slower the growth of the germinations, the greater will be the hardening effect on the steel. After tempering at 650 °C the carbide phases in the steel EI415 combined only partly with the alloying elements W, Mo, V and Cr. The alloying elements which remained in the solid

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Phase Analysis of Heat Resistant Constructional Steels

solution, slowed down diffusion process and hardened the solid solution. After tempering at 650 °C for one hour 2.2% Cr remained in the solid solution. Subsequent tempering at 500 °C for 10 and 300 hours had little effect on the redistribution of the alloying elements between the carbides and the solid solutions. Such alloying distinguishes favourably the steel EI415 from other steels of similar composition.

Card 3/3 There are 5 figures and 1 table.

SOV/135-59-6-6/20

18(7)

AUTHOR: Lashko-Avakyan, S. V., and Lashko, N. F., Candidates of Technical Sciences

TITLE: Problems in Alloying Welded Strained Aluminum Alloys

PERIODICAL: Svarochnoye Proizvodstvo, 1959, Nr 6, pp 19-23 (USSR)

ABSTRACT: For a long time aluminum-alloys have been used for welded products, with a comparatively small tendency to fissure-forming, producing plastic, weld seams. The alloys were AD-1, AMts, AMg-3. The article represents new sorts: AMg-6T, D20, M40, which are different from DK6, AK6, AK8, B95, according to their structure. The article discusses - from the point of view of improving their weldings - welded strained aluminum alloys used in the welding industry, such as AMts AV, AMg, Ah6, AK8, D16, V 95. These alloys contain almost all technical systems of aluminum alloys: Al-Mn, Al-Mg, Al-Mg-Si, Al-Mg-Si-Cu, Al-Cu-Mg, Al-Zn-Mg, Al-Zn-Mg-Cu. Single sorts of aluminum are examined separately: technical aluminum, AMts-alloys, Al-Mg-alloys, AB-alloys,

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SOV/135-59-6-6/20

Problems in Alloying Welded Strained Aluminum Alloys

AK (AK 6, AK 8) alloys, Duraluminum D1 and D16, alloy B 95. There are 5 graphs, 1 photograph, 1 table, 1 diagram and 4 references, 3 of which are Soviet and 1 German.

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A006/A001

Translation from: Referativnyy zhurnal, Metallurgiya, 1961, No. 2, p. 9 # 2E69

AUTHORS: Lashko-Avakyan, S.V., Lashko, N.F.

TITLE: On the Weldability of Aluminum Alloys

PERIODICAL: "Tr. Nauchno-tekhn. o-va sudostroit. prom-sti", 1959, No. 33, pp. 3 - 19

TEXT: The authors analyze the mechanism of hot crack formation during the welding of Al-alloys of the systems: Al-Cu; Al-Cu-Mg; Al-Mg; Al-Mg-Si; Al-Zn-Mg and Al-Zn-Mg-Cu. Problems of chemical heterogeneity and means of modifying weld joints are discussed; methods of preventing hot crack formation are recommended. There are 16 references.

Yu. S.

Translator's note: This is the full translation of the original Russian abstract.

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18(7)

SOV/32-25-6-5/53

AUTHORS: Sorokina, K. P., Blok, N. I., Lashko, N. F.

TITLE: Phase Analysis of Chromium-Nickel-Titanium Steels With Intermetallide Hardening (Fazovyy analiz khromonikel'titanovykh staley s intermetallidnym uprochneniyem)

PERIODICAL: Zavodskaya Laboratoriya, 1959, Vol 25, Nr 6, pp 659 - 661 (USSR)

ABSTRACT: It had already been shown (Ref 1) that the hardening phase in the steel type EI-696 is the phase β-Ni_3Ti which exhibits a face-centered crystal lattice. Further phase analyses of this steel revealed that the two intermetallide phases Fe_2Ti and α-Ni_3Ti with a hexagonal crystal lattice occur after heating up to 800-950°. Since also titanium carbide and titanium boride are present as primary phases, this steel exhibits as much as 6 phases. An electrolytic phase separation in the electrolyte Nr 5 (50 g copper sulphate, 80 g triammonium citrate and 100 ml methanol per 1 l of water) was carried out, and a quantitative separation of the phases β-Ni_3Ti and TiC was obtained. The content of elements in the phase β-Ni_3Ti was obtained from the difference after a second dissolution

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in the electrolyte 81 (50 ml HCl, 100 ml glycerin and 1050 ml methanol) (Ref 2). Satisfactory results were also obtained with the method TsNIIChM (Ref 3) (Table 1, results from both methods). The electrolytic dissolution of the steel EI-696 heated for 100 hours over 800°, yielded titanium carbide and -diboride and the intermetallide phases Fe_2Ti and α-Ni_3Ti at the anode (Table 2). A prolongation of the duration of treatment of the anode precipitate with the electrolyte 81 showed no influence on the result of the X-ray structural analysis (Table 3) and the phases Fe_2Ti and α-Ni_3Ti could not be separated chemically. The steel EI-696 thus represents a six-phase system: the hardening fundamental phase β-Ni_3Ti, the phases Fe_2Ti and α-Ni_3Ti, the two primary phases TiC and TiB_2, and the solid solution. There are 1 figure, 3 tables and 3 Soviet references.

18(7)

AUTHORS: Blok, N. I., Kozlova, M. N., Lashko, N. F., Sorokina, K. P. SOV/32-25-9-10/53

TITLE: Boride Phases in Alloys on the Nickel - Chromium Basis

PERIODICAL: Zavodskaya laboratoriya, 1959, Vol 25, Nr 9, pp 1059-1064 (USSR)

ABSTRACT: It was ascertained by experiment that the heat-resistivity of the alloys (A) on nickel-chromium basis increases greatly with a small content of boron. Metallographic investigations showed that at 0.01 - 0.5% of B, eutectic deposits of the boride phase occur at the grain boundaries. A method for the phase analysis of such (A) was elaborated, in which the boride phases are separated electrolytically. The phases separated were subjected to X-ray structural investigations and chemical analyses. N. M. Rudneva, Ye. A. Vinogradova, and K. V. Smirnova took part in the experimental part of the work. (A) of the type EI473 (up to 0.23% B) (I), cast alloys ZhSZ (up to 0.22% B)(II), EI617 (up to 0.5% B) (III), and the combined (A) ZhSZ (IV)(Table 1) were used. For the quantitative separation of the boride phases the following anhydrous electrolyte was the most suitable; 50 ml HCl (1.19), 100 ml glycerin and 1050 ml methanol (Ref 2). Electrolysis took

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place for 60-90 minutes at a current density of 0.06 a/cm^2 under ice-cooling. The chemical and X-ray structural analyses of the anode precipitates showed (Table 2). that practically the entire B occurs in the (A) as a compound. Besides, the boride phase, titanium nitride was found in (I), and separated from chromium boride (Table 3) according to the method (Ref 4). Formula $(Cr, Ni)_5B_4$, or $(Cr, Ni)_4B_3$ corresponds approximately to the boride phase (phase X) from (I), which shows a tetragonal crystalline structure. A combined boride (phase Y) of the incidental formula $(Mo,Cr,W,Ni)_4B_3$, or $(Mo,Cr,W,Ni)_5B_4$ is formed by an increase of the borium content in (II), (III), and (IV). The crystalline structure of this phase could not be ascertained. It is assumed that this phase is a ternary, or more complicated compound. Data of X-ray structural analysis according to the powder method for the two phases X and Y are given (Table 4). There are 2 figures, 4 tables, and 3 references, 2 of which are Soviet.

LASHKO, N.F.

PHASE I BOOK EXPLOITATION SOV/4508

Akademiya nauk SSSR. Institut metallurgii

Titan i yego splavy, vyp. 3: Metallovedeniye titana (Titanium and Its Alloys, No. 3: Metal Science of Titanium) Moscow, Izd-vo AN SSSR, 1960, 161 p. Errata slip inserted. 2,700 copies printed.

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

Resp. Ed.: N.V. Ageyev, Corresponding Member, Academy of Sciences USSR; Ed. of Publishing House: M.L. Podgoyetskiy; Tech. Ed.: Ye. V. Makuni.

PURPOSE: This collection of articles is intended for scientific research workers and metallurgical engineers.

COVERAGE: The articles summarize results of experimental studies of titanium-base alloys. The microstructure and mechanical properties of titanium-base alloys containing aluminum, chromium or other metals are analyzed along with the effect of oxygen, hydrogen and heat treatment on alloy structure and properties. The tendency of titanium alloys to embrittlement as a result of strain aging is emphasized, and the nitriding of titanium, carried out to increase the surface strength and wear resistance of titanium alloys, is described. Transformations occuring in commercial titanium under conditions of electric heating are examined. Attempts to develop titanium-base alloys capable of withstanding temperatures over 400°C are discussed as are problems of titanium-powder metallurgy and weldability of certain titanium-base alloys. No personalities are mentioned. Most of the articles have bibliographic references, the majority of which are Soviet.

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LASHKO, N.F.

PHASE I BOOK EXPLOITATION SOV/4343

Soveshchaniye po teorii liteynykh protsessov, 3d

Usadochnyye protsessy v metallakh; trudy soveshchaniya (Shrinkage Processes in Metals; Transactions of the Third Conference on the Theory of Casting Processes) Moscow, AN SSSR, 1960. 281 p. Errata slip inserted. 3,000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut mashinovedeniya. Komissiya po tekhnologii mashinostroyeniya.

Resp. Ed.: B.B. Gulyayev, Doctor of Technical Sciences, Professor; Ed. of Publishing House: V.S. Rabesnikov; Tech. Ed.: T.V. Polyakova.

PURPOSE: This collection of articles is intended for scientific workers, engineers, technicians of scientific research institutes and industrial plants, and for faculty members of schools of higher education.

COVERAGE: The collection contains technical papers presented at the Third Conference on the Theory of Casting Processes, organized by Liteynaya sektsiya Komissii po tekhnologii mashinostroyeniya Instituta mashinovedeniya AN SSSR (Casting Section of the Commission for Machine-Building Technology of the Institute of Science of Machines, Academy of Sciences USSR) and by Institut metallurgii imeni Baykova AN SSSR (Institute of Metallurgy imeni A.A. Baykov, Academy of Sciences USSR). The most serious defects in castings, ingots, and welds as a result of metal shrinkage are reviewed. Factors contributing to the formation of shrinkage cavities, porosity, cracks, fissures, distortion, and internal stresses are analyzed along with measures taken to prevent and remedy them. The hydrodynamics of molten metals and the process of solidification of metals are discussed. Also presented are resolutions adopted at the Conference with regard to the problem of shrinkage in metals. No personalities are mentioned. Most papers are accompanied by bibliographic references, the majority of which are Soviet.

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Shrinkage Processes (Cont.) SOV/4343

AVAILABLE: Library of Congress (TS230.S7)

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LASHKO, N.F.

PHASE I BOOK EXPLOITATION SOV/4544

Soveshchaniye po teorii liteynykh protsessov, 4th.

Kristallizatsiya metallov; trudy soveshchaniya (Crystallization of Metals; Transactions of the Fourth Conference on the Theory of Casting Processes) Moscow, Izd-vo AN SSSR, 1960. 325 p. 3,200 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut mashinovedeniya. Komissiya po tekhnologii mashinostroyeniya.

Resp. Ed.: B. B. Gulyayev, Doctor of Technical Sciences, Professor; Ed. of Publishing House: V. S. Rzheznikov; Tech. Ed.: S. G. Tikhomirova.

PURPOSE: This book is intended for metallurgists and scientific workers. It may also be useful to technical personnel at foundries.

COVERAGE: The book contains the transactions of the Fourth Conference (1958) on the Theory of Casting Processes. [The previous 3 conferences dealt with hydrodynamics of molten metals (1955), solidification of metals (1956), and shrinkage processes in castings (1957)]. General problems in the crystallization of metals, including the crystallization of constructional steels, alloy steels with special properties, cast iron, and of nonferrous alloys, are discussed. Recognition is given to D. K. Chernov and N. T. Gudtsov and their students, B. B. Gulyayev and A. G. Spasskiy, for their contributions to the understanding of the basic problems involved in the theory of crystallization of ferrous and nonferrous metals and alloys. Academician A. V. Shubnikov is also mentioned in connection with his work on the planning of research on crystal formation. References accompany several of the articles.

PHASE I BOOK EXPLOITATION SOV/4270

Lashko, Nikolay Fedorovich, and Sof'ya Vasil'yevna Lashko-Avakyan

Svarivayemyye legkiye splavy (Weldable Light-Metal Alloys) Leningrad, Sudpromgiz, 1960. 439 p. Errata slip inserted. 3,400 copies printed.

Scientific Ed.: G.L. Petrov; Ed.: Yu. S. Kazarov; Tech. Ed.: R.K. Tsal.

PURPOSE: The book is intended for scientific and technical personnel engaged in research, development, and use of weldable light-metal alloys.

COVERAGE: The book contains results of investigations of the structure of welded joints and the causes and prevention of hot cracking. Basic characteristics are given of industrial alloys and recently developed aluminum-, magnesium-, and titanium-base alloys. An analysis of the weldability of these alloys is also presented. Conditions for making high-grade welds are discussed. No personalities are mentioned. References accompany each part.

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S/593/60/000/000/005/007
D204/D302

AUTHORS: Blok, N.I., and Lashko, N.F.

TITLE: Phase analysis of certain multicomponent alloys

SOURCE: Soveshchaniye po khimicheskomu kontrolyu proizvodstva v metallurgicheskoy i metalloobrabatyvayushchey promyshlennosti. Dnepropetrovsk, 1958. Khimicheskiy kontrol' proizvodstva i metallurgicheskoy i metalloobrabatyvayushchey promyshlennosti; [doklady soveshchaniya] [Dnepropetrovsk] 1960, 246 - 250

TEXT: A description of phase analysis of a number of refractory alloys based on Ni-Cr, among them ЭИ-437 (EI-437), EI-617, ЖС3 (ZhS3), EI-698, EI-598 and EI-765. The highly dispersed α'-phase was separated electrolytically, using electrolyte no. 18 (10 g $(NH_4)_2SO_4$, 10 g citric acid, 1200 ml H_2O); the carbide and boride phases with electrolyte 81 (50 ml conc. HCl, 10 ml glycerine, 1050 ml methanol). Chemical, X-ray and metallographic methods were used to study the composition, structure and extent of the various pha-

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SOV/125-60-1-4/18

AUTHOR: Lashko-Avakyan, S.V. and Lashko, N.F. (Moscow)

TITLE: Crystallization Cracks Near Weld Seams

PERIODICAL: Avtomaticheskaya svarka, 1960, Nr 1, pp 27-37 (USSR)

ABSTRACT: The peculiarities and probable processes of crack formation near weld seams, mainly in aluminum alloys, are discussed. Data from existing works [Ref 1-9] as well as experimental evidence are presented in support of the inferences drawn. Macro and microphotographs of seams in steel and aluminum alloys are given. The nature of near-weld crystallization cracks is attributed to the formation (not growth) processes of metal grains, observed experimentally with the VIM-1M microscope, in the base metal at the seam. It is concluded that the tendency to form cracks can be diminished by rapid heating of the base metal to melting point, by producing a small zone of partial melting, and by any

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Crystallization Cracks Near Weld Seams

means conducive to the formation of a fine grain structure in the base metal near the weld. The following filler metals prevent cracking in and near the weld during the welding of duraluminum: "AK"(4.5-6% Si; the rest aluminum); "B61"(6-7% Cu: 2-2.5% Ni; 1.2-1.6% Mg; 0.4% Mn; 0.25--.35% Ti; the rest aluminum). These filler metals form more easily fusible alloys in the seams. There are 7 photographs, 4 graphs and 9 references, of which 8 are Soviet and 1 English.

SUBMITTED: July 2, 1959

Card 2/2

S/135/60/000/005/003/009
A115/A029

AUTHORS: Popova, L.S., Engineer; Lashko, N.F., Candidate of Technical Sciences

TITLE: Hardening in the Heat-Influenced Welding Zone of Structural Martensite Steels

PERIODICAL: Svarochnoye proizvodstvo, 1960, No. 5, pp. 11 - 15

TEXT: The structural martensite steels are processed for 150 kg/mm^2. Immediately after welding, the solidity limits of weldments decrease to 50 - 75%. In the zone of thermal influence of a weldment a section is found in which the process of disintegration is caused by destruction of martensite substance, i.e., of oversaturated alloying elements and by coagulation of carbide phases. The location of the destructed part depends on the method of welding. In structural martensite steels, a carbide phase of the type of cementite Me_3 is formed containing Mn, Cr, Mo, W, V, Ti and Nb. The rate of cementite coagulation depends on the possibility of distribution of the alloying elements between the solid solution and the isolation phases. Therefore, the rate of cementite growth is higher with chrome steels than with molybdenum or vanadium steels. Higher

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S/135/60/000/005/003/009
A115/A029

Hardening in the Heat-Influenced Welding Zone of Structural Martensite Steels

strength in the zone of thermal influence can be achieved by alloying the steel with Me_7C_3, Me_2C, MeC and $Me_{23}C_6$. The best effect of strengthening steel by the cementite phase Me_3C can be obtained at 100 - 300°C depending on the alloying elements. The best strength of structural martensite steels is retained with Me_7C_3 carbides at temperatures of up to 500°C depending on alloys and thermal treatment or by carbides Me_2C or MeC at 500 - 650°C. To investigate the disintegration of solid solutions in the zone of thermal influence of welding, two series of alloyed steels containing 0.20 - 0.30% C have been used (Table 1). In the first series (No. 278N, 320, 464), depending on chemical composition, one-phase disintegration with subsequent formation of Me_3C and corresponding carbide phases $(Cr, Fe)_7C_3$; W_2C, VC was obtained and in the second series of steels (No. 265, 273, 277, 187, 278), depending on chemical composition and the zone of thermal influence, one-phase, two-phase and three-phase disintegration of the solid solution has been produced. The average content of alloying elements is 0.25% C, 2% Cr, 1% W, 1% Ni, 0.25% Va. Steels were smelted in an induction furnace, and one of the alloying elements: C, Cr, W, V was added. The bars were pressed to 4-mm plates, heated to 890°C, cooled in oil for 15 min with

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Hardening in the Heat-Influenced Welding Zone of Structural Martensite Steels

subsequent tempering at 200°C for 1 hour; arc-welded manually with УОНИ-13/85 (UONI-13/85) electrodes. Results of mechanical tests of weldments and basic metal are given in Tables 2 and 3. Tables 4 and 5 show results of chemical and X-ray inspections. The smallest increase in firmness after two-phase treatment has been noted in the cases, where only vanadium was used as alloying substance (solution No. 464). A considerable part of vanadium is bound in the form of primary vanadium carbides VC. These do not dissolve, even if heated up to 1,300°C and do not participate in strengthening the steel. Vanadium binds a large part of carbon and the share of martensite strengthening is decreasing. In steels alloyed with tungsten the solidity of weldments increased from 64 to 83.3 kg/mm^2. In case of chrome, the solidity of weldments was strengthened up to 80 - 85 kg/mm^2. Significant improvements were achieved at welding steels alloyed with tungsten and chromium - (100 - 105 kg/mm^2). There are 5 Soviet references.

Card 3/3

18.1285

21392
S/032/61/027/012/002/015
B119/B147

AUTHORS: Blok, N. I., Glazova, A. I., Lashko, N. F., Kurayeva, V. P. Molchanova, Ye. K.

TITLE: Phase analysis of alloys on titanium basis

PERIODICAL: Zavodskaya laboratoriya, v. 27, no. 12, 1961, 1470 - 1472

TEXT: α+β-alloys with stabilized β-phase, and α-alloys with intermetallic hardening were examined. The individual phases were isolated by anodic solution of the alloy in anhydrous electrolyte (3 g of KCNS or 2 g of LiCl, 10 g of citric acid, and 1200 milliliters of methanol). Thereafter, they were subjected to X-ray structural and chemical analysis. Mo, V, Nb, and Ta were identified as stabilizers for the β-phase, the effect of which decreases in the sequence mentioned. (In the presence of 4% Mo the content of the β-phase in the alloy is 11%; at 4% V, it is 9%, and at 4% Nb or Ta, only 3%). After forging, the anodic deposit of these alloys consists entirely of β-phase. In the presence of 4% Ta, alloys aged for 100 hr at 500°C show only small quantities of β-phase, whereas 4% Mo or V completely prevent the β-phase from decomposing. Ti-Cu alloys containing up to 5% Cu have one phase of the composition Ti_3Cu

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Phase analysis of alloys on ...

with tetragonal face-centered lattice. A phase of the type Ti_3Cu of different composition was also observed in Ti-Al-Cu-Sn alloys (containing up to 3.5% Cu). An increase of the Cu content of these alloys from 2 to 3.5% results in a rise of the content of $(Ti,Al,Sn)_3Cu$ phase from 5.75 - 6.25 to 8.02 - 8.34%. Thus, strength increases from 95 - 100 to 104 - 110 kg/mm^2. In this case, specific elongation decreases from 35 to 30 - 22%. Ye. A. Vinogradova, Ye. V. Zvontsova, and L. V. Polyakova assisted in the experiments. There are 1 figure, 3 tables, and 5 references: 2 Soviet and 3 non-Soviet. The two references to English-language publications read as follows: N. Karlsson, J. of the Institute of Metals, 79, 391 (1951); A. Gaukainen, N. J. Grant, C. F. Floe, J. of Metals, 4, no 7, 766 (1952).

S/133/60/000/007/011/016

AUTHORS: Lashko, N.F.; Popova, N.M.

TITLE: The Distribution of Molybdenum and Tungsten in the Solid Solution and the Carbide Phases of Alloy Steels

PERIODICAL: Stal', 1960, No. 7, pp. 642 - 644

TEXT: Tests were carried out to replace molybdenum by tungsten in thermostable and heat resistant steels. The present paper discusses the problems of inclination of molybdenum and tungsten to concentrate in carbide phases formed upon the decomposition of the solid solution in heat resistant steels. Steels containing the most frequently occuring carbides (Me_3C, MeC, $Me_{23}C_6$, Me^1_n, Me^2_mC) were examined. The low-alloy steels were electrolyzed in a potassium chloride and citric acid solution cooled to 0°C; steels with a high chromium content were treated with hydrochloric acid adding sodiumthiosulfate (Ref. 5), nickel alloys in a solution of hydrochloric acid and sodium fluoride. The dissolution was carried out during 4 hours at a low current density (max. 0.02 amp/cm^2), the anode deposits were washed with water and an alkaline solution in order to eliminate the amorphous residues of tungstic acid and molybdenum sulfides formed during the electrol-

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S/133/60/000/007/011/016

The Distribution of Molybdenum and Tungsten in the Solid Solution and the Carbide Phases of Alloy Steels

ysis and other impurities. Six types of steels were tested and mainly the carbides of type Me_3C, which form in the steels A(A), B(B) and B(V), were examined for Fe, Cr, Mo, W and V content, after hardening at 1,050°C and tempering at 350°C, 400°C and 450°C with holding times of 50 and 200 hours. Under all conditions of heat treatment it was found that the relation of atomic contents $[Mo]_a : [W]_a$ was higher in the Me_3C carbide than in the investigated A, B and V steels and from this it was concluded that molybdenum is a more powerful carbide-forming element than tungsten. This can be explained mainly by the relatively smaller atomic radius of molybdenum promoting its diffusion in steel. As the increase in molybdenum and tungsten concentration is accompanied by an increase in the thermostability of the carbides, this also brings about the increse in thermostability of the steel. Similar conclusions were drawn from other steels examined. There are 5 tables and 6 references: 5 Soviet and 1 English.

Card 2/2

S/762/61/000/000/005/029

AUTHORS: Yelagina, L.A., Lashko, N.F.

TITLE: Decomposition of the β phase in alloys of the titanium-chromium-aluminum system containing 7% (Cr+Al).

SOURCE: Titan v promyshlennosti; sbornik statey. Ed. by S.G.Glazunov. Moscow, 1961, 79-84.

TEXT: The experimental investigation reported in this paper was performed to study the process of the aging decomposition of the metastable solid-solution (SS) β phase formed by quenching a Ti alloy with 7% Cr and to clarify the nature of their hardening and the reason for the brittleness evoked by the accompanying formation of a metastable ω phase. The alloys were prepared from sponge Ti Ti00, Al A00, and electrolytical chromium. 3-kg ingots, 120-mm diam, were cast (chemical compositions tabulated). Test rods 14x14 mm were forged at 950-1150°C (depending on composition) and cut into test specimens 20-25 mm long. Tests were made for H_V, microstructure, and phase composition of the alloys in three states: (a) After 2-hr tempering at 650° and cooling in the furnace; (b) after water quench from 1,000° (30 min); (c) after quench per (b) and 450° aging with various soaking times (according to P.D.Frost, et al., Trans.ASM, v.46, 1954, 231). Tempering at 450° with aging yields maximum hardening with a Ti-7.5Cr alloy. Tempering increases the H_V with increasing Al and decreasing Cr content. Quenching increases the hardness of alloys with 7-2%Cr and 0-5%Al, does not affect that of the Ti-1Cr-

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