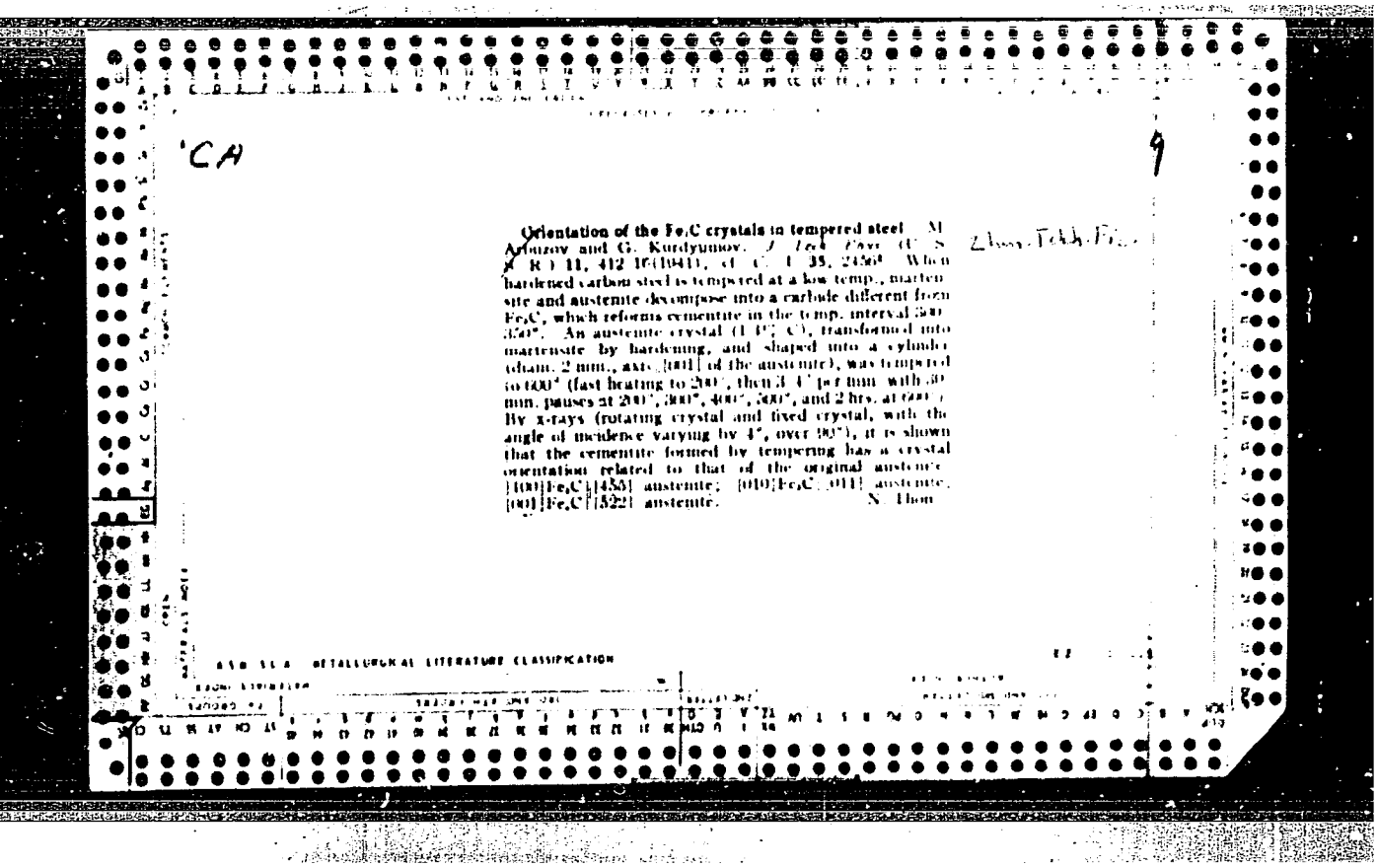
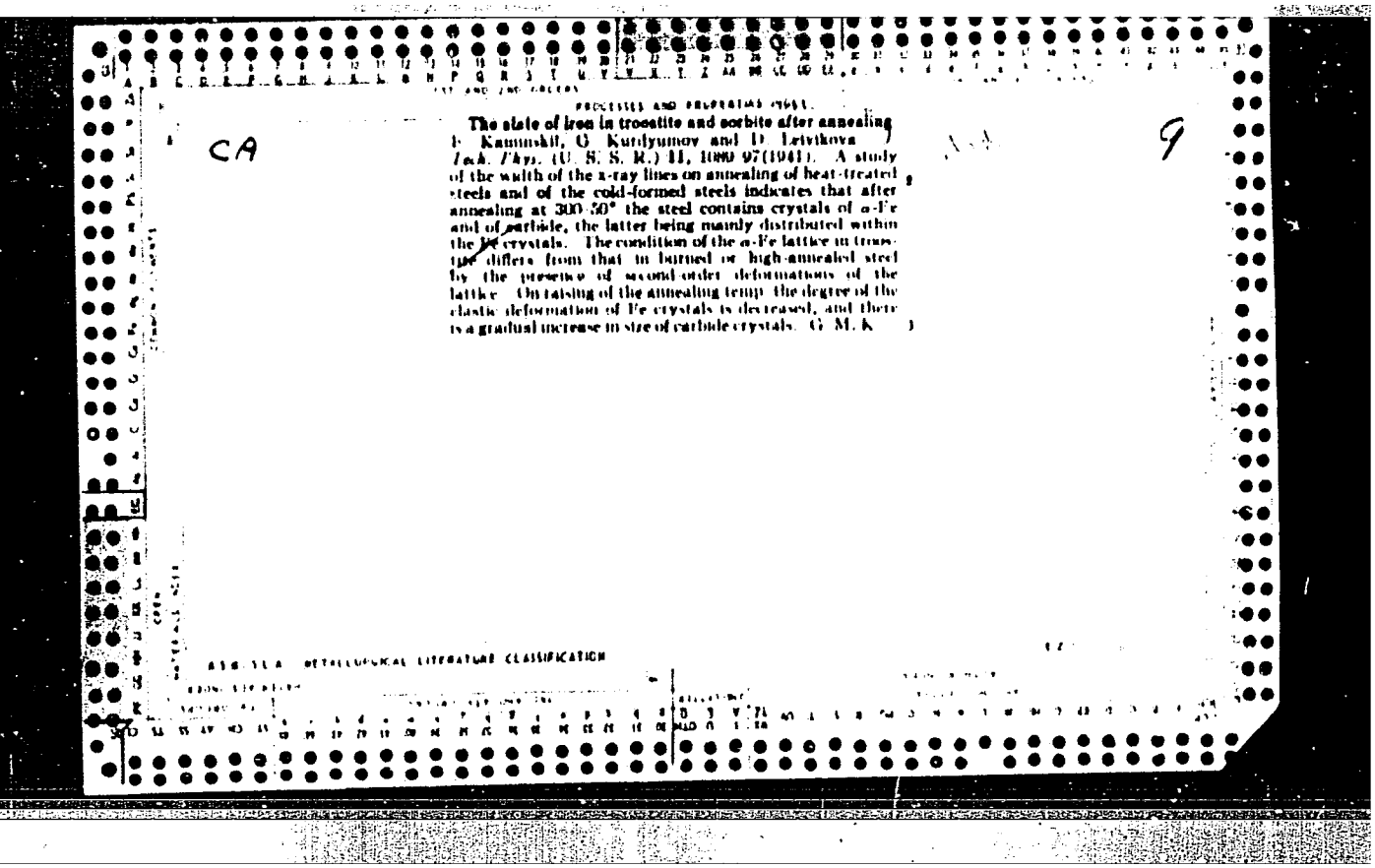


'CA

9

Orientation of the Fe_3C crystals in tempered steel. M. Arbuzov and G. Kurdyumov. *J. Tech. Phys. (U.S.S.R.)* 11, 412-16(1941). cf. C. A. 35, 2456⁸. When hardened carbon steel is tempered at a low temp., martensite and austenite decompose into a carbide different from Fe_3C, which reforms cementite in the temp. interval 300-350°. An austenite crystal (1.4% C), transformed into martensite by hardening, and shaped into a cylinder (diam. 2 mm., axis [001] of the austenite), was tempered to 400° (fast heating to 200°, then 3.4° per min. with 30 min. pauses at 200°, 300°, 400°, 500°, and 2 hrs. at 600°). By x-rays (rotating crystal and fixed crystal, with the angle of incidence varying by 4°, over 90°), it is shown that the cementite formed by tempering has a crystal orientation related to that of the original austenite: [100]Fe_3C[435] austenite; [010]Fe_3C[011] austenite; [001]Fe_3C[522] austenite. N. Thon



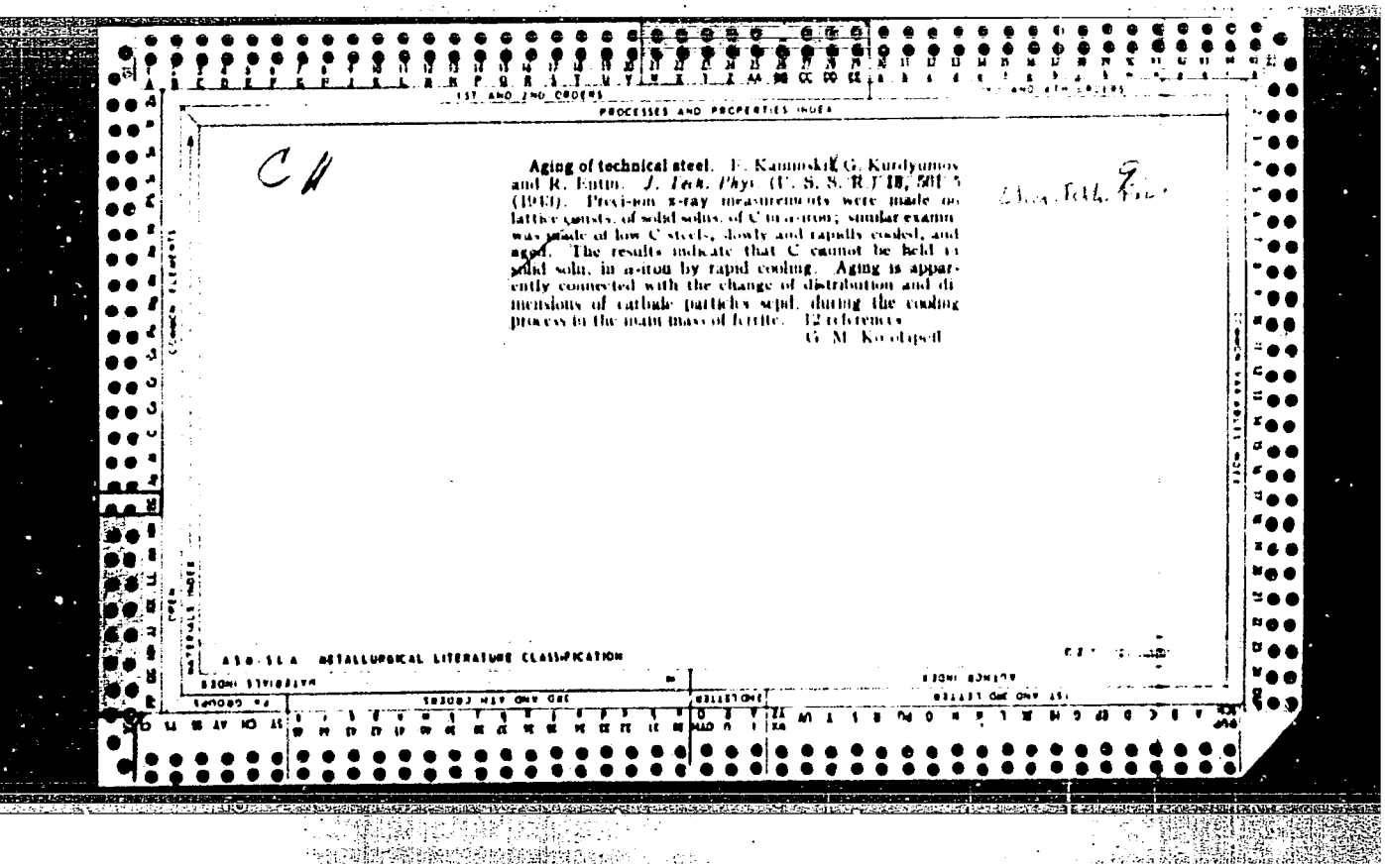
CA

The state of iron in troostite and sorbite after annealing

I. Kaminskii, G. Kurdyumov and D. Letvikova *Zavod. Lab.* (U. S. S. R.) 11, 1089-97(1941). A study of the width of the x-ray lines on annealing of heat-treated steels and of the cold-formed steels indicates that after annealing at 300-50° the steel contains crystals of α-Fe and of carbide, the latter being mainly distributed within the Fe crystals. The condition of the α-Fe lattice in troostite differs from that in burned or high-annealed steel by the presence of second-order deformations of the lattice. On raising of the annealing temp. the degree of the elastic deformation of Fe crystals is decreased, and there is a gradual increase in size of carbide crystals. G. M. K.

9

Orientation of Fe_3C crystals in tempered steel. M. Arbusov and G. Kurdjumov. *J. Physics, U.S.S.R.*, 1942, **6**, 163—166). —X-Ray diffraction data for samples of monocryst. austenitic steel containing 1·4% of C, after gradual heating to 600°, show a regular orientation of Fe_3C crystals with respect to the original austenite axes. The [100], [010], and [001] planes of Fe_3C are parallel with the {455}, {011}, and {533} planes of the austenite, respectively. L. J. J.



PROCESSES AND PROPERTIES INDEX

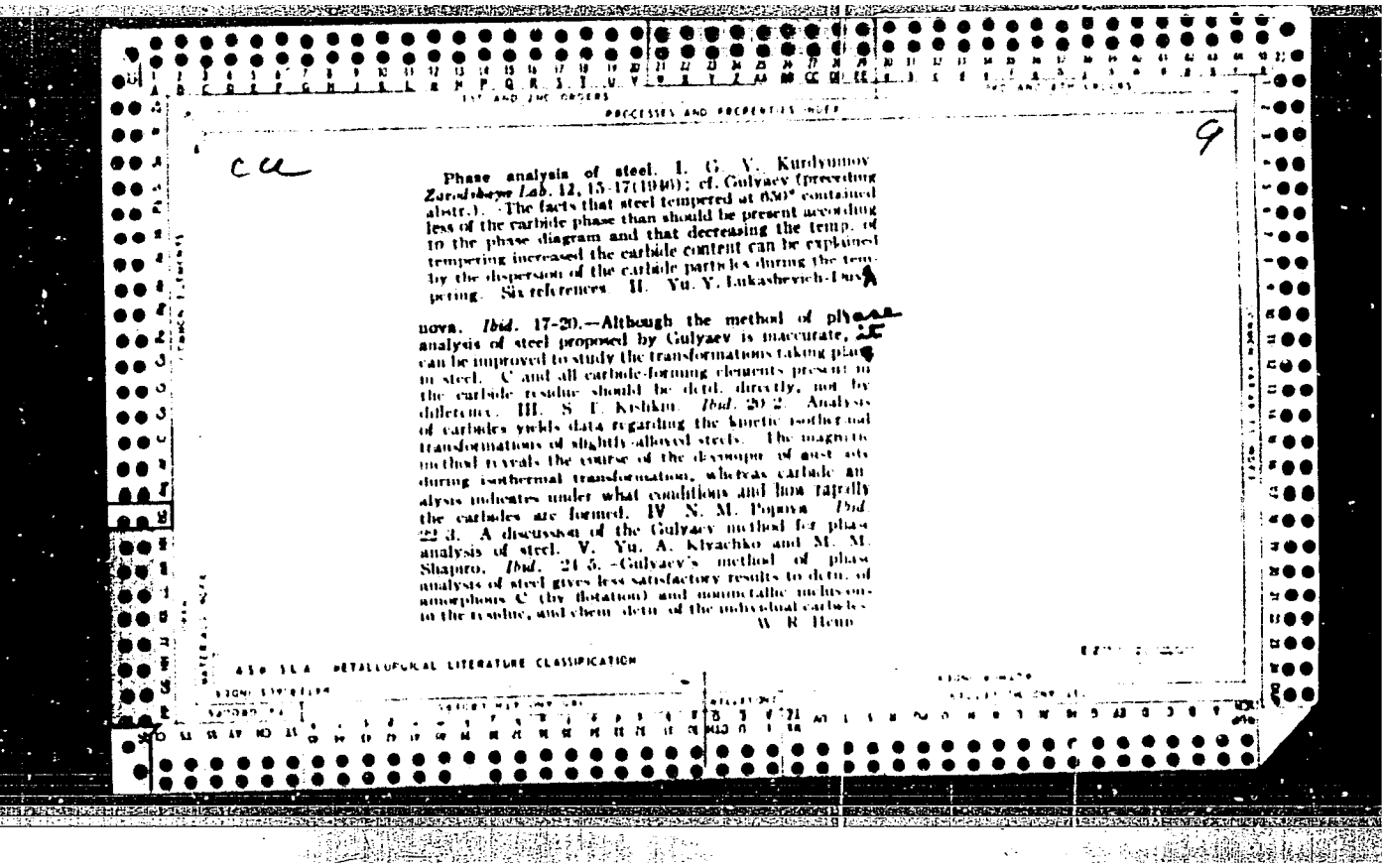
Aging of technical steel. I. Kamnoskii, G. Kurdyumov and R. Entin. *J. Tech. Phys.* (U. S. S. R.) 18, 501–5 (1948). Precision x-ray measurements were made on lattice consts. of solid solns. of C in α-iron; similar examn. was made of low C steels, slowly and rapidly cooled, and aged. The results indicate that C cannot be held in solid soln. in α-iron by rapid cooling. Aging is apparently connected with the change of distribution and dimensions of carbide particles sepd. during the cooling process in the main mass of ferrite. 12 references.
G. M. Kondpaeff

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

KURDYUMOV, G. V.

"Temper Brittleness of Construction Steels," by G. V. Kurdyumov and R. I. Entin. Gosudarstvennoe Nauchno-Tekhnicheskoe Izdatelestvo Literatury po Chernoi i Tsvetnoi Metallurgiy. Moscow, 1945.

Comments and critique by US Metallurgist available--I-63078, 25 Mar 53.



PROCESSES AND PROPERTIES INDEX

9

CU

Phase analysis of steel. I. G. V. Kurdyumov *Zavodskaya Lab.* 12, 15-17(1940); cf. Gulyaev (preceding abstr.). The facts that steel tempered at 650° contained less of the carbide phase than should be present according to the phase diagram and that decreasing the temp. of tempering increased the carbide content can be explained by the dispersion of the carbide particles during the tempering. Six references. II. Yu. V. Lukashevich-Dunova. *Ibid.* 17-20.—Although the method of phase analysis of steel proposed by Gulyaev is inaccurate, it can be improved to study the transformations taking place in steel. C and all carbide-forming elements present in the carbide residue should be detd. directly, not by difference. III. S. I. Kishkin. *Ibid.* 20-2. Analysis of carbides yields data regarding the kinetic isothermal transformations of slightly-alloyed steels. The magnetic method reveals the course of the decompn. of aust. ste during isothermal transformation, whereas carbide analysis indicates under what conditions and how rapidly the carbides are formed. IV. N. M. Popova. *Ibid.* 22-3. A discussion of the Gulyaev method for phase analysis of steel. V. Yu. A. Klyachko and M. M. Shapiro. *Ibid.* 24-5.—Gulyaev's method of phase analysis of steel gives less satisfactory results to detn. of amorphous C (by flotation) and nonmetallic inclusions in the residue, and chem. detn. of the individual carbides

W. R. Hess

ASM SLA METALLURGICAL LITERATURE CLASSIFICATION

KURDYUMOV, G. V.

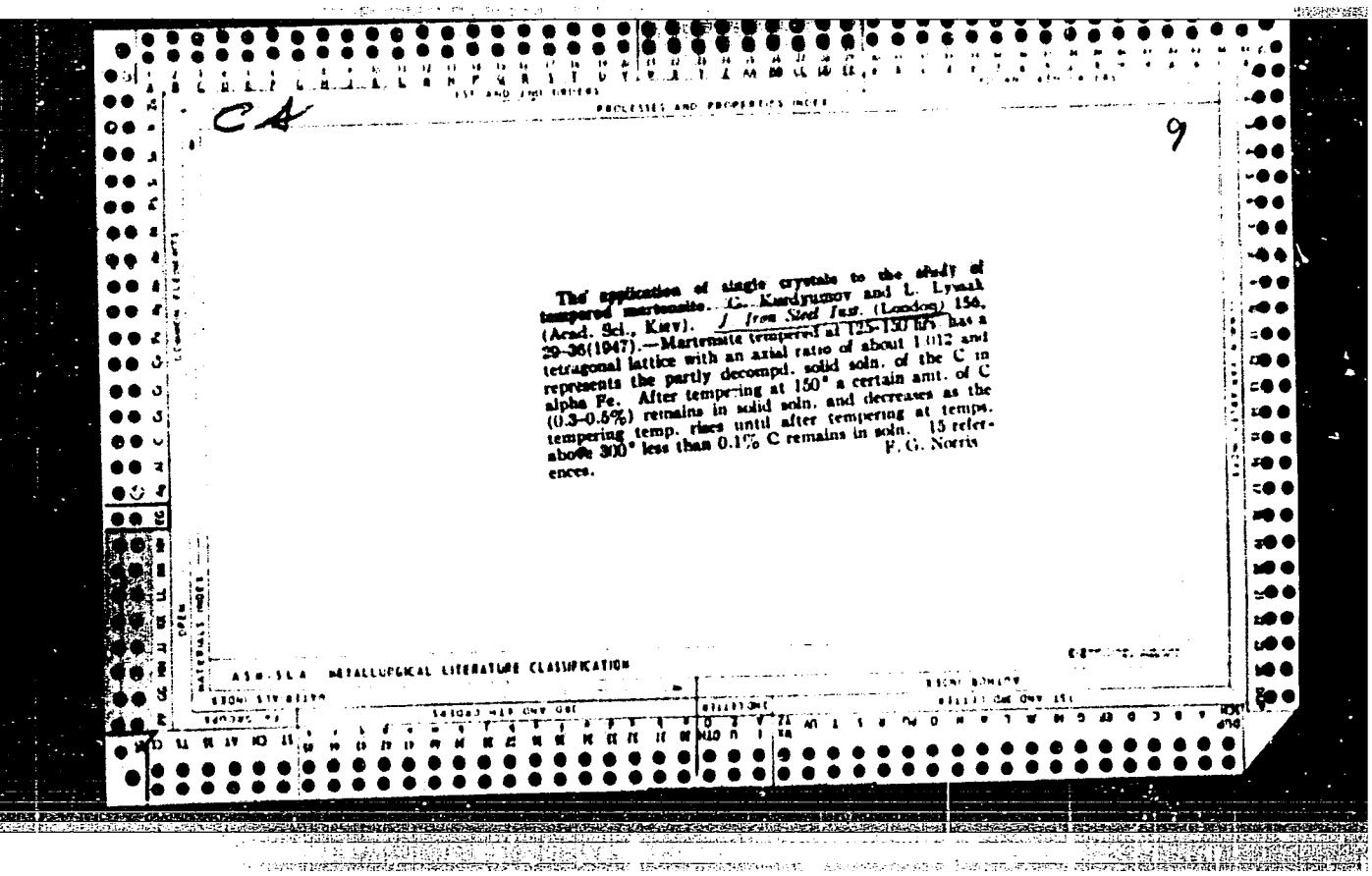
"Application of Monocrystals for the Study of Tempered Martensite Structure," Zhur. Tekh. Fiz., Vol. 16, No. 11, 1946.

CA

No. 9

Nature of the diffuseness of interference lines on x-ray patterns of tempered martensite. G. V. Kurdyumov and L. Lysak (Akad. Sci. Ukr. S.S.R., Kiev). *Zhur. Tekh. Fiz.* 17, 1003 [1022] (1947); cf. *C.A.* 42, 826.—An exptl. study was made with specimens cut from the same single crystal used in the previously reported work. Reflections of Fe radiation from the (110) and (220) planes were measured on 0.4-mm. cylindrical specimens with [100] directions in austenite as axes. This method had the advantage that it did not depend on the *c* parameter of the tetragonal lattice and that it increased the intensity compared to the background. Also, the *a* parameter involved was almost independent of C concn. Line breadth was measured with microphotometer curves in which intensity was assumed to be proportional to blackening, since the latter did not exceed 0.8. Line width was taken as the ratio of integrated intensity to max. intensity. Reflections from (110) planes were photographed 60 mm. from the specimen, those from (220) planes were obtained by means of a 21.5 mm. Debye camera. The specimens were oscillated through 30°. Line breadths in degrees after 10 years aging at room temp. were 26×10^{-4} for (110) and 126×10^{-4} for (220). The corresponding values after 1 hr.'s tempering at various temps. were: 100°, 27, 130; 150°, 28, 130; 200°, 30, 91; 250°, 30, 80; 300°, 39, 80; 350°, 18, 74; 400°, 14, 62; 450°, 11, 39; 0.40°, 9, 34. Since chem. inhomogeneity is decreased on going from 100° to 150° tempering temp., line widening is not due to this cause in this case. However, in polycryst. specimens tempered at 350° or less both tetragonality and inhomogeneity contribute to line widening. In the single crystals line widening was caused by the small size of coherent regions within martensite crystals. These regions remained about 10^{-6} cm. up to about 400° tempering temp. and grew larger at higher temps. Internal stresses, which were on the order of 150 kg./sq. mm. at tempering temps. of 100 to 150°, also contributed to line widening. These stresses decreased on tempering at about 250° and again at about 350°.

A. G. Guy



CA

9

The application of single crystals to the study of tempered martensite. L. Kurdjumov and L. Lysak (Acad. Sci., Kiev). *J. Iron Steel Inst. (London)* 156, 29-36(1947).—Martensite tempered at 125-150° has a tetragonal lattice with an axial ratio of about 1.012 and represents the partly decompd. solid soln. of the C in alpha Fe. After tempering at 150° a certain amt. of C (0.3-0.5%) remains in solid soln. and decreases as the tempering temp. rises until after tempering at temps. above 300° less than 0.1% C remains in soln. 15 references. F. G. Norris

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

KURDYUMOV, G.V.

The Laboratory of Physical Metallurgy, Academy of Sciences, Ukrainian S.S.R. Sbor. nauch. rab. Lab. metallofiz. no.1: 3-4 '48. (MLRA 8:9)

(Ukraine--Metallurgical laboratories)

KURDYUMOV, G.V.

Ivan Vasil'evich Isaichev; obituary. Sbor. nauch. rab. Lab. metallofiz. no.1:5-7 '48. (MLRA 8:9)

1. Deystvitel'nyy chlen Akademii nauk USSR, direktor Laboratorii metallofiziki Akademii nauk USSR
(Isaichev, Ivan Vasil'evich, 1901--1946)

KURDYUMOV, G.V.; LYSAK, L.I.

Use of single crystals for studying martensite structural changes in tempering carbon steel. Sbor. nauch. rab. Lab. metallofiz. no.1:37-52 '48. (MLRA 8:9)
(Martensite) (Steel--Heat treatment)

KURDYUMOV,G.V.; LYSAK,L.I.

Characteristics of blurredness in the interference lines on radiographs of tempered martensite. Sbor. nauch. rab. Lab. metallofiz. no.1:53-65 '48. (MLRA 8:9)
(Martensite) (X-rays--Industrial applications)

KURDYUMOV, G. V.

Kurdyumov, G. V. and Lysak, L. I. - "Kinetics of the primary stage in dissociation of martensite," Dokl~~ady Akad~~. ~~Nauk~~ Ukr. SSR No. 5, 1948, p. 3-7. (In Ukrainian, resume in Russian), Biblio: 5 items

SO: U-4355, 14 August 53, (Letopis 'Zhurnal 'nykh Statey, No. 15, 1949)

KURDYUMOV, G. V.

PA 10/49T94

USSR/Metals
Martensite
Copper Alloys

Aug 48

"Nondiffused (Martensitic) Type of Conversion in Alloys," G. V. Kurdyumov, 26 pp

"Zhur Tekh Fiz" Vol XVIII, No 8

Discusses: I. Characteristic features of transformation of austenite into martensite steels; II. Martensitic transformations in aluminum, tin and zinc alloys of copper; III. Martensitic transformations on heating. "Reversibility" of martensitic transformations; IV. Nature of

[redacted] 10/49T94

USSR/Metals (Contd)

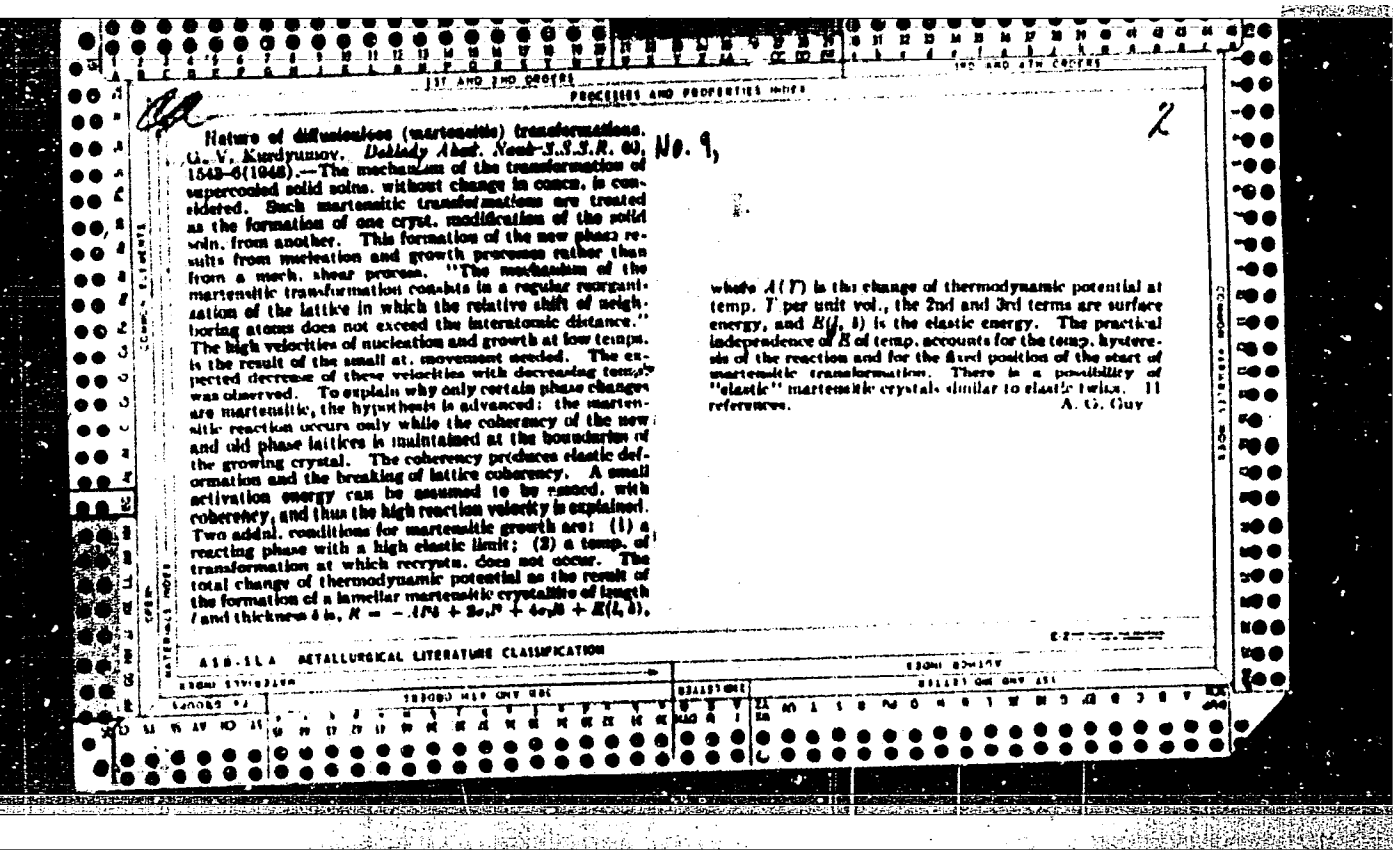
Aug 48

martensitic transformations. Submitted 8 Mar 48.

[redacted] 10/49T94

KURDYUMOV, G. V.

"Regrouping the Azoxy Compounds," Zhur. Obshch. Khim., Vol. 18, No. 11, 1948.



Nature of diffusionless (martensitic) transformations. G. V. Kurdyumov. *Doklady Akad. Nauk S.S.S.R.* 60, No. 9, 1543–6(1948).—The mechanism of the transformation of supercooled solid solns. without change in concn. is considered. Such martensitic transformations are treated as the formation of one cryst. modification of the solid soln. from another. This formation of the new phase results from nucleation and growth processes rather than from a mech. shear process. "The mechanism of the martensitic transformation consists in a regular reorganization of the lattice in which the relative shift of neighboring atoms does not exceed the interatomic distance." The high velocities of nucleation and growth at low temps. is the result of the small at. movement needed. The expected decrease of these velocities with decreasing temp. was observed. To explain why only certain phase changes are martensitic, the hypothesis is advanced: the martensitic reaction occurs only while the coherency of the new and old phase lattices is maintained at the boundaries of the growing crystal. The coherency produces elastic deformation and the breaking of lattice coherency. A small activation energy can be assumed to be caused, with coherency, and thus the high reaction velocity is explained. Two addnl. conditions for martensitic growth are: (1) a reacting phase with a high elastic limit; (2) a temp. of transformation at which recrystn. does not occur. The total change of thermodynamic potential as the result of the formation of a lamellar martensitic crystallite of length l and thickness δ is, $R = -\Delta F\delta + 2\sigma_1 l^2 + 4\sigma_2 l\delta + E(l, \delta)$, where $\Delta(T)$ is the change of thermodynamic potential at temp. T per unit vol., the 2nd and 3rd terms are surface energy, and $E(l, \delta)$ is the elastic energy. The practical independence of E of temp. accounts for the temp. hysteresis of the reaction and for the fixed position of the start of martensitic transformation. There is a possibility of "elastic" martensitic crystals similar to elastic twins. 11 references.

A. G. Guy

A58-11A METALLURGICAL LITERATURE CLASSIFICATION

PA 8/49T92

USSR/Metals
Austenite
Martensite

Jul 48

"Kinetics of the Transformation of Austenite to Martensite at Low Temperatures," G. V. Kurdyumov, Corr Mem, Acad Sci USSR, O. P. Maksimova, Inst of Metallophys, Cen Sci Res Inst of Ferrous Metals, 4 pp

"Dok Ak Nauk SSSR" Vol LXI, No 1 p. 83-86

It is generally held that transformation of austenite into martensite cannot be inhibited by any available cooling speeds; the position of the martensite point does not depend on the speed

8/49T92

USSR/Metals (Contd)

Jul 48

of cooling and austenite cannot be supercooled below the martensite point. Authors conducted special investigation of kinetics of austenite-martensite transformation below room temperature. Below -70° the speed of the process can be measured and approaches zero in many cases at the temperature of liquid nitrogen. It, therefore, seemed possible to supercool austenite below the martensite point and see how the transformation speed varied with temperature. Present paper gives results of such experiments. Authors also propound equations representing kinetics of the process. Submitted 19 Apr 1948.

8/49T92

KURDYUMOV, G. V.

KURDYUMOV, G. V.

27759. KURDYUMOV, G. V.--Bezdiffuzionnyye (martensitnyye) prevrashcheniya v splavakh. v. sb: problemy metallovedeniya i fiziki metallov. L., 1949, s. 132-72. Bibliogr: 52 nazv.

SO: Letopis' Zhurnal'nykh Statey, Vol. 37, 1949.

KURDYUMOV, G.V.; GROZIN, B.D.; LIZAK, L.I.

Effect of deformation on the decomposition of martensite in tempered steel. Dop.AN URSR no.1:17-21 '49. (MLRA 9:9)

1.Diysniy chlen AN URSR (for Kurdyumov).2.Chlen-korrespondent AN URSR (for Grozin).3. Laboratoriya metalefiziki AN URSR.

Kurdyumov, G.V.

KURDYUMOV, G.V.

Transformations (Martensite) not involving diffusion in alloys. Probl.metalloved.i fiz. met. no.[1]:132-172 '49. (MIRA 11:4)

1.Laboratoriya fazovykh prevrashcheniy TSentral'nogo nauchno-issledovatel'skogo instituta chernoy metallurgii. Chlen-korrespondent AN SSSR.

(Alloys--Metallography)
(Martensite)

KURDYUMOV, G.

PA 51/49T40

USSR/Metals
Martensite
Tempering

May 49

"Kinetics of the First Stage of Martensite Decomposition," G. Kurdyumov, L. Lysak, Lab of Metallophys, Acad Sci USSR, 7 pp

"Zhur Tekh Fiz" Vol XIX, No 5, p. 525-31

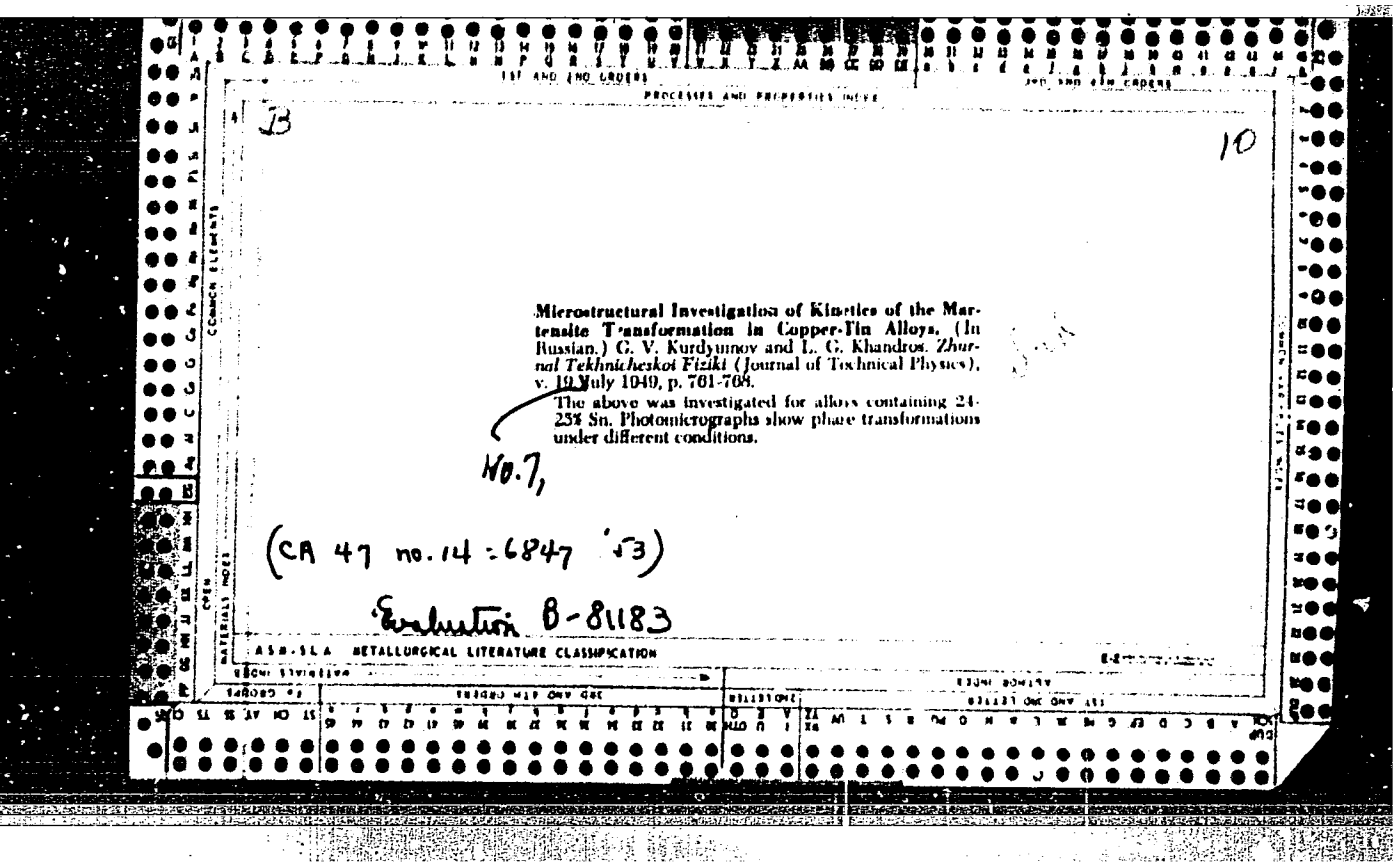
Studied martensite decomposition as a function of tempering time at temperatures of 80, 100, and 120° C. Experiments confirmed heterogeneous nature of first stage of martensite decomposition. Curves of decomposition kinetics show formation

[redacted]. 51/49T40

USSR/Metals (Contd) May 49

speed of carbide nuclei remains constant approximately until semidecomposition, after which it decreases. Decomposition time for temperatures 80, 100, and 120° C was equal to 6 1/3 hrs, 45 min, and 7.5 min, respectively. Submitted 28 Jul 48.

[redacted] 51/49T40



JB

10

Microstructural Investigation of Kinetics of the Martensite Transformation in Copper-Tin Alloys. (In Russian.) G. V. Kurdyumov and L. G. Khandros. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 19, July 1949, p. 761-769.

The above was investigated for alloys containing 24-25% Sn. Photomicrographs show phase transformations under different conditions.

No. 7,

(CA 47 no. 14 : 6847 '53)

Evaluation B-81183

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

CA 2

No. 2

Thermoelastic equilibrium in martensitic transformations. G. V. Kurdyumov and L. G. Khandros. *Doklady Akad. Nauk S.S.S.R.* 66, 211-14(1949); cf. C.A. 43, 1235e.—The "elastic" martensitic crystals predicted by Kurdyumov's new theory were demonstrated in a Cu alloy contg. 14.5% Al and 1.5% Ni. The β_1 phase in this alloy was produced by quenching from 800°. On cooling below 10° (the martensitic point) crystals of γ' were observed to form on a polished surface. Two kinds of crystals were found: wedge-shaped crystals grew with decreasing temp., remained stationary at const. temp., shrank with increasing temp., disappearing at 10°, and exhibited no hysteresis; streak-shaped crystals grew with decreasing temp. but shrank only on heating above room temp., after which growth on further cooling occurred at other centers. In Cu-25% Sn alloys elastic martensite crystals were not observed. The behavior of the martensite in steel is due to the breaking of coherency between the martensite and austenite. In the case of elastic martensite crystals coherency is maintained but an equil. crystal size is detd. at each temp. by the min. value of thermodynamic potential, R, given by $R = -\Delta\phi + E_s + E_e$, where $\Delta\phi$ is the decrease in potential due to the phase change, and E_s and E_e are the surface and elastic energies. Photographs of the growth and disappearance of martensite crystals are given. A. G. Guy

ASB-SLA METALLURGICAL LITERATURE CLASSIFICATION

KURDYUMOV, G. V.

PHASE I TREASURE ISLAND BIBLIOGRAPHICAL REPORT AID 334 - I

BOOK Call No.: TN672.V8

Author: KURDYUMOV, G. V., Academician
Full Title: THEORY OF MARTENSITE TRANSFORMATION IN METALS AND ALLOYS
Transliterated Title: K teorii martensitnykh prevrashcheniy v metallakh i splavakh

Publishing Data
Originating Agency: All-Union Scientific Engineering and Technical Society of Machine Builders. Urals Branch
Publishing House: State Scientific and Technical Publishing House of Machine Building Literature ("Mashgiz")
Date: 1950 No. pp.: 3 No. of copies: 3,000

Text Data
This is an article from the book: VSESOYUZNOYE NAUCHNOYE INZHENERNO-TEKHNICHESKOYE OBSHCHESTVO MASHINOSTROITELEY. URAL'SKOYE OTDELENIYE, THERMAL TREATMENT OF METALS - Symposium of Conference (Termicheskaya obrabotka metallov, materialy konferentsii), (p. 4-6), see AID 223 - II

Coverage: Transformation of austenite to martensite in steels is explained by formation and growth of nuclei. "Elastic" crystals are formed which grow at lower temperatures and shrink at higher temperatures.

K teorii martensitnykh prevrashcheniy v metallakh i splavakh

AID 334 - I

Stable and metastable modification of martensite phases in solid solutions can occur in "normal" or in martensite kinetics. The martensite phase may be stable modifications of solid solutions or of pure metals, e.g., martensite of non-carbon alloys of iron, alpha-modification of cobalt, and occasionally of zirconium and titanium.

Purpose: For scientific workers
Facilities: None
No. of Russian and Slavic References: None
Available: Library of Congress.

2/2

CA

9

Elastic crystals of the martensite phase in copper-aluminum-nickel alloys. G. V. Kurdyumov and L. G. Khandros. *Doklady Akad. Nauk [illegible]* 66, No. 1, 27-30(1949); cf. C. A. 43, 09918. Cu-Al-Ni alloys (I) contg. 14.7% Al, 1.6% Ni, and 14.4% Al, 1.5% Ni were used to demonstrate the "elastic" martensitic crystals predicted by K.'s new theory. The β' phase of NI is preserved by quenching to room temp. from 900°. γ' Crystals appear on cooling further to 10° (the martensitic point). Quenching of I to room temp. produced γ' phase as well as a small amt. of β' phase. The martensitic point for I is 70°. Photographs of phases of NI and I, made at various other temps., are given. It is held that the existence of thermoelastic equil. and elastic crystals have been demonstrated thus providing addnl. support for the K. interpretation of the mechanism of martensitic transformations. M. Senkus

CA

9

Work of formation of martensite nuclei. G. V. Kurdyumov and O. P. Maksimova. *Doklady Akad. Nauk S.S.S.R.* 73, 95-8(1950); cf. C. A. 43, 86. The temp. dependence of the velocity of isothermal transformation from austenite to martensite of an alloy of Fe with 23% Ni and 3.4% Mn was studied. On continuous cooling at 10°/min. transformation began at −17°, which was taken as the martensite point. Kinetic curves at higher const. temps. showed transformation. The velocity of tapering off of the transformation was a max. at −47°. A plot of the logarithm of the initial rate of transformation *vs.* $1/T$ was a straight line at temps. below −50°, but deviated from this line at higher temps. The activation energy for nucleation was 800 cal./mole. The work of nucleus formation was 0 at −50°, 100 cal./mole at −40°, 700 at −30°, and 1400 at 0°. Thus, martensite formation is a typical phase transformation. Near the martensite point the velocity of transformation is slow because of the large value of the work of nucleus formation.

A. G. Guy

1951

CA

9

Transformation of deformed austenite into martensite. G. V. Kurdyumov, O. P. Maksimova, and T. V. Tagunova. *Doklady Akad. Nauk* 73, 307-10(1950); cf. *C.A.* 43, 8616.

The effect of plastic deformation on the martensite reaction in a 0.6 C, 7.1 Mn steel and in a 24% Ni, 3.4 Mn alloy of Fe was studied to test the hypothesis that this reaction proceeds by nucleation and growth. The steel and alloy were deformed by compression just before testing in a magnetometer. The deformed specimens were then cooled to cause the martensite reaction to proceed, and the amt. of reaction was detd. by a magnetometer. The results were verified by x-ray and micrographic studies. Deformed specimens of the steel showed 3 effects. Above about 4% deformation austenite transformation occurred during deformation and reached 32% transformation at about 60% deformation. The martensite point was lowered from about −50° to −80° and leveled off at this value at about 30% deformation. The martensite reaction became sluggish in the deformed specimens. The total amt. of martensite formed as a result of both deformation and cooling was 40% at 0% deformation, decreased to 18% at about 25% deformation, and increased to 32% at 50% deformation. At about 60% deformation no formation of martensite occurred during cooling. Deformed specimens of the alloy showed similar, more pronounced effects except that no lowering of the martensite point was observed. At 50% deformation only about 0.2% as much total transformation occurred as at 0% deformation. The kinetics of the isothermal martensite reaction at temps. in the range −15 to −190° were studied on specimens of the alloy deformed 0% and 14%. At all temps. the 14% alloy showed an initial rate that was about 0.1 as fast as the 0% alloy, but the final amt. of reaction was comparable for the two specimens. The activation energy was 600 cal./mol. for both. Thus, the essential nature of the reaction is not changed by deformation.

A. G. Guy

1951

KURDYUMOV, G.V.; MAKSIMOVA, O.P., kand. tekhn. nauk.

Transformation of austenite to martensite at low temperatures.
Probl. metalloved. i fiz. met. no.2:64-97 '51. (MIRA 11:4)

1. Chlen-korrespondent AN SSSR (for Kurdyumov).
(Metals at low temperature) (Phase rule and equilibrium)

Author Card

GLOVCHINER, Ya.M.; KURDYUMOV, G.V.

Microstructural investigation of the transformation of austenite to martensite in steels and alloys at low temperatures. Probl. metalloved. i fiz. met. no.2:98-118 '51. (MIRA 11:4)

1. Chlen-korrespondent AN SSSR (for Kurdyumov).
(Steel--Metallography) (Alloys--Metallography)
(Metals at low temperature)

KURDYUMOV, G.V.; MAKSIMOVA, O.P., kand. tekhn. nauk.

Martensite nuclei formation process. Probl. metalloved. i fiz. met. no.2:129-134 '51. (MIRA 11:4)

1. Chlen-korrespondent AN SSSR (for Kurdyumov).
(Metal crystals) (Martensite)

KURDYUMOV, G.V.; MAKSIMOVA, O.P., kand. tekhn. nauk; TAGUNOVA, T.V.

Effect of plastic deformation on the kinetics of austenite transformation to martensite. Probl. metalloved. i fiz. met. no.2: 135-152 '51. (MIRA 11:4)

1. Chlen-korrespondent AN SSSR (for Kurdyumov)
(Deformations (Mechanics)) (Metallography)

KURDYUMOV, G.V.; PERKAS, M.D.

Effect of alloying elements on the stability of martensite during tempering. Probl. metalloved. i fiz. met no.2:153-166 '51.
(MIRA 11:4)

1. Chlen-korrespondent AN SSSR (for Kurdyumov).
(Steel alloys--Metallography) (Tempering)

KURDYUMOV, G.V.; PERKAS, M.D.

Mechanism of austenite dissociation in the intermediate temperature range. Probl. metalloved. i fiz. met. no.2:167-175 '51. (MIRA 11:4)

1. Chlen-korrespondent AN SSSR (for Kurdyumov).
(Steel alloys--Metallography) (Austenite)

IL'INA, V.A.; KRITSKAYA, V.K., kand. fiz.-mat. nauk; KURDYUMOV, G.V.

Distorted lattices in deformed metals and solid solutions. Probl. metalloved. i fiz. met. no.2:222-231 '51. (MIRA 11:4)

1. Chlen-korrespondent AN SSSR (for Kurdyumov).
(Crystal lattices) (Deformations (Mechanics))

KURDYUMOV, G.V.

NESTERENKO, Ye.G.; SMYRNOV, A.A.; KURDYUMOV, H.V., diysnyy chlen.

Disturbance of regularity in the crystallic lattice of alloys. Dop.AN URSR no.3:184-193 '51. (MLRA 6:9)

1. Akademiya nauk Ukrayins'koyi RSR (for Kurdyumov). 2. Laboratoriya metalofizyky Akademiyi nauk Ukrayins'koyi RSR (for Nesterenko and Smyrnov). (Metallography)

KURDYUMOV, G. V.

USSR/Metals - Diffusion

1 Sep 51

"The Influence of Carbon on the Self-Diffusion of Iron," P. L. Gruzin, Yu. V. Kornev, G. V. Kurdyumov, Corr Mem, Acad Sci USSR, Inst of Metal Sci and Phys of Metals, Cen Sci Res Inst of Ferrous Metallurgy

"Dokl Ak Nauk SSSR" Vol LXXX, No 1, pp 49-51

Preliminary data touching on the influence of carbon on the self-diffusion of gamma-iron was obtained during the investigation of the self-diffusion of pure iron. It was shown that the addn of carbon strongly influences the parameters governing the self-diffusion of iron. Current article subjects this problem to a special study. Concludes that the addn of carbon in iron decreases the energy of the bond of the austenite lattice. Submitted 12 July 51.

PA 221T45

USSR/Physics - Martensite Conversion 1 Dec 51

"Kinetics of Martensite Conversion at Temperatures Higher Than Room Temperature," G. V. Kurdyumov, Corr-Mem, Acad Sci, USSR, O. P. Maksimova, Inst of Metallophys, Cen Sci Res Inst of Ferrous Metallurgy

"Dok Ak Nauk SSSR" Vol LXXXI, No 4, pp 565-568

Investigates: reduced initial speed of conversion of austenite into martensite vs temp (+150°C to -150°C); martensite curve (quantity of martensite vs temp) of continuous cooling taking into account the isothermal effect; quantity of martensite vs hrs for various isotherms starting at beginning of soaking;

202T94

USSR/Physics - Martensite Conversion 1 Dec 51
(Contd)

reduced quantity of martensite vs soaking time for various temps. N. A. Bondarenko assisted in the computations. Submitted 10 Aug 51.

202T94

KURDYUMOV, G. V.

Austenite

Remarks on A. S. Zav'yalov's work "Mechanics and kinetics of austenite transformation in ferrocarbon alloys," Zhur. tekh. fiz., 22, No. 1, 1952.

Monthly List of Russian Accessions, Library of Congress, May 1952. Unclassified.

KURDYUMOV, G. V.

USSR/Metallurgy - Steel, X-Ray Analysis 1 Aug 52

"Causes for Decrease in the Intensity of Martensite X-Ray Interferences," V. A. Il'ina, V. K. Kritskava, G. V. Kurdyumov, Corr Mem, Acad Sci USSR, Inst of Metallography and Metal Phys of TsNIIChM

"Dokl Ak Nauk SSSR" Vol 85, No 4, pp 773-775

Studies character of distortions of martensite crystal lattice by measuring intensities of X-ray diffraction of hardened steel with 0.35 and 0.41% C at 2 temps: +23° and -185°. Establishes that martensite lattice is characterized by considerable stresses of 3rd kind, i.e., considerable displacement of oscillation centers of atoms. Presence of C in soln causes considerable increase in amplitude of thermal oscillations and leads to weakening of interatomic bond in comparison to lattice of alpha-iron.

PA 227T32

Translation B-825'33, 2 Feb 53

K-URdyumov, G. V.

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(3)

13140* Anisotropy of Distortions of Crystal Lattice of Martensite. V. A. Ilina, V. K. Kritskaya, and G. V. Kurdyumov. *Henry Brutcher, Altadena, Calif., Translation no. 3080,* 6 p. (From *Doklady Akademii Nauk SSSR*, v. 85, no. 5, 1952, p. 997-999.)

Studies true cause intensity weakness of certain doublet lines on X-ray photographs of martensite; random static deviations of Fe atoms from ideal position in direction of tetragonal axis versus increase in amplitude of thermal vibrations in this direction. Table. 4 ref.

USSR

Formation of carbide in the alloy steels during tempering at higher temperatures. G. V. Kurdyumov and M. D. Perkas. Doklady Akad. Nauk S.S.S.R. 87, 41-4 (1952). Two types of the alloy steels containing [illegible] were hardened at 1 40, Mn 1 [illegible] temp of [illegible] and [illegible] hardness (34-36 R_c after tempering [illegible] not changed. Further increasing [illegible] creasing the hardness (secondary hardness) [illegible] R_c (at 520°-600°) upon which a sharp drop of the hardness follows. The expil. data show that quenched [illegible] steels has no noticeable decomposition at temps [illegible] 500°, but at the higher temps the [illegible] of special carbides tensite decomposition and formation of [illegible] (Mo$_2$C and VC).

[redacted], S. P.

Kompleksnaia mekhanizatsiia [illegible] torfa (Over-all mechanization [illegible] of peat). Kiev, Gostekhizdat USSR, 1[illegible]. 72 p.

SO: Monthly List of Russian Accessions, Vol. 7, No. 7, Oct. 1[illegible]

Effect of carbon on strength of the bond in the lattice of martensite. G. V. Kurdyumov, V. K. Kritskaya, and I. M. Nodia. *Problemy Met., Moscow: Izdatel. Akad. Nauk S.S.S.R., Sbornik* 1953, 117–20; *Referat. Zhur., Fiz.* 1955, No. 4777.—A method of measuring the relative intensities of reflection at 2 temps. was used. This made it possible to appraise the alteration in the lattice quantitatively and to establish that the presence of dissolved atoms weakens interat. bonds. Steel with a C content of 0.05 to 1.0% was studied. In such tempered steel, the characteristic temp. (*θ*) corresponds to 430° and practically does not differ from that for tempered α-Fe. With an increase in the C content, a decrease in *θ* is observed.

Marjorie Kerner

GRUZIN, P.L.; KURDYUMOV, G.V.

Use of artificially radioactive isotopes for the study of alloy diffusion and self-diffusion. Self-diffusion in γ-iron. Izv. AN SSSR. Otd.tekh. nauk. no. 3:383-392 Mr '53. (MLRA 6:5)

1. Akademiya nauk SSSR (for Kurdyumov). (Diffusion) (Alloys)

LYSAK, L.I.; KHANDROS, L.H.; KURDYUMOV, G.V., diisnyi chlen.

Quantitative modification of residual austenite following the deformation of U12A steel. Dop.AN URSR no.4:236-239 '53. (MLRA 6:8)

1. Laboratoriya metalofizyky Akademiyi arkhitektury URSR. 2. Akademiya nauk URsr (for Kurdyumov). (Austenite) (Steel--Metallography)

KURDYUMOV, G.V.

ALEKSANDROV, L.N.; KURDYUMOV, H.V., diysnyy chlen.

Field of stress originating in the decay of austenite near the pearlitic kernels. Dop.AN URSR no.5:337-343 '53. (MLRA 6:10)

1. Akademiya nauk Ukrayins'koyi RSR (for Kurdyumov). 2. Artemivs'kyy uchytel's'kyy instytut (for Aleksandrov). (Austenite)

KURDYUMOV, G. V.

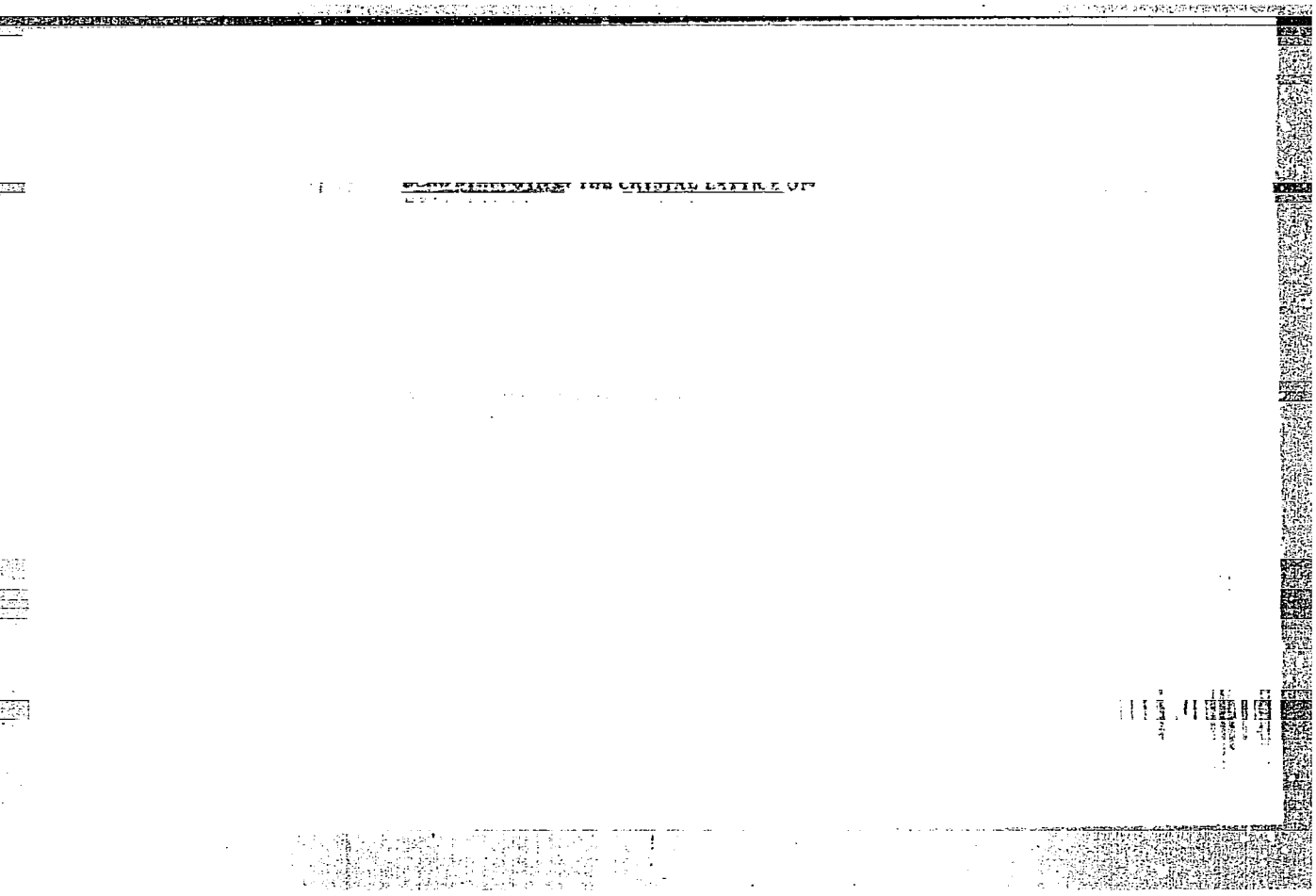
USSR/Physics - Conference, X-Rays Applied

"Introductory Word," G.V. Kurdyumov

Iz Ak Nauk SSSR, Ser Fiz, Vol 17, No 2, pp 143,144

States that this issue of journal is devoted to topics discussed during the Fourth All-Union Conference (22-26 Jun 52, Leningrad) on Application of XRays to Investigation of Materials. First part concerns application to industry, second part to scientific research. The reports are mostly reviews of foreign modern scientific techniques.

26 T87

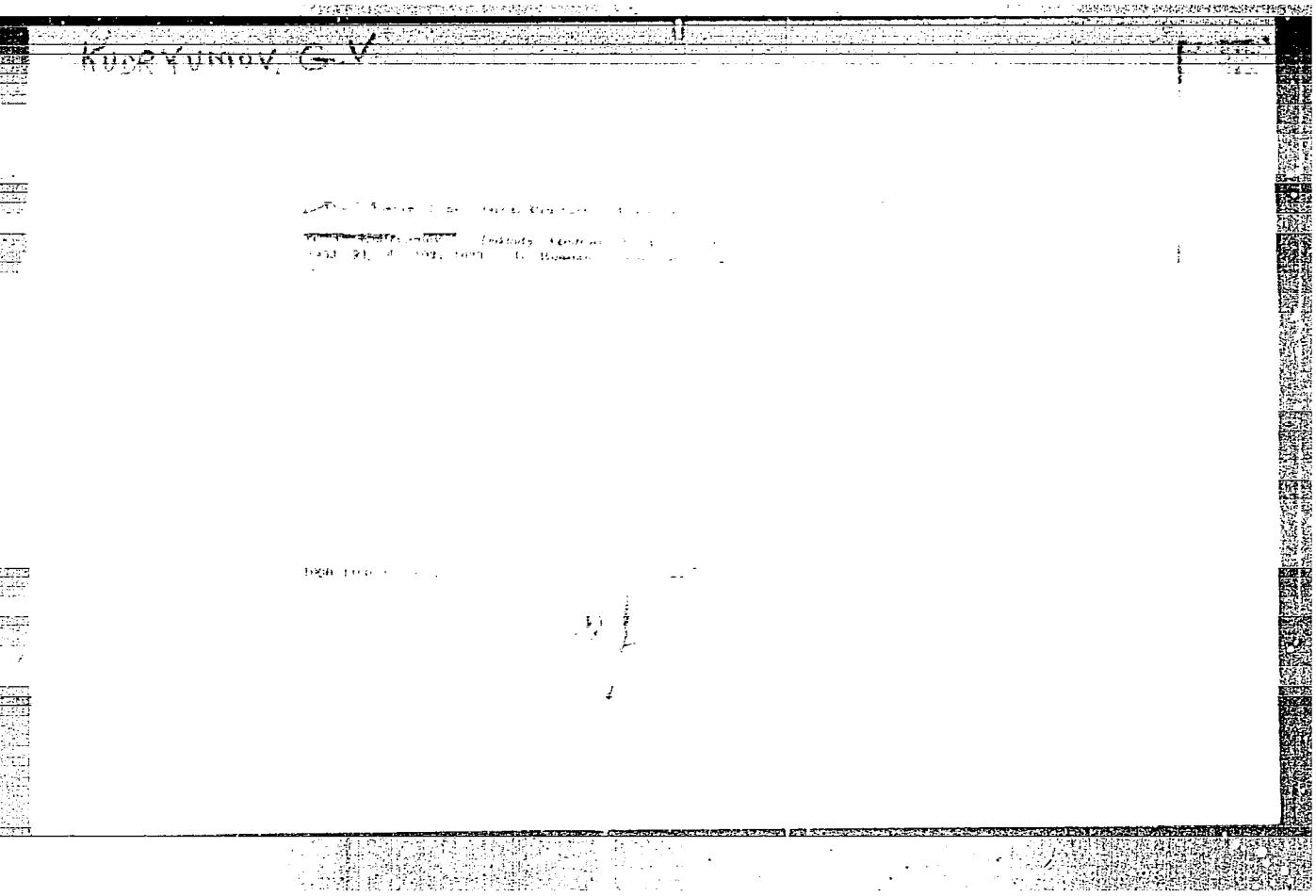


KURDYUMOV, G.V.

Journal of the Iron and Steel Institute
Vol. 176
Apr. 1954
Metallography

On the State of Martensite Crystals of Hardened Low-Carbon Steels. G. V. Kurdyumov, M. D. Perkas, and A. E. Rhamov, (*Doklady Akademii Nauk SSSR.*, 1953, 92, (5), 953-957). (In Russian). The state of martensite in a series of low-carbon steels (quenched from 1000–1050° C. in a solution of sodium hydroxide at 0° C.) was investigated by determining the width of the (211) line in chromium radiation, the hardness, and the coercive force. An increase in carbon content leads to a continuous increase of all three quantities, indicating an increasing amount of carbon in solid solution. Concerning the influence of manganese content on the width of the line (211) it was found that, in all alloys, the carbon content of martensite was the same and that the carbon was retained in solid solution. It is concluded from the data obtained that, during the rapid quenching of carbon steel containing 0·1% of carbon, martensite is not able to decompose during cooling and the carbon remains in solution. This conclusion is valid for steels with carbon < 0·1%. The main condition for the retention of all the carbon in α-solid solution is a high quenching speed.—v. o.

Evaluation B-78539, 8 Sep 54



KURDJUMOV, G.

"Theory of Changes in Martensite." p. 52,
(STROJNOELEKTROTECHNICKY CASOPIS, Vol. 5, No. 1, 1954, Bratislava, Czechoslovakia)

SO: Monthly List of East European Accessions, (EEAL), LC, Vol. 4
No. 5, May 1955, Uncl.

Kurdyumov, G. V.

USSR/Physics - Hardening of steel FD-903

Card 1/1 Pub 153-12/26

Author : Kurdyumov, G. V.

Title : Nature of hardness of drawn steel

Periodical : Zhur. tekh. fiz. 24, 1254-1267, Jul 1954

Abstract : The martensite behavior of transition of a solid solution during drawing of steel can be separated into two types. A new phase without stress relief and typified by microstructure occurs as consequence of the martensite formation mechanism. The other type consists in a diffusionless transition of martensite with structural changes of alpha-phase crystals in microspaces. Thirty references including one U. S.

Institution : --

Submitted : March 15, 1954

KURDYUMOV, G. [V.]

USSR/Minerals - X-ray analysis

Card 1/1 : Pub. 22 - 16/44

Authors : Kritskaya, V. K.; Kurdyumov, G. B., academician; and Stelletskaya, T. I.

Title : Effect of chromium on the coupling forces of the crystals of α-iron

Periodical : Dokl. AN SSSR 98/1, 63-68, Sep 1, 1954

Abstract : Effect of chromium on the bond forces in the α-iron crystals was studied experimentally. The experiments were conducted with the help of X-rays. Some results are shown on a diagram and tables. Four references (1951-1953).

Institution : Institute of Metallurgy and Physics of Metals of the Central Scientific Research Institute of the Pure Metals (TsNIIChM).

Submitted : .....

Kurdyumov, G. V.

USSR/Physics - Technical physics

Card 1/1 Pub. 22 - 16/48

Authors : Bil'dzyukevich, I. A.; Golovchiner, Ya. M.; and Kurdyumov, G. V., Academician

Title : The nature of coercive force changes during the tempering of hardened low-carbon steel

Periodical : Dok. AN SSSR 98/3, 385-387, Sep 21, 1954

Abstract : The three factors playing an important role in the intensive development of coercive forces, during hardening of steel, are listed. It was established that the Martensite conversion mechanism in itself leads to considerable increase in coercive force as result of the originating internal hammering. The effect of other factors on the change in coercive force, during the tempering of low-carbon steel, is explained. Experimental results show that tempering at 220° results in lesser increase in coercive force than hardening. Fifteen USSR references (1933-1954). Graph.

Institution : Central Scientific Research Institute of Ferrous Metallurgy, Institute of Metal Research and Physics of Metals

Submitted : June 9, 1954

Kurdyumov, G. V.

USSR/Engineering - Ferrous metals

Card 1/1 Pub. 22 - 21/47

Authors : Kurdyumov, G. V., Academician; and Travina, N. T.

Title : Roentgenographic study of interatomic reactions in solid solutions with a nickel base

Periodical : Dok. AN SSSR 99/1, 77-80, Nov 1, 1954

Abstract : Experiments with crystallic solid solutions, having a nickel base, are described. The experiments are intended to determine the strength of the interatomic bonds of the solutions. This was accomplished by measuring the thermal factors of Roentgen's ray-dispersion. Results are given. Five references (1951-1954). Tables; graphs.

Institution : Institute of Metallurgy and Physics of Metals of TsNIIChM (Central Scientific Research Institute of Ferrous Metals)

Submitted : ...

KURDYUMOV, G. V.

"Investigations of Diffusion and Atomic Interaction in Alloys with the Aid of Radioactive Isotopes," a paper presented at the Atoms for Peace Conference, Geneva, Switzerland, 1955

KURDYUMOV, G.V.

[Using radioactive isotopes for studying diffusion and interatomic reaction in alloys] Primenenie radioaktivnykh izotopov dlia izucheniia diffuzii i mezhduatomnogo vzaimodeistviia v splavakh. Moskva, 1955. 15 p. (MIRA 14:7)
(Alloys) (Radioisotopes--Industrial applications)

KURDYUMOV, G. V., DANILOV, V. I., and Others (53)

"Evaluation of Problems in Metallography and Physics of Metal"
Metallurgizdat - 1955

Translation 563700

KURDYUMOV, G.V.

BIL'DZYUKEVICH, I.A.; GOLOVCHINER, Ya.M.; KURDYUMOV, G.V., akademik

Coercive force changes during tempering of hardened, low-carbon steel. Probl. metalloved. i fiz. met. no.4:205-208 '55. (MIRA 11:4)
(Steel--Heat treatment) (Ferromagnetism)

KURDYUMOV, G.V., akademik; PERKAS, M.D., kand.tekhn.nauk; SHAMOV, A.Ye., kand. fiz.-mat.nauk

State of martensite crystals in hardened commercial iron and low-carbon steel. Probl. metalloved. i fiz. met. no.4:228-238 '55.
(Metal crystals) (Martensite)
(MIRA 11:4)

KURDYUMOV, G.V., akademik; TRAVINA, N.T., kand.fiz.-mat.nauk

X-ray interference intensity changes during nickel-chromium-titanium-aluminum alloy aging. Probl. metalloved. i fiz. met. no.4:265-472 '55. (MIRA 11:4)
(Nickel-Chromium-Titanium alloys--Hardening)
(X rays--Industrial applications)

KURDYUMOV, G.V., akademik

Hardness properties in heat treatment-hardened steel. Probl. metalloved. i fiz. met. no.4:321-338 '55. (MIRA 11:4)
(Steel--Heat treatment)

Category : USSR/Solid State Physics - Structural crystallography E-3

Abs Jour : Ref Zhur - Fizika, No 1, 1957, No 1073

Author : Kurdyumov, G.V., Il'ina, V.A., Kritskaya, V.K., Lysak, S.I.
Title : X-ray Diffraction Investigation of the Strains and Binding Forces in the Crystal Lattice of Metals and Alloys

Orig Pub : Probl. metalloved. i fiz. metallov, sb. 4, 1955, 339-359

Abstract : Extensive experimental material is reported on the study of x-ray diffraction of strains and interatomic-interaction forces in the crystal lattice of metals and alloys. The characteristic features of the live crystalline structure of metals and alloys in strengthened state are examined. An analysis is made of metals for determining the various changes in the fine crystalline structure and of the properties of the crystals in the micro regions. Bibliography, 28 titles.

Card : 1/1

KURDYUMOV, G.V., akademik; ENTIN, R.I., doktor tekhn.nauk; ROZENBERG, V.M., kand.tekhn.nauk

Relation of the kinetics of weakening during the aging process to the composition of the hardening phase. Probl. metalloved. i fiz. met. no.4:360-376 '55. (MIRA 11:4)
(Metals--Hardening) (Crystal lattices)

KURDYUMOV, G.V., akademik; TRAVINA, N.T.

X-ray investigation of interatomic interaction in nickel-base solid solutions. Probl. metalloved. i fiz. met. no.4:402-407 '55.
(Solutions, Solid) (MIRA 11:4)
(X rays--Industrial applications)

KRITSKAYA, B.K., kand.fiz.-mat.nauk; KURDYUMOV, G.V., akademik; STELLETSKAYA, T.I.

Effect of chromium on the binding energy in -iron crystals. Probl. metalloved. i fiz. met. no.4:408-411 '55. (MIRA 11:4)
(Iron--Metallography) (Chromium)

KURDYUMOV, G.V., akademik; KRITSKAYA, V.K., kand.fiz.-mat.nauk; NODIA, N.M., kand.fiz.-mat.nauk.

Effect of carbon on binding energy and static distortion in crystals of martensite. Probl. metalloved. i fiz. met. no.4:455-460 '55.
(Crystal lattices) (Martensite) (Carbon) (MIRA 11:4)

KURDYUMOV, G.V.

GRUZIN, P.L., kand.fiz.-mat.nauk; KUZNETSOV, Ye.V.; KURDYUMOV, G.V., akademik

Effect of the intergranular structure of austenite on the self-diffusion of iron. Probl. metalloved. i fiz. met. no.4:494-497 '55.
(Diffusion) (Iron alloys--Metallography) (MIRA 11:4)
(Austenite)

USSR/Physics - Distortion

FD-3032

Card 1/2 Pub. 153 - 1/23

Author : Kritskaya, V. K.; Kurdyumov, G. V.; Nodia, N. M.

Title : Binding forces and distortions in martensite crystals

Periodical : Zhur. tekh. fiz., 25, February 1955, 177-181

Abstract : The essence of tempering of steel consists in the formation of supersaturated solid solution of carbon in the alpha phase (martensite) as a result of diffusionless conversion of austenite, the considerable change in the steel's properties as a result of tempering being due mainly to those changes in the state of the alpha-phase lattice which cause the presence in it of carbon atoms distributed among the iron atoms; therefore for an understanding of the nature of the properties of martensite and their variations in the annealing process it is important to know the characteristics of the structure of its lattice, hence binding forces and distortions. The authors conclude that the great resistence of martensite crystals to plastic deformation cannot be due to variation in the binding forces in the lattice, since it is not only not higher than in alpha-iron crystals but even significantly lower; and that

Card 2/2

FD-3032

the cause for the high elastic limit of deformation in annealed steel is the greater static distortion of the martensite lattice caused by the presence of carbon atoms dissolved in it. Nine references.

Institution : --

Submitted : July 19, 1954

USSR/Metals - Aging

FD-3033

Card 1/1 Pub. 153 - 2/23

Author : Kurdyumov, G. V.; Travina, N. T.

Title : Variations in the intensity of x-ray interferences during aging of nickel-chromium-titanium-aluminum alloy

Periodical : Zhur. tekh. fiz., 25, February 1955, 182-187

Abstract : The authors confirm the notion that in the supercooled solid solution even before the beginning of decay proper of the solid solution with the formation of second-phase particles there occur within the solid solution processes that change the distribution of atoms in the lattice of the crystals of the solid solution which coherently scatter x-rays similarly to a homogeneous solid solution, this process in aluminum alloys being called natural aging in as much it proceeds at room temperature; in the investigated alloy it proceeds at a considerably higher temperature (500-600°) in correspondence with the stronger interatomic bonds and consequently with the less mobility of the atoms. Seven references.

Institution : --

Submitted : July 19, 1954

USSR/Physics

Card 1/1 Pub. 22 - 21/59

Authors : Kritskaya, V. K.; Kurdyumov, G. V., Academician; and Tikhonov, L. V.

Title : Effect of machining on the coupling forces in the crystals of an solid solution of iron-nickel alloy

Periodical : Dok. AN SSSR 102/2, 271-274, May 11, 1955

Abstract : Studies are described of the harding and tempering effect on the coupling forces of the plastic deforation of iron-nickel alloys of the following compound: 4% Ni; 0.015% C; 0.04% Si, and 0.001% P. Intensities of the Spectral lines were studies. Fourteen USSR references (1951-1955). Diagram; table.

Institution : Central Scientific Research Institute of Ferrous Metals, Institute of Metallography and Physics of Metals

Submitted : February 23, 1955

DANILOV, Vitaliy Ivanovich, professor, doktor fiziko-matematicheskikh nauk, laureat Stalinskoy premii; KURDYUMOV, G.V., akademik, redaktor; DANILOVA, A.I., redaktor; ZUBKO, A.M., redaktor; KAMENETSKAYA, D.S., redaktor; LASHKO, A.S., redaktor; OVSIYENKO, D.Ye., redaktor; SKRYSHEVSKIY, A.F., redaktor; SPEKTOR, Ye.Z., redaktor; KAZANTSEV, B.A., redaktor izdatel'stva; RAKHLINA, N.P., tekhnicheskiy redaktor

[Structure and crystallization of liquids; selected articles] Stroenie i kristallizatsiia zhidkosti; izbrannye stat'i. Pod red. G.V.Kurdiumova. Kiev, Izd-vo Akademii nauk UkSSR, 1956. 566 p. (MLRA 9:10)

1. Deystvitel'nyy chlen AN USSR (for Danilov)
(Liquids) (Crystallization)

formation on the strength of the intent

Kurdyumov, G.V.

Category : USSR/Solid State Physics - Mechanical Properties of Crystals and Crystalline Compounds E-9

Abs Jour : Ref Zhur - Fizika, No 3, 1957, No 6813

Author : Kurdyumov, G.V., Kaminskiy, E.Z., Rozenberg, V.M.
Title : Influence of Internal Structure of the Austenite Grain on the Strength with Increasing Temperature

Orig Pub : Dokl. AN SSSR, 1956, 107, No 1, 85-87

Abstract : A study was made of the influence of the intragranular structure of austenite on the strength at 700°, as a function of the speed of the formation. Various structures were received by phase hardening (direct and reverse martensitic transformation) and heating at various temperatures above the temperature of the end of the reverse martensitic transformation. It was established that the presence of a thin submicroscopic inhomogeneity in the structure of the grains, due to the large number of intragranular seperation surfaces, leads to an increase in the resistance to deformation at high deformation speed and to a reduction in the resistance to deformation at speeds causing failure after 100

Card : 1/2

KUDRYUMOV, G. V.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1245
AUTHOR KUDRJUMOV, G.V., KAMINSKIJ, E.Z., ROZENBERG, V.M.
TITLE The Influence exercised by the Interior Structure of the Austenite Grain on Strength at Increased Temperature.
PERIODICAL Dokl. Akad. Nauk, 109, fasc.1, 85-87 (1956)
Publ. 7 / 1956 reviewed 9 / 1956

In the present work a solid solution on an iron base containing about 29% nickel and 1% titanium is examined. The direct martensite transformation of this alloy takes place below room temperature, but the inverse transformation ceases at 640°. The samples were homogenized for 8 hours at 1000° after melting and forging. After the aforementioned treatment the samples had austenite structure, and their state depends on working temperature. The endurance strength was tested at 700° in an argon atmosphere by tension. As a result, the dependence of endurance strength on the connected tension and on the temperature during preliminary treatment is obtained, and herefrom also the tensions necessary for a fracture of the sample after 100 hours. Furthermore, short tests of breaking strength were carried out at 700°, on which occasion the following results were obtained: The higher the temperature of annealing after the martensite transformation, the lower is the strength limit and the larger the endurance limit of stress, i.e. the tension necessary to bring about a fracture after 100 hours.
X-ray examination supplied information concerning the state of the crystals

of the γ-solid solution after corresponding treatment. Some X-ray pictures taken with manganese radiation are attached; they permit a qualitative description of the state of the crystal lattice of the austenite after an inverse martensite transformation and following heating. The broadening of the lines in a radial direction is due to tensions of the 2. kind, and to the reduction of the domains of the coherent scattering of X-ray radiation. The description of the interference spot in azimuthal direction indicates a mutual(?) or opposite (?) rotation of these domains. These states of the crystals (grain) of the solid solution are conserved up to very high temperatures and recrystallization begins only at 1000°. After annealing at 1100° and 1200° reflections of new recrystallized grains become noticeable. Each austenite grain is a total of small domains with a proper crystal lattice, and this lattice is interrupted at the boundaries of the grain. The higher the annealing temperature after the inverse martensite transformation, the more completely will the destructions of the crystal lattice be removed, and the more will the strength of the solid solution be reduced. At high temperatures and low tensions a treatment that removes (or increases) defects of the lattice will increase (or deteriorate) resistance against plastic deformation.

INSTITUTION: Institute for Metallurgy and Physics of Metals of the Central Scientific Research Institute for Iron Metallurgy

KUDRYUMOV, G-V KUDRJUMOV, G. V.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1857
AUTHOR KUDRJUMOV,G.V., PERKAS,M.D.
TITLE On the Hardening of Not Alloyed Carbonless Iron.
PERIODICAL Dokl.Akad.Nauk, 111, fasc.4, 818-820 (1956)
Issued: 1 / 1957

At first some previous works are discussed. The impossibility of hardening carbonless iron, i.e. the impossibility of the production and the growth of the germs of the α-phase above the martensite point is due to a disturbance of the crystal structure of austenite, and consequently by the high mobility of the atoms. Heating up to 1000° and more diminishes the production velocity of the α-phase in a higher range of transformation temperatures and makes undercooling of the austenite down to the domain of martensite transformation possible. If these assumptions are correct the possibility of hardening pure iron by increasing the temperature of heating will increase. For this purpose a heating temperature of more than 1100° is taken, because in that case the dependence of the diffusion coefficient on temperature takes a normal course.

The iron examined in this case had the following chemical composition: 0,01% C; 0,05% Mn; 0,02% Si; 0,008% P; 0,03% S; 0,041% O_2; 0,009% N_2; 0,004% H_2. The samples consisted of 20 x 10 x 1 mm plates. The samples were chilled in a 10% aqueous NaOH solution at 5°. The state of the iron after various forms of processing was estimated by measuring the hardness (according to VICKERS) and the breadth of roentgen-interferences. For the samples

annealed at 600°, 80 H_V was obtained for hardness, and for the breadth of the line (220) 9.10^{-3} radian was obtained in iron radiation. After hardening of the samples from 980 to 1020°, hardness increased to 100 - 120 H_V. The interference lines were somewhat washed-out on this occasion, but the doublet Kα of the line (220) did not fuse completely. In the course of hardening which proceeded from 1350°, hardness amounted to from 190 to 210 H_V, and the doublet Kα fused into a broad line.

The data at present available concerning the strength and the roentgen properties of carbonless iron show that the solidification attainable by martensite transformation has a similar strength as solidification attainable by cold plastic transformation. By comparing the results of chilling and cold deformation of iron it is possible to conclude that on the occasion of chilling proceeding from 1350°, the transition $\gamma \rightarrow \alpha$ (at least with respect to the greater part of the volume), takes place according to the martensite mechanism. However, chilling proceeding from 1000° caused only partial hardening. A possibility of undercooling the γ-phase of iron (and therefore its hardening properties) depends largely on the inner structure of the grain and on the quality of the crystal structure.

INSTITUTION: Institute for Metallurgy and Physics of Metals of the Central Scientific Research Institute for Iron Metallurgy.

KURDYUMOV, G. V.

Acad. Sci. USSR

"The Nature of Martensite Transformation,"

paper presented at the Metallurgical Congress in Chicago, 6 Nov. 1957

Eval. and Abst. B-3095, 520, 6 Nov 57

KURDYUMOV, G.V.

137-58-5-10592

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 5, p 246 (USSR)

AUTHORS: Gruzin, P.L., Kurdyumov, G.V., Tyutyunik, A.D., Entin, R.I.

TITLE: On the Role of Diffusive Displacements of Atoms in High-temperature Strength (O roli diffuzionnykh peremeshcheniy atomov v zharoprochnosti)

PERIODICAL: V sb.: Issled. po zharoprochn. splavam. Vol 2. Moscow, AN SSSR, 1957, pp 3-8

ABSTRACT: Some results of investigations of diffusion (D) in metals and alloys relative to the problem of high-temperative strength (H) are examined. It is noted that the special features of the behavior of metals at high temperatures under load are conditioned by the existence of rather frequent diffusive shifts of atoms (A) in the crystal lattice of the phases constituting the alloy. Therefore, along with the shear mechanism of plastic deformation, a diffusion mechanism becomes active. The number of atomic displacements, increasing with temperature, tends to limit the temperature zone in which hardened alloy phases may be employed, owing to the reduction in the resistance to plastic deformation due to the shear mechanism. The relatively higher A

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137-58-5-10592

On the Role of Diffusive (cont.)

mobility at the grain boundary or the intra-grain interface, as against that within the body, means that the grain boundaries constitute the weak spot in the resistance of a metal to deformation and failure at high temperatures. A reduction in the mobility of the A is required to increase the level of H. It is demonstrated that an identical level of mobility of the A can be attained at different temperatures with different metals. The temperature at which a given level of diffusive mobility of A is attained is determined primarily by the energy of activation. In some metals the level of mobility of the A is also significantly shifted by the change in the magnitude of the factor D_o preceding the exponent in the expression for the relationship between the coefficient of diffusion (CD) and the temperature. Accumulated experimental data show that a variation in the CD may occur owing to changes in either parameter of the temperature dependence of the CD. At elevated energies of activation (due to alloying), there is usually an increase in the multiplier D_o, with the result that at temperatures that are high for the given alloy base metal there is little change in the CD, while at low temperatures they may change by a full order of magnitude or even more. Addition to the alloy of elements that strengthen the bond in the solid solution causes a shift toward higher temperatures for the onset of the diffusive ductility mechanism.

1. Metals--Diffusion 2. Alloys--Diffusion 3. Metals--Temperature factors
Card 2/2 4. Metals--Mechanical properties

KURDJMOV, G.V. [Kurdyumov, G.V.]; NEJMAN, M.B. [Neyman, M.B.]; FRANK, G.M.

Use of radioisotopes in the Soviet Union. Jaderna energie 3 no.11:389-399 N '57.

KURDYUMOV, G. V.

AUTHORS: Kurdyumov, G. V., Neyman, M. B., Frank, G. M. 89-11-9/9

TITLE: The Use of Radioactive Isotopes in the USSR (Primeneniye radioaktivnykh izotopov v SSSR)

PERIODICAL: Atomnaya Energiya, 1957, Vol. 3, Nr 11, pp. 465-478,(USSR)

ABSTRACT: Only some of the most important uses of radioactive isotopes in chemistry, biology, medicine and agriculture are described:

I. Radioactive isotopes in chemistry.

1) Anorganic chemistry.
   a) Mechanism of the isotope of complex compounds of Pt, Br.
   b) Mechanism of the formation of thiosulphate.
   c) Establishment of the diffusion exchange theory for the systems solid body-gas, solid-liquid, etc.
2) Analytical chemistry.
   a) Use of indicators.
   b) Absorption of carbon for the separation and purification of radioisotopes.
   c) Chromatographic separation of salts and gaseous mixtures.
3) Physical chemistry.
   a) Determinations of the vapor pressure of metals, salts and oxides.
   b) Rapid method for the determination of solubility.
4) Chemical kinetics
5) Organic chemistry

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a) Determination of the rearrangement of closed groups, rings, etc.
b) Determination of the place where the splitting of a large molecule or ring etc. takes place
c) Participation of oxygen in catalytic oxidation processes

II. Radioactive isotopes in engineering.
1) Gammadefectoscopy (samples with a thickness of up to 300 mm)
2) Control of working processes (Co, Ir^{190}, Cs^{137}, Tm^{170})
3) Employment in the current thickness measurement without disturbing the working process, but on the contrary to control it
4) Search for new ore and oil deposits
5) Use in mining and in foundries

III. Radioactive isotopes in biology and medicine
1) Determination of the exchange of phosphorus in the sick tissue, in the lungs, in the central nervous system
2) Determination of the exchange of iodine
3) Use in therapeutics (internally and externally applied)
4) Determination of the speed of an exchange process in dependence on the functional state of the central nervous system
5) The use labelled microorganisms for determinations of immunity
6) Gammasterilization

Card 2/3 IV. Radioactive isotopes in agriculture

The Use of Radioisotopes in the USSR. 89-11-9/9

1) Determination of the actual course of photosynthesis
2) Determination of the actual process of nutrition in plants
3) Biosynthesis of chlorophyll
4) Improvement of fertilizers

There are 3 figures and 98 references.

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126-3-5/34

AUTHORS: Il'ina, V.A., Kritskaya, V.K. Kurdyumov, G.V., Osip'yan, Yu.A. and Stelletskaya, T. I.

TITLE: Study of the dependence of the bond forces on the state of crystals in metals and solid solutions. (Izucheniye zavisimosti sil svyazi ot sostoyaniya kristallov v metallakh i tverdykh rastvorakh).

PERIODICAL: "Fizika Metallov i Metallovedeniye" (Physics of Metals and Metallurgy), 1957, Vol.IV, No.3, pp.417-431 (U.S.S.R.)

ABSTRACT: Numerous studies revealed that the interatomic bond forces in a metallic crystal lattice can be influenced by alloying. Depending on the nature of the alloying element, the bond forces can be increased or decreased. Earlier work of the authors (3) and of Iveronova, V.I. and Katsnel'son, A.A.(4) have shown that the concentration of the alloying component is also of great importance, the heat treatment and plastic deformation was also found to influence the characteristic temperature of the solid solution (2,3,5,6). In recent years a considerable amount of work has been published inside and outside the Soviet Union in which anomalies are reported in the changes of certain properties as a result of heat treatment and deformation of numerous solid solutions. On the basis of experimental data of various authors it can

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Study of the dependence of the bond forces on the state of crystals in metals and solid solutions. (Cont.)

be considered as an established fact that certain properties of the solid solution can be changed appreciably by heat treatment and deformation without any change occurring in the chemical composition of the investigated phase; this phenomenon (change in the characteristic temperatures, electrical resistance anomalies, change of the lattice period etc.) was detected only in solid solutions but not in pure metals. Analysis of results of other authors permits the assumption that the anomalies in the properties observed by various authors can be attributed to a general cause and are the result of the same process taking place inside very small volumes of the crystal lattice of the solid solution. The most likely assumption is that the observed anomalies in the properties are due to changes in the distribution of the atoms in the lattice of the solid solution and on that numerous authors are in agreement but, on the other hand, various authors disagree on the character of the redistribution of the atoms inside the solid and on the nature of this phenomenon; however, there is no direct confirmation of this assumption and the problem requires further study. In the here described work the

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Study of the dependence of the bond forces on the state of crystals in metals and solid solutions. (Cont.)

influence was investigated of differing treatments on the interatomic interaction in crystals of solid solutions and of some high melting point metals and the influence was studied of the plastic deformation and heat treatment on the bond forces. The investigations were effected by X-ray methods and by measuring the resonance frequency of the longitudinal elastic oscillations (determination of the modulus of elasticity). The investigations were carried out on iron alloyed with chromium, manganese, W, Ni, Ti and also on pure Cr, W and Ta. For melting the metals a 50 kg capacity high frequency furnace was used and the material was cast into 25 kg ingots. The ingots were subjected to diffusion annealing at 1200 C and then forged into a square of 40 x 40 mm cross section and into rods of 15 mm dia. Forging was begun at 1000 to 1100 C and, after forging, the material was cold rolled with a total reduction of 62.5%, the specimens for determining the modulus of elasticity were cut from the rolled strip in the direction of rolling and were 100 mm long and 10 mm dia. The chemical analyses of eight of the investigated melts are given in Table 1, p 419. The results are described in some detail which were obtained

Study of the dependence of the bond forces on the state of crystals in metals and solid solutions. (Cont.)

for the characteristic temperature of the solid solutions, Fe-Cr, Fe-Mn, Fe-W, Fe-Ti and for the bond forces in the pure metals Cr, W, Ta and also for the Young modulus of iron and the alloys Fe-Ni, Fe-W, Fe-Cr, Fe-Mn after various types of heat treatment. It was found that the characteristic temperature of the pure metals Fe, Mo, W and Ta does not change after heat treatment and deformation of these metals. In chromium an increase was observed in the characteristic temperature after heating deformed specimens to 600 C; after heating deformed chromium at 800 C its characteristic temperature did not change; it was found that the effect of changes in the characteristic temperature as a function of the heating temperature is reversible. There is a bond force during heat treatment and deformation of the solid solutions Fe-Cr, Fe-W and Fe-Mn: the characteristic temperature increases on heating within a given temperature range and decreases as a result of plastic deformation and hardening (Fe-Cr, Fe-Mn). It was established that there is full correspondence between the direction of the change in the characteristic temperature and the Young modulus, resulting from heat treatment and working of the solid solutions

Study of the dependence of the bond forces on the state of crystals in metals and solid solutions. (Cont.)

Fe-Cr, Fe-W and Fe-Mn. It is assumed that the revealed phenomenon of a change in the bond forces during heat treatment and working of various solid solutions is due to a redistribution of the atoms in the crystal lattice and that an increase in the bond forces corresponds to an increase of the degree of the near order.
There are 10 figures, 6 tables and 24 references, 17 of which are Slavic.

SUBMITTED: December 4, 1956.

ASSOCIATION: Central Ferrous Metallurgy Scientific Research Institute. (Tsentral'nyy Nauchno-Issledovatel'skiy Institut Chernoy Metallurgii).

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Kurdyumov, G. V.

126-2-33/35

AUTHORS: Il'ina, V. A., Kritskaya, V. K., and Kurdyumov, G. V.

TITLE: On the change of the absolute intensities of X-ray interferences of cold deformed iron. (Ob izmenenii absolyutnykh intensivnostey rentgenovskikh interferentsiy kholodnodeformirovannogo zheleza).

PERIODICAL: Fizika Metallov i Metallovedeniye, 1957, Vol.5, No.2, pp. 379-381 (USSR)

ABSTRACT: In X-ray investigations of deformed metals and alloys (Refs.1-7, 10) it was found that there is a weakening in the intensity of the lines of radiograms obtained from deformed specimens as compared to the intensity of the same lines obtained from non-deformed specimens; the degree of weakening is the more pronounced the higher the order of reflection and complies with the law $e^{-B\Sigma h_i^2}$. The work described in this paper aimed at verifying the correctness of this law and was carried out by means of an ionization method using YPC-50M equipment which incorporated additional equipment for controlling the change in the intensity of the primary beam of X-rays (I_o). The investigations were carried out on deformed

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On the change of the absolute intensities of X-ray interferences of cold deformed iron.

(filed off) and annealed iron powders. The obtained results are entered in a table, p.380 and a graph, Fig.1. Using the ionization method of measuring the absolute intensities, it was again proved that cold plastic deformation brings about a weakening of the intensity of the reflection of the X-rays in accordance with the expontential law

$$e^{-b\Sigma h_i^2}.$$

There are 1 figure, 1 table and 10 references, 4 of which are Slavic.

SUBMITTED: September 6, 1957.

ASSOCIATION: Institute of Metal Technology and Physics of Metals, TsNIIChM. (Institut Metallovedeniya i Fiziki Metallov TsNIIChM).

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Card 2/2

Kurdyumov, G.V.

126-2-34/35

AUTHORS: Il'ina, V. A., Kritskaya, V. K., and Kurdyumov, G. V.

TITLE: On the weakening of X-ray reflections of α-iron as a result of extinction. (Ob oslablenii rentgenovskikh otrazheniy α-zheleza za schet ekstinktsii).

PERIODICAL: Fizika Metallov i Metallovedeniye, 1957, Vol.5, No.2, pp. 381-383 (USSR)

ABSTRACT: Determination of the static distortions of the crystal lattice (third order distortions) is usually effected by comparing the absolute or the relative intensities of X-ray reflections from equal crystallographic planes of deformed and of annealed metal. It is thereby assumed that a change in the intensity should be due solely to one cause, namely, the existence of a disordered distribution of the displacements in the deformed specimens. The second (annealed) specimen is used as a standard. The preliminary heat treatment of this specimen must be so carried out that there should not be an intensive coarsening of the crystal structure which would lead to a weakening of the intensity of X-ray reflections (extinction). In order to determine the annealing temperature of deformed iron powder at which a weakening of the intensity of the X-ray as a result of

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On the weakening of X-ray reflections of α-iron as a result of extinction.

extinction takes place, the following experiments were made: deformed iron powder was annealed at 500, 650, 700 and 750°C. These powders were used for producing cylindrical specimens of 0.9 mm dia. The X-ray investigation was effected using molybdenum radiation. The X-ray patterns were photometrically evaluated by means of a recording micro-photometer which recorded the curve of intensity distribution on a self-recording electron potentiometer. Each half of the radiograph was photometered twice. The intensity was determined of X-ray interferences from crystallographic planes with the following sums of the square values of the indices: 6, 14, 26, 62. Obtained experimental data are entered in Table 1. After annealing at 500 and 700°C the relative intensity of all the measured interference values did not change; only after annealing at 750°C was a weakening observed of the intensity of the X-ray reflections from the planes (211) and (321). The intensity of the same X-ray interference from the planes (510) and (732) remained practically unchanged. In Fig.1

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On the weakening of X-ray reflections of α-iron as a result of extinction.

the effect of the extinction for the various crystallographic planes is graphed. The effect of extinction was also studied in a solid specimen. One of the investigated specimens of hardened iron was tempered successively at 450, 550 and 600°C for two hours and the intensities were measured of the X-ray reflections from the planes with the sum of the square values of the indices 6, 14, 26 and 62 and in the hardened state - 6, 14, 26. The experimental results are entered in Table 2. It can be seen that the effect of extinction in a solid specimen of hardened iron manifests itself even after tempering at 600°C. It can also be seen that type III distortions do not occur during hardening.

Card 3/3 There are 2 tables, 1 figure and 1 Slavic reference.

SUBMITTED: September 6, 1957.

ASSOCIATION: Institute of Metal: Technology and Physics of Metals, TsNIIChM. (Institut Metallovedeniya i Fiziki Metallov TsNIIChM).

AVAILABLE: Library of Congress.

GOLUBKOV, V.M.; IL'INA, V.A.; KRITSKAYA, V.K.; KURDYUMOV, G.V.; PERKAS, M.D.

Studying physical factors determining the hardening of alloyed iron. Fiz. met. i metalloved. 5 no. 3:465-483 '57. (MIRA 11:7)

1. Institut metallovedeniya i fiziki metallov TSentral'nogo nauchno-issledovatel'skogo instituta chernoy metallurgii.
(Iron alloys--Hardening)
(Deformations(Mechanics))

AUTHORS: Kurdyumov, G. V. and Maksimova, O. P. (Moscow). 24-6-2/24

TITLE: Regularities in the kinetics of martensitic transformations. (O zakonomernostyakh kinetiki martensitnykh prevrashcheniy).

PERIODICAL: "Izvestiya Akademii Nauk, Otdeleniye Tekhnicheskikh Nauk" (Bulletin of the Ac.Sc., Technical Sciences Section), 1957, No.6, pp.4-11 (U.S.S.R.)

ABSTRACT: In earlier work (1 and 2) the authors have shown that at sufficiently low temperatures the speed of martensitic transformations is measurable. Researches carried out by the present authors indicate that in some steels with a low martensitic point T_m (temperature at which martensitic transformation begins) the transformation of austenite into martensite can be completely halted by rapid cooling in liquid nitrogen, and isothermal transformation of austenite into martensite can be observed at temperatures above the boiling point of liquid nitrogen (3 and 4). It was shown that a definite energy of thermal vibrations of atoms is necessary for the formation of martensite nuclei. At insufficient energy the speed of formation of nuclei is practically zero; as the energy of vibrations increases the speed of formation increases proportionally to $\exp(-U/RT)$, where U can be considered as the energy of activation of

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