L 8782-66

ACC NR: AP5028141

the oscillator average frequency; these changes are oscillatory. The envelopes of these changes can be described by Bessel functions of the product of the line electrical length and the frequency deviation. These effects increase with the degree of mismatch and with the decrease in the line attenuation, the directivity of the coupler, and the electrical length of the oscillation loop. Orig. art. has: 4 figures and 38 formulas.

SUB CODE: 09 / SUBM DATE: 16Dec64 / ORIG REF: 003

jw

Card 2/2

SOKOLINSKIY, V. M.

SOKOLINSKIY, V. M.

Bee Culture - Equipment and Supplies

Hive screen. Pchelovodstvo, 29, No. 7, 1952.

9. Monthly List of Russian Accessions, Library of Congress, October 1952 1953, Uncl.

POSTNOV, G.A.; YEFIMOV, O.N.; MILEYEV, V.S.; SOKOLINSKIY, Ye.A.

Observations of Mars in 1950. Biul.VAGO no.12:12-15 '53. (MLRA 7:3)

1. Moskovskoye otdeleniye VAGO, otdel planet i luny. (Mars (Planet))

ACC NR: AP7002978 SOURCE CODE: UR/0413/66/000/024/0077/0077

INVENTOR: Veksler, B. Ye; Katkov, G. F.; Malinskiy, S. A.; Minkin, M. M.; Remennikov, V. S.; Rybakov, L. A.; Sokolinskiy, Ye. A.; Fedorov, V. N.; Shmulovich, I. Sh.; Gertsov, S. M.; Pishchulin, V. V.

ORG: None

TITLE: A seismic prospecting station. Class 42, No. 189598

SOURCE: Izobreteniya, promyshlennyye obraztsy, tovarnyye znaki, no. 24, 1966, 77

TOPIC TAGS: seismic prospecting, frequency divider, quartz crystal, seismologic station

ABSTRACT: This Author's Certificate introduces a seismic prospecting station containing an amplification-conversion channel, registration unit and power supply. The unit is designed for improved reliability and operational convenience. A quartz oscillator with a frequency divider system is used as a precision-frequency power supply and synchronizing unit. The oscillator is connected through amplifiers to the actuating units of the station.

SUB CODE: 08 / SUBM DATE: 04Jun65

UDC: 550.340.19

Card 1/1

[illegible] /0115/66/000/015/0094/0094

[illegible] V. N.; Avu[illegible], Yu. A.; Sokolinskiy, Yu. A.; [illegible] V. A.; [illegible], A. A.; [illegible], S. A.; [illegible] V. M.; [illegible]skiy, Yu. A.; Z[illegible]kiy, V. M.; [illegible]rov, V. V.; [illegible], V. V.; Yevnerov, D. A.; Germanov, Yu. G.; Maksimov, K. P.; [illegible], V. V.

[illegible]: none

[illegible] Class 42, No. 184466 [Announced by "Neftepribor" Factory [illegible] Administration of Mosgorsovnarkhoz (Zavod "Neftepribor" [illegible] Mosgorsovnarkhoza)]

SOURCE: Izobret prom obraz tov zn, no. 15, 1966, 94

TOPIC TAGS: [illegible] station, seismologic instrument

ABSTRACT: This Author Certificate presents a seismic station containing a seismic [illegible], a recording amplifier unit, an oscillograph, a magnetic drum [illegible] reproduction unit, a control unit, a reproduction amplifier, a [illegible], a drum with photographic paper, a retransmitting unit, [illegible] a power supply. To increase the reliability when transferring from operation with the method of reflected waves to the method of refracted waves, a filter unit is connected between the first and second stages of the recording amplifier unit. A

UDC: 550.340.19

Card 1/2

modulator-demodulator unit and a reel type magnetic recorder are connected in series to the output of the recording amplifier unit. For operation with the method of reflected waves, the filter unit has frequency cutoffs of 7--30 hz, and for operation the same frequency cutoffs of 20--50 hz. To increase the reliability of the recorded drum with operation by the method of regulated directional reception, a switching unit for the channels to be summed, a static correction unit, and a summing unit are connected in series between the magnetic drum recorder and the reproduction amplifier. To increase the reliability when transferring from operation with the method of reflected waves to seismic logging, a frequency selection unit is connected between the multichannel borehole probe and the magnetic drum recorder. To improve the quality of the recorded material, an electron beam unit for introducing static and dynamic corrections is connected between the reproduction amplifier and the drum with photographic paper.

SUB CODE: 08/ SUBM DATE: 05May65

SOKOLINSKIY, Yu.A.

Calculation of the equilibrium of ammonia synthesis with the aid of computers. Khim.prom. no.6:410-413 Je '62. (MIRA 15:11)
(Ammonia) (Chemical equilibrium)

SOKOLINSKIY, Yu.A.

Distribution of concentrations and temperature in heterogeneous catalytic exchange reactors with inner heat exchange. Kin. i kat. 4 no.6:910-918 N-D '63. (MIRA 17:1)

1. Moskovskiy institut khimicheskogo mashinostroyeniya.

SOKOLINSKIY, Yu.A.

Design of catalytic reactors with internal heat transfer. (MIRA 18:5)
Trudy MIKHM 26:161-173 '64.

[illegible] O V., [illegible], MIKHAYLOV [illegible], POMERANTSEV, V. [illegible]

[illegible] of ammonia [illegible] phenol. Khim. prom. 40 no. [illegible] (MIRA 18:4)
[illegible]

1. Moskovskiy institut khimicheskogo mashinostroyeniya (for Rumyantsev, Sokolinskiy). 2. Leningradskiy ordena Trudovogo Krasnogo Znameni tekhnologicheskiy institut im. Lensoveta (for Mikhaylov, Pomerantsev).

APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651930001-5"

CHEKHOV, O.S.; PLANOVSKIY, A.N.; [illegible]LANSKIY, Yu.A.

Accounting for liquid mixing in the calculation of mass exchange plate columns. Khim. prom. 40 no.10:768-772 O '64.

(MIRA 18:3)

USSR/Engineering

Card 1/1 : Pub. 128 - 29/38

Authors : Konson, A. S.; Bugakov, M. Sh.; and Sokolitsyn, S. A.

Title : On accurate methods of calculating material requirements

Periodical : Vest. mash. 9, 83-91, Sep 1954

Abstract : A critical review is presented of V. D. Lavrov's article published in "Vest. mash. 12, 1952" on, "Progressive Methods for Calculating Material Requirements in Part Production". Tables; graph.

Institution : .....

Submitted : .....

SOKOLITSYN, S.A.

Calculating turnover stocks of materials needed for regular flow of production. Trudy LPI no.186:69-80 '56. (MIRA 10:7)
(Machinery industry)

SOKOLITSYN S. A.

PHASE I BOOK EXPLOITATION 702

Klimov, Aleksey Nikolayevich and Sokolitsyn, Sergey Alekseyevich, Candidates of Technical Sciences

Puti obespecheniya ritmichnoy raboty promyshlennogo predpriyatiya (Ways of Ensuring Balanced Operations in an Industrial Establishment) Leningrad, 1957. 52 p. 3,050 copies printed.

Sponsoring Agency: Obshchestvo po rasprostraneniyu politicheskikh i nauchnykh znaniy RSFSR. Leningradskoye otdeleniye.

Scientific Ed.: Karlik, Ye. M., Candidate of Economic Sciences, Docent; Ed. of Publishing House: Savraskin, A. G.; Tech. Ed.: Gurdzhiyeva, A. M.

PURPOSE: This pamphlet is intended to acquaint the reader with the progress made by various sectors of Soviet industry in the development of a balanced and uniform rate of production.

COVERAGE: This pamphlet reviews some of the organizational measures employed by plants of the Soviet machinery industry to develop and assure balanced

Card 1/2

Ways of Ensuring Balanced Operations (Cont.) 702

operation and a uniform rate of production. There are 7 Soviet references. No personalities are mentioned.

TABLE OF CONTENTS:

AVAILABLE: Library of Congress (T58.K48)

Card 2/2

JG/aak
10-9-58

Sokolitsyn, S.A.

PHASE I BOOK EXPLOITATION SOV/2393

25(5)

Leningrad. Politekhnicheskiy institut

Mashinostroyeniye; ekonomika, organizatsiya i planirovaniye proizvodstva (Machinery Manufacturing; Economics, Organization and Planning of Production) Moscow, Mashgiz, 1958. 110 p. (Series: Its: Trudy, Nr 200) Errata slip inserted. 2,800 copies printed.

Sponsoring Agency: USSR, Ministerstvo vysshego obrazovaniya.

Resp. Ed.: V.S. Smirnov, Doctor of Technical Sciences, Professor; Eds.: Ye. M. Karlik, Candidate of Economic Sciences, Docent; and S.A. Sokolitsyn, Candidate of Technical Sciences, Docent; Tech. Ed.: R.G. Pol'skaya.

PURPOSE: This collection of articles is intended for engineering and technical personnel of machine-manufacturing establishments.

COVERAGE: This collection covers the theoretical aspects of the

Card 1/4

economics, organization, and planning of production and the actual operation of machine-manufacturing establishments. The first five articles deal with problems of classifying production lines for lot production, variations of the flow of lots of parts, and duration of the machining cycle, etc. The remaining articles are devoted to the economic efficiency of new technology, problems of quality control, and to the question of specialization and cooperation. No personalities are mentioned. References are given at the end of several articles.

TABLE OF CONTENTS:

Machinery Manufacturing; (Cont.) SOV/2393

Titova, M.V. Organizing Quality Control of Parts Manufactured on Automatic Lathes 90

Karlik, M., and G.V. Malakhovskiy. Specialization and Cooperation in the Iron-casting Industry in the Leningrad Economic Region 96

AVAILABLE: Library of Congress

Card 4/4

JG/ec
10-16-59

APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651930001-5"

SOKOLITSYN, S.A.

25(5) PHASE I BOOK EXPLOITATION SOV/1212

Potochnyye metody proizvodstva v seriynom mashinostroyenii i priborostroyenii (Assembly-line Methods in Serial Manufacturing of Machinery and Tools) Moscow, Mashgiz, 1958. 325 p. 3,500 copies printed.

Eds.: Berman, A.G., Candidate of Economic Sciences, and Neymark, A.I., Candidate of Technical Sciences; Eds. of Publishing House: Varkovetskaya, A.I., and Chfas, M.L.; Tech. Ed.: Sokolova, L.V.; Managing Ed. for Literature on Technical Machine Building (Leningrad Division, Mashgiz): Naumov, Ye. P.

PURPOSE: This book is intended for production managers, dispatchers, and engineering personnel engaged in the production of machinery and instruments. It may also be useful to scientific workers, planning personnel, and vtuz students specializing in industrial engineering.

Card 1/8

COVERAGE: The book contains background material for the 1958 Conference on Methods of Line Production scheduled under the auspices of the Committee on Production Organization of the Leningrad regional administration NTO of the machinery manufacturing industry. The Committee's recommendation for this Conference was prompted by the inadequate development of line production methods and techniques in Leningrad plants specializing in series [large-scale] production of machinery and instruments. Theoretical studies based on Soviet industrial practices are presented in Part I of this book. Part II discusses the introduction and development of line production methods in Leningrad plants while Part III reviews foreign literature and some of the more pertinent problems of line production as seen by foreign authors. There are no references.

TABLE OF CONTENTS:

PART ONE. BASIC PROBLEMS OF CALCULATING AND ORGANIZING LINE PRODUCTION IN SERIES [LOT] MACHINERY AND INSTRUMENT MANUFACTURING

Card 3/8

Card ...

PART THREE. FOREIGN EXPERIENCE IN ORGANIZING LINE PRODUCTION IN SERIAL [LOT] MACHINERY AND INSTRUMENT MANUFACTURING

AVAILABLE: Library of Congress

JG/ksv
3-11-59

Card 8/8

KLIMOV, A.N., dots., kand.tekhn.nauk; SOKOLITSYN, S.A., dots., kand.tekhn.nauk

Indices of rhythmical work flow and even production output in serial machinery production. Trudy LIEI no.22:69-77 '58. (MIRA 11:12)

1. Leningradskiy politekhnicheskiy institut imeni Kalinina.
(Machinery industry) (Industrial management)

SOKOLITSYN, S.A., dots., kand.tekhn.nauk; KLIMOV, A.N., dots., kand.tekhn.nauk

Methods for setting up production reserves in serial production flow. Trudy LIEI no.22:225-231 '58. (MIRA 11:12)

1. Leningradskiy politekhnicheskiy institut imeni Kalinina. (Industrial management)

KORBUT, A. A.; NEMCHINOV, V.S., akademik, otv.red.; NOVOZHILOV, V.V., red.; PINSKER, A.G., red.; SOKOLITSYN, S.A., red.; LUCHKINA, A.N., red.izd-va; SHEVCHENKO, G.N., tekhn.red.

[Transactions of the Scientific Conference on the Use of Mathematical Methods in Economic Research and Planning] Trudy Nauchnogo soveshchaniia o primenenii matematicheskikh metodov v ekonomicheskikh issledovaniiakh i planirovanii. Moskva, Izd-vo Akad.nauk SSSR. Vol.6.[Use of mathematical methods in technical and economic calculations] Matematicheskie metody v tekhniko-ekonomicheskikh raschetakh. 1961. 166 p. (MIRA 15:2)

1. Nauchnoye soveshchaniye o primenenii matematicheskikh metodov v ekonomicheskikh issledovaniyakh i planirovanii, Moscow, 1960. 2. Leningradskoye otdeleniye Matematicheskogo instituta AN SSSR (for Korbut). 3. Leningradskiy politekhnicheskiy institut (for Sokolitsyn).

(Mathematical statistics) (Electronic calculating machines) (Industrial management)

TATEVOSOV, Konstantin Georgiyevich; SOKOLITSYN, S.A., kand. tekhn. nauk, dots., retsenzent; KLIMOV, A.N., kand. tekhn. nauk, dots., retsenzent; VARKOVETSKAYA, A.I., red. izd-va; SPERANSKAYA, O.V., tekhn. red.

[Establishment of norms for a uniform production flow in series-manufacture of machinery] Normativnye raschety ravnomernogo proizvodstva v seriinom mashinostroenii. Moskva, Mashgiz, 1961. 246 p. (MIRA 15:2)

(Machinery industry—Production standards)

KLIMOV, Aleksey Nikolayevich, kand. tekhn. nauk, dots.; OLENEV, Ivan Dmitriyevich, dots.; SOKOLITSYN, Sergey Alekseyevich, dots., kand. tekhn. nauk; TYAMSHANSKIY, N.D., kand. ekonom. nauk, dots.; SHAKHIDZHANYAN, V.M., kand. tekhn. nauk; SABITOV, F.Sh., kand. ekonom. nauk, retsenzent; NEYMARK, A.I., dokt.tekhn.nauk, prof., red.; GRUNKIN, M.N., kand. ekonom.nauk, dots.,red.; RUBCHINSKIY, A.M., kand.ekonom.nauk,dots.,red.; VARKOVETSKAYA, A.I., red. izd-va; KONTOROVICH, A.I., tekhn. red.

[Organizing and planning the operations of a machinery plant] Organizatsiia i planirovanie mashinostroitel'nogo zavoda. Moskva, Nauchno-tekhn. izd-vo mashinostroit. lit-ry, 1961. 512 p. (MIRA 14:8)

1. Nachal'nik planovo-ekonomicheskogo otdela Leningradskogo metallicheskogo zavoda imeni Stalina (for Sabitov)
(Machinery industry—Management)

SOKOLITSYN, S. A. (Leningrad)

"Anwendung der Methoden der linearen Programmierung auf die Losung der Fragen der Verteilung und Konzentration der Produktion neuer Erzeugnisse."

report presented at the VII Intl. Colloq, Ilmenau Inst. of Technology, Ilmenau, GDR 22 -26 Oct 1962.

VIL'DAVSKIY, Isaak Matveyevich; SOKOLITSYN, S.A., kand. tekhn. nauk, retsenzent; KLIMOV, A.N., kand. tekhn. nauk, retsenzent; VARKOVETSKAYA, A.I., red.izd-va; SPERANSKAYA, O.V., tekhn. red.

[Design and operation of production lines for lot production of machinery and instruments]Proektirovanie i ekspluatatsiia potochnykh linii v seriinom proizvodstve mashin i priborov. Moskva, Mashgiz, 1962. 219 p. (MIRA 16:2)
(Machinery, Automatic) (Assembly-line methods)

SOKOLITSYN, S.A.

Calculating efficient uniform size for part lots. Trudy LIP no.227:168-186 '63. (MIRA 17:4)

SUKHANOV, V.P., inzh.; SOKOLKIN, A.F., inzh.

Construction of a plant for the continuous rolling of pipe. Prom. stroi. 40 no.8:7-10 Ag '63. (MIRA 16:8)
(Pipe mills)

SUKHANOV, V.P., inzh.; SOKOLKIN, A.F., inzh.

For the industrialization of erecting foundations under rolling shop equipment. Prom. stroi. 41 no.11:23-26 N '63. (MIRA 17:2)

STREL'NIKOV, N.P.; BESPALOV, Ye.M.; SOKOLKIN, A.F.; SHPINEV, V.F.; KRUPENNIKOV, S.S.; SPEKTOR, M.D.

Some conclusions from the experiences of building a pipe rolling mill. Prom.stroi. 42 no.11:6-9 N '64. (MIRA 18:8)

1. Trest Uraltyazhtrubstroy (for Strel'nikov, Bespalov, Sokolkin). 2. Upravleniye kapital'nogo stroitel'stva Pervoural'skogo novotrubnogo zavoda (for Shpinev). 3. Uralpromstroyniiproyekt (for Krupennikov, Spektor).

ACC NR: AP6036171 (A) SOURCE CODE: UR/0209/66/000/011/0036/0042

AUTHOR: Gudzev, N. (Colonel; Candidate of technical sciences); Lavrik, G. (Colonel; Doctor of military sciences); Perepelitskiy, S. (Engineer; Colonel; Candidate of technical sciences); Sokolkin, N. (Engineer; Major; Candidate of technical sciences)

ORG: none

TITLE: Planning operations in aviation headquarters

SOURCE: Aviatsiya i kosmonavtika, no. 11, 1966, 36-42

TOPIC TAGS: job analysis, ~~organization coordination, planning,~~ operations research, PERT, economic planning, industrial management, air force organization

ABSTRACT: A method of preparing a functional plan of operations is described in detail. It is said that the flow diagrams and outlines currently being prepared by commanders and officers at aviation headquarters have certain shortcomings, such as poor estimation of the time required for each operation, lack of coordination between sections, and no visual means for timely detection and elimination of potential difficulties. Many of these problems can be eliminated by adapting methods of network planning and management (SPU), which are widely used in the national economy. In this case the planned process is broken down into individual tasks. Each task is performed in phases which are called events and are designated by the resultant term, such as "aircraft fueled," "decision made." Consequently, each event expresses some important moment in the realization of the planned action.

ACC NR: AP6036171

Events are logically related to each other by means of tasks which actually transform one event into another. The task or operation means a working process which utilizes time and materials; "fictional work" means either a rest period or an enforced waiting period, which takes time but does not produce. On the basis of this terminology, flow charts of such planning are presented and methods of computation for determining the time allotment for each task are given. It is said that such graphic plans can be prepared well ahead of time not only for such stationary processes as actions during alert, preparation for second flight mission, retraining of a flight crew, etc, but also for such highly dynamic processes as the organization of activities during training under various circumstances. Experience with this type of planning should result in the preparation of standard plans which are periodically revised, and in the capability for estimating work capacity and anticipating difficulties in certain cases.

SUB CODE: 05, 12, 01/ SUBM DATE: none

Sokolkov, E.N.

4000

Causes of irreversible temper brittleness. E. N. Sokolkov and V. D. Sadovskii. *Fiz. Metal. i Metalloved.* 1, 362-5 (1955).—In order to sep. the effect of austenite decompn. from carbidic decompn. of martensite, steels contg. C 0.30, Cr 1.50, and Ni 5.60; C 0.38, Si 1.12, Cr 1.60, and Ni 5.80; and C 0.33, Si 1.98, Cr 3.09, and Ni 4.10% were isothermally quenched from 1200° at a temp. ranging from room to slightly above the martensitic point for 5 min. and then were either water quenched or heated for 5 min. in the temper brittle range, after which both sets of specimens were drawn at 200° for 1 hr. The compn. selected assured austenite stability in the 2nd heating range, so that only martensite decompn. entered the picture. The curves giving impact strength *vs.* the temp. of the first isothermic treatment show that the temper brittleness is directly connected with processes occurring in martensite on tempering it in the dangerous interval, expressing itself in a characteristic intergranular fracture along austenitic grains. Decompn. of austenite has no effect whatever. A max. brittleness was always observed when the boundaries of austenitic grains were filled with martensitic crystals. J. D. Gat

SOKOLKOV, E.N.

Influence of deoxidation with aluminum on the irrever-
sible temper brittleness of alloy structural steels. E. N.
Sokolkov, G. V. Gaidukov, and V. D. Sadovskii. Fiz. d
Metal. i Metalloved. 1, 366-7(1955).—The frequently ex-
pressed opinion that Al reduces temper brittleness was
checked by making 4 heats of steel by using different amts.
of Al for deoxidation. Two of them were made *in vacuo* by
using here the widest Al range. Deoxidation with Al
smoothens the embrittling effect reversely proportionally
to the amt. of it used but has no effect on vacuum-melted
heats. Its influence is assocd. with grain refinement and
not with the prevention of nitride formation. J. D. Gat

Ural affil, AS USSR
Inst Physics of Metal

SOKOLOV, Ye. N.

"Investigating the Irreversible Released Brittleness of Construction Alloy Steels." Cand Tech Sci, Ural' Polytechnic Inst, Sverdlovsk, 1954. (RZhKhim, No 21, Nov 54)

Survey of Scientific and Technical Dissertations Defended at USSR Higher Educational Institutions (11)

SO: Sum. No. 521, 2 Jun 55

SOKOLKOV, E. N.

15164 Problem of the Nature of the Plastic Deformations of Surface Layers of Substances Subjected to Friction Processes. K voprosu o prirode plasticheskikh deformatsii poverkhnostnykh sloev trushchikhsia tel. (Russian.) K. V. Savitskii, E. N. Sokolkov, and V. D. Sadovskii. *Doklady akademii nauk SSSR*, v. 103, no. 4, Aug. 1, 1955, p. 605-608.

Dynamic and static compression; effect of tempering temperature and original structure; microhardness. Graphs. 8 ref.

(2)

SOKOLKOV, E. N.

91/1112 539.388 :669.15-157

Effect of Plastic Deformation (in Austenitic state) on Tempering Brittleness of Alloyed Structural Steel

Dokl. Akad. Nauk 103(4), 609-610 1955 62

L. V. Smirnov, E. N. Sokolkov, V. D. Sadovsky U. S. S. R.

When combining rolling with hardening under conditions precluding recrystallisation of cold-hardened austenite, a considerable repression of the development of both reversible and irreversible temper brittleness is observed. Plastic deformation in austenite state followed by hardening (in the absence of recrystallisation) also prevents destruction of metal along the boundaries of austenite grains. It is conceivable that plastic deformation affects the distribution and segregation of phases causing the development of the two kinds of brittleness. The mechanisms of the initiation of the two kinds of brittleness are, apparently, identical. (Bibl. 5)

(2)

Sokolkov, Ye. N.

E-10

USSR/Solid State Physics - Mechanical Properties of Crystals and Polycrystalline Compounds.

Abs Jour : Referat Zhur - Fizika, No 5, 1957, 11937

Author : Sokolkov, Ye.N., Sadovskiy, V.D.
Inst : -
Title : Investigation of the Irreversible Temper Brittleness of Structural Alloyed Steels.

Orig Pub : Probl. metalloved. i term. obrabotoh. Mos kva - Sverdlovsk, Mashgiz, 1956, 99-119

Abstract : Study of the development of the irreversible temper brittleness of a large number of alloyed steels has shown that the occurrence of temper brittleness is not connected with the decay of the residual austenite, but is in correspondence with the start and development of the carbide formation during the decay of the martensite. The irreversible temper brittleness takes place also in the case of a special heat treatment, which prevents the decay of the

Card 1/2

E-10

USSR/Solid State Physics - Mechanical Properties of Crystals and Polycrystalline Compounds.

Abs Jour : Ref Zhur - Fizika, No 5, 1957, 11937

residual austenite. Carbide formation during the decay of martensite leads, at a definite tempering stage, to a reduction in the brittle strength upon damage along the boundaries of the grain.

Bibliography, 34 titles.

Card 2/2

SOKOLKOV, E. N.

18 181-4E2C

Irreversible temper brittleness of structural steel alloys.
E. N. Sokolkov and V. D. Sadovskii. *Trudy Inst. Fiz.*
Metal., Akad. Nauk S.S.S.R., Ural. Filial 1956, No. 18,
3-20.—Irreversible temper brittleness in structural steels
was studied as a function of (a) the chem. compn. of 18 steel
alloys; (b) the degree of decompn. of the residual austenite
detd. magnetometrically and expressed by the change in
magnetic strength ΔI; and (c) the degree of carbide formation
detd. by the change in the coercive power, ΔH_c, between 250
and 100°. Functions of the impact strength a_k, ΔI, ΔH_c and
the hardness H_{R_c} vs. the tempering temp. t were detd. for the
following alloys contg., besides C 0.28-0.38, Mn 0.20-1.74,
Cr 1.27-1.97, P 0.025-0.061, and S 0.022-0.38%, the fol-
lowing: 38KhN4, Si 0.25, Ni 4.20%; 38KhN4C, Si 1.77, Ni
3.70%; 38KhN4Yu, Si 0.43, Ni 4.10, Al 0.96%; 38KhN4B,
Si 0.22, Ni 4.35, W 1.01%; 30KhN4K, Si 0.11, Ni 4.04,
Co 1.99; 38KhN4M, Si 0.12, 3.96, Mo 0.51; 38KhN4CB,
Si 1.99, Ni 4.35, W 1.22; 38KhN4CBG, Si 2.50, Ni 4.80, W
1.15, Mn 1.74%; 38KhN4D, Si 0.20, Cu 0.61, Ni 4.38%;
30N8, Si 0.21, Cr 0.31, Ni 8.17; 38KhN8, Si 0.40, Ni 7.80%;
38KhN8C, Si 1.73, Ni 7.64; 38KhN8Yu, Si 0.40, Ni 8.00,
Al 1.10%; 38KhN8B, Si 0.05, Ni 8.10, W 0.70%; 38Kh-
N8K, Si 0.23, Ni 7.60, Co 1.70; 38KhN8M, Si 0.23, Ni
7.60, Mo 0.40%; 38KhN8CB, Si 2.11, Ni 7.50, W 0.68%;
38KhN8CBG, Si 3.12, Ni 8.31, W 0.32, Mn 1.46%. Pre-
liminary tests indicated that the decompn. of the residual
austenite in these steels could be arrested up to a high temp.
above that of the annealing processes of martensite so that
both processes could be observed separately. The values of
a_k were detd. on specimens 10 × 10 × 60 mm. notched after
the thermal treatment was completed: oil-quenched from
1100°, tempered for 1 hr. at the temp. range between 200 and
500° in 50° intervals, and water quenched. The min. in the
a_k vs. t curves at 250-400° (defined as the irreversible brittle-

1/2

SOKOLKOV, E.N.; SADOVSKIĬ, V.D.

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14E2c

ness) was present in all the steels tested. Cr, W, and Mo shifted the min. to higher temps., to 300–400° as compared with 250–300° of C steel; this shift was increased by 4 and 8% Ni. No correlation was found between the curves of a_k vs. t and those of ΔI vs. t. In most specimens the decompn. of residual austenite occurred after the min. in a_k was passed. On the other hand, a definite relation between this min. and ΔH_c was established; in all cases the min. a_k corresponded to the point of carbide formation. In steels 36KhN8B and 36KhN8M the decrease in a_k was slight, whereas ΔH_c passed through a well-defined max. The lack of a sharp decrease in a_k was attributed to the abundance of fine crystals in these alloys. These and earlier available data pointed to the conclusion that carbide formation rather than the decompn. of the residual austenite (cf. Grossman, *C.A.* 40, 3379[7]) was the detg. factor in the development of irreversible temper brittleness. This conclusion was further supported by studies of micrograms and by the following expts.: to decrease the austenite decompn. to a min. the effect of the duration of tempering was detd. on pieces of 36KhN4C tempered at 400° and of 36KhN8CB tempered at 420° for 5, 10, 20, 30, 40, and 50 min. and 1, 2, 3, and 4 hrs. and then water-quenched. The decrease in a_k with the duration of tempering was gradual, and ΔH_c increased simultaneously; decompn. of residual austenite was not detected in any of these tests.

I. Bencowitz

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Sokolkov, Ye.N.

1-4E2c

Effect of aluminum deoxidation in tempering on the irreversible temper brittleness of structural steel alloys. E. N. Sokolkov, G. V. Gaidukov, and V. D. Sadovskii. *Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial* 1956, No. 18, 30-5; cf. preceding abstr.—Alloys of 36KhN4 without Al and with 0.02-0.16% Al were prepd. in open magnesite crucibles. Specimens 10 × 10 × 55 mm. were oil-quenched from 1100°, tempered for 1 hr. at temps., t, from 200 to 500° in 50° intervals, quenched in water, and notched for tensile tests. The curves of the impact strength a_k vs. t of the alloy without Al and with only 0.02% Al varied very little: a pronounced min. at 350° followed by a sharp rise and a shallow min. at 500°, indicating the presence of both irreversible and reversible brittleness. The fracture at the brittleness range was coarse-grained. The a_k vs. t curves of the alloys with 0.05 and 0.16% Al exhibited only a slight min. at 350°, and the fracture showed an increased amt. of fine-grained austenite. To det. whether the effect of Al, reducing the irreversible brittleness, was due to the formation of Al nitride, thus preventing the formation of Cr and Mn nitrides (cf. Schrader, *et al.*, *C.A.* 44, 4399*f*) or to the increase of fine-grained structure (cf. Houdremont and Schrader, *C.A.* 33, 3733[2]) alloys contg. 0.03 and 0.15% Al were prepd. *in vacuo* (0.05-1 mm. Hg). The excess of Al secured the absence of N and 0.03% of Al was not enough to affect a_k. The a_k vs. t curves of both alloys were practically identical, passing through a sharp min. at 350° and a shallower one at a higher level at 500°. No effect on the grain structure was noted. Conclusion: the effect of Al on a_k was due to the increase of the fine structure rather than to the prevention of Cr and Mn nitride formation. I. B.

Sokolkov, E.N.

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Effect of plastic deformation in the austenite state on the character of embrittlement of structural steel alloys developed in tempering. L. V. Smirnov, E. N. Sokolkov, and V. D. Sadovskii. *Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial* 1956, No. 18, 30-60.—The effect of hot rolling on the tendency of steel to develop irreversible (1st-order) and reversible (2nd-order) brittleness was investigated by the following series of expts. with steels contg. besides C 0.37–0.38 and Cr 1.33–1.53% the following: 35 KhGCA, Mn 1.02, Si 1.30, P 0.028, S 0.020%; 37KhN3A, Mn 0.35, Si 0.4, Ni 3.3, P 0.018, S 0.010%. (1) After heating for 30 min. at 1200° the specimens were treated as follows: (a) rolled at 1200° and oil-quenched immediately, (b) oven-cooled to 900°, rolled, and immediately oil-quenched, (c) oven-cooled to 900° and oil-quenched immediately without rolling. The impact strength, a_k, of (a), (b), and (c) of the 2 alloys were 1.0 and 2.3, 5.5 and 6.5, 0.5 and 1.2 kg./sq. cm., resp. The fracture of (a) was brittle, fine-grained, intergranular, characteristic of the 2nd-order brittleness; that of (b) was amorphous without a trace of brittleness; and that of (c) was coarse-grained, intragranular. The difference between (a) and (b) suggested the possibility of instantaneous austenite recrystn. at 1200°. The difference between (b) and (c) emphasized the effect of hot deformation on brittleness. (2) Specimens held for 1 hr. at 1000° were oven-cooled to 900° and (a) immediately oil-quenched without rolling and (b) hot-rolled to 20% reduction and then oil-quenched. Pieces of both groups were then tempered for 1 hr. in a salt bath at 50° intervals in the range of 200-600°. The hardness as a function of the tempering temp., t, were parallel curves decreasing slightly as t increased. The curve of a_k vs. t of (a) passed through a min. at 350°, a max. at 450°, and another min. at 500°. The same curves of pieces

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SMIRNOV, L.V.; SOKOLKOV, E.N.; SADOVSKII, V.D

(b) dipped slightly at 350–400° and then rose continuously. These variations were more pronounced with 37KhN3A than with 35KhGCA. (3) The effect of the degree of rolling on a_k was detd. on pieces oven-cooled from 1150° to 900°, rolled to 10, 20, and 30% reduction, and oil-quenched immediately. The max. rise of a_k was completed at the lowest, 10%, reduction. Further rolling had no effect on a_k; in some cases it was slightly decreased. This was an indication that the effect of hot-rolling was not due to the fibrous grain and fracture, for practically all of the elongation, and fibrousness, was completed at 10% reduction. (4) a_k as a function of the temp. of hot-rolling increased linearly with the temp., passed through a rounded max. at 900–1000°, and then decreased linearly. These expts. were made with alloy 40KhN3N4 contg. C 0.34, Mn 0.27, Si 0.21, Cr 3.23, and Ni 4.54%. The other alloys gave similar results. (5) The effect of the time held at the rolling temp. after rolling before water quenching was detd. on pieces preheated at 1200° and rolled at 1200, 1100, 1000, 900, and 800° and held at these temps. for 1, 5, and 20 min. The function a_k vs. the time held at the rolling temp. decreased exponentially, and this effect increased with the rolling temp. Thus the effect of hot-rolling reducing brittleness was lost when sufficient time for the recrystn. of austenite was allowed. Micrograins of the fractured pieces indicated that at 1200° this recrystn. was practically instantaneous and that it stopped by immediate

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quenching. (0) The variation of a_k as a function of the test-
ing temp. was detd. in the range of +140 to −200°. a_k be-
gun to decrease into the brittleness range at 0° when hot-
rolled and at +100° when not rolled. Conclusion: Hot
mech. working reduced both reversible and irreversible tem-
per brittleness providing recrystn. of austenite was instantly
arrested. Both types of brittleness are similar processes but
initiated by different causes. I. Bencowitz

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SOV/137-58-9-19827

Translation from: Referativnyy zhurnal,Metallurgiya, 1958, Nr 9, p 246 (USSR)

AUTHORS: Sadovskiy, V.D., Malyshev, K.A., Sokolkov, Ye.N., Smirnov, L.V., Bogacheva, G.N., Biryulin, V.T., Petrova, S.N.

TITLE: The Effect of High-temperature Plastic Deformations on Brittleness of Hardened Steels During Tempering and Aging (Vliyaniye plasticheskoy deformatsii pri vysokikh temperaturakh na khrupkost' pri otpuske i starenii zakalennykh staley)

PERIODICAL: V sb.: Issled. po zharoprochn. splavam. Vol 2. Moscow, AN SSSR, 1957, pp 76-91

ABSTRACT: Investigations were performed in order to determine the effect of thermomechanical treatment (TMT) procedures (plastic deformation in the austenite state combined with immediate quenching of austenite which had not been allowed to recrystallize) on the a_k of steels 35KhGSA and 60Kh4G8N8V, and on the a_k of special grades of heat-resistant steels. Mechanical properties of the metals involved were measured and metallographic investigations were performed. The TMT increases the a_k value of austenite steels which are susceptible to aging (thermal brittleness). The lower limit of the temperature of TMT

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corresponds approximately to the position of the austenite recrystallization temperature for a given alloy. Since the value of the maximum temperature for the TMT is dependent on the tendency of austenite toward growth of recrystallized grains, the conditions of the TMT must be such as to preclude recrystallization of austenite. The effects observed are attributable to the fact that the deformation becomes progressively localized on grain boundaries as the temperature is increased and the coefficient of work hardening is diminished. This localization of the deformation, in turn, leads to changes in the form and the distribution of precipitated particles formed in the process of tempering and aging and, owing to the fact that the a_k of the steel is determined by the nature of the precipitated particles, results in a reduction of temper brittleness.

L.M.

1. Steel--Deformation 2. Steel--Temperature factors 3. Steel--Heat treatment
4. Steel--Aging

SOKOLKOV, Ye.N., kandidat tekhnicheskikh nauk.; SMIRNOV, L.V., kandidat tekhnicheskikh nauk.

Effect of heat treatment and mechanical working on the temper brittleness of structural alloyed steels. Metalloved. i obr. met. no.3:31-35 Mr '57. (MLRA 10:4)

1. Institut fiziki metallov Ural'skogo filiala Akademii nauk SSSR.
(Steel, Structural--Metallography) (Steel--Brittleness)

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AUTHOR: Sokolkov, E.N. and Sadovskiy, V.D.

TITLE: Influence of plastic deformation by tension on the notch impact strength of alloy structural steel in the case of exclusion of processes of recrystallisation of austenite. (Vliyanie goryachey plasticheskoy deformatsii rastyazheniem pri isklyuchenii protsessov rekristallizatsii austenita na udarnuyu vyazkost' konstrukstionnoy legirovannoy stali.)

PERIODICAL: "Fizika Metallov i Metallovedenie", (Physics of Metals and Metallurgy), 1957, Vol.IV, No.1 (10), p.187, (U.S.S.R.)

ABSTRACT: The authors carried out tests of hardening during deformation in tension of a Cr-Si-Mn steel of the following composition: 0.32-0.39% C, 1.10-1.40% Si, 0.80-1.10% Mn, 1.10-1.40% Cr, 0.40% Max Ni. A decrease was observed in the development of reversible temper brittleness which is accompanied by an increase in the impact strength and a changeover to tough ductile fracture without any visible traces of brittle inter-crystalline fracture. The deformation in tension of the specimen in the austenitic state was effected in a special attachment to an hydraulic press. For excluding re-crystallisation of the austenite an increased deformation rate of 5 mm/sec was applied with rapid hardening after completion of the stretching. 3 Russian references.

Institute of Metal Physics, Ural Branch of the Ac.Sc.

Recd. November, 2, 1956.

SOV/126-6-2-12/34

AUTHORS: Sokolkov, Ye. N., Smirnov, L. V. and Petrova, S. N.

TITLE: Influence of Thermo-mechanical Treatment Under Conditions of Forging on the Impact Strength of Alloy Steels (Vliyaniye termomekhanicheskoy obrabotki v usloviyakh kovki na udarnuyu vyazkost' konstruktsionnykh legirovannykh staley)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol 6, Nr 2, pp 276-280 (USSR)

ABSTRACT: In earlier work (Refs.1-3) it was established that combination of hot rolling of steel in the austenitic state with a hardening regime such as to eliminate recrystallisation of austenite enables to reduce the drop in impact strength after tempering at temperatures at which temper brittleness develops. The authors considered it of interest to study the effect of such "thermo-mechanical" treatment under conditions of free forging. The experiments were effected on the commercial steels 37KhNZA and 35KhGSA. As blanks, beams of 20 x 20 x 200 mm were used; the forging was effected by means of a pneumatic hammer with a reduction of 20%. Four differing regimes were used, namely: heating to 1150°C, cooling down to 950°C,

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Influence of Thermo-mechanical Treatment under Conditions of Forging on the Impact Strength of Alloy Steels

forging, quenching; heating to 1150°C, forging, quenching; heating to 1150°C, cooling to 950°C, forging, soaking in a furnace (1150°C for 5 minutes), quenching; heating to 1150°C, quenching. The cooling to 950°C was applied as a means of impeding possible recrystallisation during forging. For the same reason the time necessary for obtaining the desired reduction was reduced to the possible minimum and amounted to 4-5 secs which was followed immediately by quenching. After quenching, standard specimens of 10 x 10 x 60 mm were produced by grinding for impact bend tests. All the specimens were tempered at a temperature at which reversible temper brittleness occurs (550°C for four hours). On the finally machined specimens a notch 2 mm wide, 2 mm deep with a curvature radius of 1 mm at the bottom of the notch was produced. The obtained impact strength and hardness values are given in a table, p 276. Micro-structure photographs and photographs of fractures are reproduced. It was found that "thermo-mechanical" treatment under conditions of forging as well as under

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Influence of Thermo-mechanical Treatment Under Conditions of Forging on the Impact Strength of Alloy Steels

conditions of rolling brings about a reduction of the sensitivity of the steel to develop reversible temper brittleness. In both cases this effect is associated with the localisation of the deformation along the boundaries of the austenite grains of the initial heating, distortions in the crystal lattice of the intergranular transient zones (which are conserved after hardening) and the thereby caused change in the form of the phases and compounds which are responsible for developing temper brittleness. The here described effect of thermo-mechanical treatment can also be observed in other types of hot working as, for instance, stamping and extrusion, under conditions such that recrystallisation of work-hardened austenite is prevented.

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Influence of Thermo-mechanical Treatment Under Conditions of Forging on the Impact Strength of Alloy Steels

There are 3 figures, 1 table and 4 references, 3 of which are Soviet, 1 German.

ASSOCIATION: Institut fiziki metallov Ural'skogo filiala AN SSSR (Institute of Metal Physics, Ural Branch of the Ac.Sc. USSR)

SUBMITTED: November 19, 1956.

Card 4/4 1. Steel--Mechanical properties 2. Steel--Temperature factors 3. Steel--Test results

SOV/126-6-4-30/34

AUTHORS: Sokolkov, Ye. N. and Petrova, S. N.

TITLE: On the Mechanism of the Effect of Plastic Deformation in the Austenitic State on the Temper Brittleness (O mekhanizme deystviya plasticheskoy deformatsii v austenitnom sostoyanii na otpusknuyu khrupkost')

PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol 6, Nr 4, pp 762-764 (USSR)

ABSTRACT: Transition to brittle fracture (cold brittleness temperature) is closely associated with the ratio of the yield point to the brittle strength of the material. Steynburg and Popov (Ref 5) found that for the case of temper brittleness a high temperature of transition to brittle fracture is the result of a reduced magnitude of the brittle strength. The authors of this paper considered it of interest to establish the reasons for a decrease in the temperature of transition to brittle fracture of steel in the state of temper brittleness caused by thermo-mechanical treatment. It was assumed that the observed decrease in the temperature of transition to brittle fracture is due to an increase of

SOV/126-6-4-30/34

On the Mechanism of the Effect of Plastic Deformation in the Austenitic State on the Temper Brittleness

the brittle strength. This seemed likely since thermo-mechanical treatment leads to a suppression of the brittle fracture along the boundaries of the austenitic grain which is characteristic for temper brittleness, whilst a weakening of the grain boundaries during the evolution of phenomena causing temper brittleness brings about a reduction in the brittle strength. To verify this assumption, the brittle strength was determined for specimens of steel 20KhNZ after hardening from 1250°C, preliminary tempering at 650°C, followed by rapid cooling and subsequent tempering at 550°C for 4 hours; the impact strength was 1.5 kgm/cm² with a sharply pronounced brittle intercrystallite fracture. To enable easier observation of the development of the brittleness and also for obtaining a grain size as large as practicable, the applied hardening temperature was higher than usual. The thermo-mechanical treatment consisted of deformation by rolling on a laboratory hand-driven stand with a reduction of 23% at a speed of 5.7 m/min. The heating temperature was 1250°C, however,

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On the Mechanism of the Effect of Plastic Deformation in the Austenitic State on the Temper Brittleness

the deformation was effected at 900°C so as to suppress recrystallisation of the work-hardened austenite. Hardening of the deformed specimens was effected immediately after rolling so that the time interval from the ending of the rolling to the instant of hardening was 0.1 to 0.2 sec. From the rolled material, small specimens of a diameter of 3.5 mm and non-standard impact specimens of 8.5 x 8.5 x 55 mm were produced. Similar specimens were also produced and hardened in the normal way. The impact and the tensile specimens were manufactured after the final heat treatment, namely, tempering at 550°C for 4 hours. On the basis of the obtained results it is concluded that the reduction in the temper brittleness observed in the case of combining plastic deformation in the austenitic state with hardening under conditions excluding recrystallisation

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SOV/126-6-4-30/34

On the Mechanism of the Effect of Plastic Deformation in the Austenitic State on the Temper Brittleness

of the work hardened austenite is due to an increase in the brittle strength.
There are 3 Soviet references.

ASSOCIATION: Institut fiziki metallov Ural'skogo filiala AN SSSR (Institute of Metal Physics, Ural Branch of the Ac.Sc. USSR)

SUBMITTED: December 7, 1957

SOV/126-6-5-41/43

AUTHORS: Sadovskiy, V. D., and Sokolkov, Ye. N.

TITLE: Appearance of Brittleness in the Decomposition of a Solid Solution of Mn and Si Based on Copper (Yavleniye khrupkosti pri raspade tverdogo rastvora Mn i Si na osnove medi)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol 6, Nr 5, pp 954-955 (USSR)

ABSTRACT: The process of decomposition of a copper based solid solution with 1.5% Mn and 3.5% Si (manganese-silicon bronze) and its relationship with plastic properties were studied. In the decomposition of this solid solution a second phase separates out (Refs 1,2). This second phase is Mn_2Si and it is assumed that it does not affect the plastic properties of the bronze (Ref 3). The present paper deals with further studies of this process and its effect on plastic properties. The bronze was hardened at 800°C. Such a treatment ensures complete dissolution of Mn_2Si and subsequent rapid cooling on quenching produces a saturated solid solution at room temperature. A series of samples subjected to the above

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Appearance of Brittleness in the Decomposition of a Solid Solution of Mn and Si Based on Copper

treatment was tempered at temperatures of 200-750°C in steps of 50°C. The duration of tempering was three hours and the samples were subsequently quenched in water. Microstructure studies of the samples showed that in the hardened state the alloy is homogeneous and it consists of uniform grains of the α-phase (Fig 1). As the temperature of the subsequent tempering is increased, the second phase separates out in the alloy starting from 350°C tempering. The amount of Mn_2Si separating out is greatest in samples tempered at 500-600°C (Fig 2). Impact tests were carried out on samples of 10 x 10 x 60 mm dimensions with notches 2 mm wide and 2 mm deep. The results showed no dependence of the impact strength on the degree of decomposition of the alloy. A second series of samples, which had undergone the treatment described above (hardening and tempering), were further subjected to cold plastic deformation by rolling at the rate of 1.5 m/min. The reduction in size during rolling was 30%. The initial size of the samples was chosen to make the final dimensions the same as for the first series, i.e.

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Appearance of Brittleness in the Decomposition of a Solid Solution of Mn and Si Based on Copper

10 x 10 x 60 mm. Fig.3 shows the results of tests of samples subjected to cold plastic deformation. The ordinate represents impact strength and the abscissa represents the tempering temperature. This time the plastic properties are obviously affected by the decomposition of the alloy and the minimum of impact strength occurs at those tempering temperatures (500-600°C) which produced the largest amounts of the second phase in the alloy. Impact strength decreases from 19 kg.m/cm^2 for cold-rolled samples which were previously tempered at 250°C to 5.5 kg.m/cm^2 for cold-rolled samples tempered at about 600°C. These results are in agree with the data obtained from the microstructure. The observed behaviour is due to lowering of the degree of plasticity of the alloy by previous plastic deformation; such a lowering of plasticity makes it possible for the second phase (Mn_2Si) to produce the expected embrittlement of the alloy. Plastic deformation of a 2-phase alloy produces also high internal stresses which are higher than the stresses in the corresponding alloy consisting of a single phase.

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SOV/126-6-5-41/43

Appearance of Brittleness in the Decomposition of a Solid Solution of Mn and Si Based on Copper

There are 3 figures and 3 references, 2 of which are Soviet, 1 English.

ASSOCIATION: Institut fiziki metallov Ural'skogo filiala AN SSSR (Institute of Metal Physics, Ural Branch of the Ac.Sc., USSR)

SUBMITTED: November 5, 1967

Card 4/4

SOV/129-58-11-3/13

AUTHORS: ~~Sokolkov, Ye.~~ N., Candidate of Technical Sciences,
Lozinskiy, M. G., Doctor of Technical Sciences and
Antipova, Ye. I., Engineer

TITLE: Structure of Grain Boundaries and Heat Resistance of Austenitic Steel (Struktura granits zeren i zharoprochnost' austenitnoy stali)

PERIODICAL: Metallovedeniye i Obrabotka Metallov, 1958, Nr 11, pp 19-25 + 4 plates (USSR)

ABSTRACT: Hardening of the boundaries of austenitic grains, detected during impact bending tests and also as a result of static tensile stresses at liquid nitrogen temperature (Ref 6), leads to the assumption that the hardening is accompanied by an increase in the resistance to plastic deformation at elevated temperatures. Therefore, it was considered advisable to investigate the influence of the structure of the grain boundaries in the austenitic steel 60Kh4G8N8V on the creep speed. After hardening from 1100-1150°C, this steel has an austenitic structure and possesses a high impact strength, 30-40 kgm/cm^2. Ageing in the range of 600-800°C results in separating out of a carbide phase which brings about a drop in the impact

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Structure of Grain Boundaries and Heat Resistance of Austenitic Steel

strength to 3-5 kgm/cm^2. The development of brittleness is accompanied by inter-crystallite type disruptions. It was established that rolling of steel at 900 to 1000°C under conditions excluding recrystallisation of austenite leads to a reduction in the brittleness. The authors considered it of interest to compare the established influence of plastic deformation on the impact strength with the creep speed at elevated temperatures. The experiments were effected by means of the test device IMASh-5M which permits studying the micro-structure during heating and tensile tests in vacuum (Refs.7-9). The material was prepared for the investigations as follows: the blanks were heated to 1200°C and allowed to cool to the rolling temperature (1000-1100°C). Rolling with a reduction of 25% was effected on a laboratory rolling stand. For preventing recrystallisation of the work hardened austenite, the metal was cooled immediately afterwards in water, whereby the time interval between the end of the rolling and the cooling process amounted to no more than 0.2-0.3 sec. A part of the blanks which were not subjected to deformation were also hardened from 1000-1100°C. Following that, the blanks were

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Structure of Grain Boundaries and Heat Resistance of Austenitic Steel

aged for a duration of four hours at 750°C and then specimens were cut out to a shape as shown in Fig.1. The flat surface of the specimen was ground and chemically etched for the purpose of revealing the structure. The etched structure was conserved during subsequent heating to 900-1000°C in vacuum and this enabled observations of the changes in the structure during plastic deformation. For measuring the deformation during the tests a number of indentations were made on the ground surface; these were arranged perpendicular to the axis of the specimen with spacings of 6 mm; during the tests the distance between the individual indentations were measured with an accuracy of ± 1μ. The specimen was heated by passing current directly through it, whereby the temperature was controlled by a thermocouple which was welded onto the specimen. All the changes in the structure observed during the tests were recorded by photographing one and the same spot of the ground surface. The micro-structures of the specimens after three heat treatment regimes are reproduced in Fig.2, whereby the duration of ageing in all cases was 4 hours at 750°C. The test results graphed in

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Structure of Grain Boundaries and Heat Resistance of Austenitic Steel

Fig.3, i.e. the changes in the elongation of the steel 60Kh4G8N8V with various initial structures as a function of the test duration at 900°C and an initial load of 5 kg/mm^2, show that the behaviour of the specimens differs greatly for differing initial structures. It can be seen from Figs.4 and 5 that in ordinary specimens, as well as in specimens preliminarily deformed at 1000°C, cracks will appear and develop along the boundaries of the austenitic grains. The influence of partial recrystallisation at elevated temperatures on the heat resistance is graphed in Fig.3; a special experiment (curve 4) shows to what extent the creep speed can increase when crystallisation develops. On the basis of the obtained results the following conclusions are arrived at: For the investigated alloy an increase in the heat resistance will be brought about by such changes of the structural state of the austenitic grain boundaries which result in an intensive distortion of the preliminary plastic deformation under conditions excluding development of recrystallisation; a decrease in the creep speed is linked with braking of the plastic

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Structure of Grain Boundaries and Heat Resistance of Austenitic Steel

deformation along the boundaries of the austenitic grain; hardening of the alloy is apparently also determined by a change in the fine structure throughout the entire body of the grain.
There are 5 figures and 9 references, 8 of which are Soviet, 1 Czech.

ASSOCIATIONS: Institut fiziki metallov UFAN SSSR (Institute of Metal Physics, Ural Branch of the Ac.Sc., USSR) and Institut mashinovedeniya AN SSSR (Institute of Mechanical Engineering, Ac.Sc., USSR)

1. Steel--Structural analysis 2. Grains (Metallurgy)--Boundary layer 3. Grains (Metallurgy)--Crystal structure 4. Austenite--Metallurgical effects

Card 5/5

S/123/59/000/008/001/043
A004/A002

Translation from: Referativnyy zhurnal, Mashinostroyeniye, 1959, No. 8, p. 12, # 28674

AUTHORS: Shteynberg, M. M., Sokolkov, Ye. N., Varaksina, M. N.

TITLE: On the Problem of the Tendency of Metals to Brittle Failure 26

PERIODICAL: Tr. Ural'skogo politekhn. in-ta, 1958, Vol. 68, pp. 54-58

TEXT: Plastic deformation which is effected by monoaxial static tension leads to a considerable increase in breaking strength, which was determined during tensile tests at the temperature of liquid nitrogen. The intensity of such an increase depends on the alloy composition and the initial structure. Systematic data on the dependence of breaking strength on preliminary plastic deformation may be used for a more founded estimation of the tendency of alloys to brittle failure. Besides, such data make it possible, in a number of cases, to determine the breaking strength of some steels by the extrapolation method.

B. A. M.

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

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SoKolKov, Ye.N.

24(6) PHASE I BOOK EXPLOITATION 307/2385

Akademiya nauk SSSR

Nekotoryye problemy prochnosti tverdogo tela; sbornik statey (Some Problems in the Strength of Solids; Collection of Articles) Moscow, Izd-vo AN SSSR, 1959. 386 p. Errata slip inserted. 2,000 copies printed.

Ed. of Publishing House: V. I. Aver'yanov; Tech. Ed.: R. S. Pevzner; Editorial Board: A.F. Ioffe, Academician; G. V. Kurdyumov, Academician; S. N. Zhurkov, Corresponding Member, USSR Academy of Sciences; B. P. Konstantinov, Corresponding Member, USSR Academy of Sciences; F. F. Vitman, Doctor of Physical and Mathematical Sciences, Professor (Resp. Ed.); L. A. Glikman, Doctor of Technical Sciences, Professor; N. A. Zlatin, Doctor of Physical and Mathematical Sciences; V. A. Stepanov, Doctor of Technical Sciences; Ya.B. Fridman, Doctor of Technical Sciences, Professor; B. S. Ioffe, Candidate of Technical Sciences (Deputy Resp. Ed.).

PURPOSE: This book is intended for construction engineers, technologists, physicists and other persons interested in the strength of materials.

COVERAGE: This collection of articles was compiled by the Otdeleniye fiziko-matematicheskikh nauk AN SSSR (Department of Physical and Mathematical Sciences) and the Fiziko-tekhnicheskiy institut AN SSSR (Institute of Applied Physics, Academy of Sciences, USSR) in commemoration of the 80th birthday of Nikolay Nikolayevich Davidenkov, Member of the Ukrainian Academy of Sciences, founder and head of the Otdel prochnosti materialov (Department of the Strength of Materials) at the Institute of Applied Physics, Academy of Sciences, USSR, founder of the Fakul'tet fizicheskogo metallovedeniya (Department of Physical Metallurgy) at the Leningradskiy politekhnicheskiy institut (Leningrad Polytechnic Institute), recipient of the Stalin Prize (1943), the Order of the Red Banner of Labor (1945) and the Order of Lenin (1953). The articles deal with the strength of materials, phenomena of imperfect elasticity, temper brittleness, hydrogen embrittlement, cold brittleness, influence of deformation speed on the mechanical properties of materials, fatigue of metals, and general problems of the strength, plasticity, and mechanical properties of nonmetals. Numerous personalities are mentioned in the introductory profile of Professor Davidenkov. References are given at the end of each article.

S/137/60/000/009/015/029
A006/A001

Translation from: Referativnyy zhurnal, Metallurgiya, 1960, No. 9, p. 250,
21524

AUTHORS: Sokolov, Ye.N., Sadovskiy, V.D., Petrova, S.N.

TITLE: Structure of Austenitic Grain Boundaries and Temper Brittleness of Structural Steels

PERIODICAL: V sb.: Nekotoryye probl. prochnosti tverdogo tela. Moscow-Leningrad, AN SSSR, 1959, pp. 165-171

TEXT: The authors investigated the mechanism of the effect of heat and mechanical treatment on the weakening of temper brittleness of structural alloyed 20ХН3 (20KhNZ), 35ХГСА (35KhGSA), 35ХН4Ю (35KhN4Yu) and 30ХН8С (30KhN8S) steels. It is established that the weakening of the temper brittleness of structural alloyed steels during the thermomechanical treatment is connected with higher values of brittle strength. Plastic deformation in austenitic state under conditions preventing the development of recrystallization of hardfaced austenite

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S/137/60/000/009/015/029
A006/A001

Structure of Austenitic Grain Boundaries and Temper Brittleness of Structural Steels

causes distortions of the austenitic grain boundaries. The combination of such a treatment with quenching for structural alloyed steels weakens the reversible temper brittleness. There are 9 references.

K.M.

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

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SOV/126-7-2-31/39

18(3), 18(7), 24(6)

AUTHORS: Sokolkov, Ye. N. and Petrova, S. N.

TITLE: Influence of Plastic Deformation of Steel 35KhGSA in the Austenitic State on the Nature of Fracture in the Temper Brittle Condition (Vliyaniye plasticheskoy deformatsii v austenitnom sostoyanii na kharakter razrusheniya stali 35KhGSA v sostoyanii otpusknoy khrupkosti)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1959, Vol 7, Nr 2, pp 306-308 (USSR)

ABSTRACT: Plastic deformation of metals in the austenitic state, combined with quenching under conditions which exclude recrystallization of the worked austenite, lead to a decrease in the development of temper brittleness (Refs 1,2). In this case a lowering of the transition temperature of brittle fracture, as well as suppression of a characteristic temper brittleness fracture along the boundaries of the austenitic grains that existed prior to quenching of the steel (Ref 3), can be observed. In series experiments, steel fractures, in the case of brittle fracture, after thermo-mechanical treatment, occur not along the austenitic grain boundaries as after

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Influence of Plastic Deformation of Steel 35KhGSA in the Austenitic State on the Nature of Fracture in the Temper Brittle Condition

normal quenching, but across the grain bodies. Brittle fracture along the austenite grain boundaries does not occur even when the testing temperature is lowered to -195°C (Ref 3). The conclusions arrived at as to the nature of fracture are based on a microscope study of the appearance of the fracture at a magnification of x5. These conclusions are in a certain measure subjective, and hence special investigations were necessary. To this end a study was carried out in which the nature of the failure of steel 35KhGSA in the brittle state, after normal quenching and after thermo-mechanical treatment, was investigated by a known method, involving destruction of the specimen at a sufficiently low temperature, and compared with a previously prepared and etched microsection (Ref 4). In order best to be able to observe the characteristics of brittle fracture, the steel was heated to a temperature of 250°C prior to quenching. Plastic deformation in the process of thermo-mechanical treatment was carried out at 900°C (on

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cooling from 1250°C); it was necessary for the deformation temperature to be lowered in order to facilitate supression of recrystallization of the worked austenite, as exclusion of recrystallization is the main condition for carrying out a thermomechanical treatment. Deformation was carried out by rolling in a laboratory hand-roller, in which a cross-section of 10 x 10 mm was reduced to one of 8.5 x 8.5 mm, i.e. by 28%. The rolling speed was 5.7 m/min. Control specimens were quenched also after heating to 1250°C and cooling to 900°C. The control and deformed specimens were tempered at 550°C for 4 hours. A section was prepared on one of the faces of the specimen, perpendicular to the axis of cut, and etched in a solution of picric acid in xylol in order to expose the austenite grains. In Fig 1 a photograph of the structure in the region of probable crack propagation of a specimen having undergone thermomechanical treatment is shown. In Fig 2 a photograph of the same place of the section is shown after the specimen had fractured at a

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temperature of -195°C. Whereas failure of a specimen, having undergone normal quenching, takes place along the boundaries of austenite grains, which form on heating the steel prior to quenching (S. F. Yur'yev and Z. P. Kusnitsina (Ref 4) have shown this convincingly by means of the method under consideration), a specimen deformed at 900°C and quenched under conditions which exclude recrystallization of the worked austenite, fails in such a way that the fracture crack does not coincide anywhere with the austenite grain boundaries, i.e. failure occurs across the grain bodies (see Figs 1 and 2). In Fig 1 the line of demarcation reproducing the boundaries of failure in accordance with Fig 2 is marked by dashes. Thus, it can be assumed that when plastic deformation in the austenitic state is carried out together with quenching under conditions of reversible temper brittleness development, the characteristic temper brittleness along the austenitic grain boundaries will be suppressed. It is impossible to ignore the relationship

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between this fact and those changes in structure which arise when the above thermomechanical treatment is applied. These changes consist, as a rule, in a strong distortion of the shape of the austenite grains - a pronounced serration, the period of which is many times smaller than the cross-sectional dimension of the grain (10-20μ, Fig 3). In some cases, however, no such serration is observed. Special experiments have shown that this depends on the temperature of plastic deformation. We shall not deal with this problem specifically, but note that a localisation of deformation along the austenite grain boundaries, which can be observed in deformation throughout a fairly wide temperature range, is most favourable from the point of view of thermomechanical treatment effect when serration occurs. It has already been assumed that a localisation of plastic deformation in the austenitic grain boundaries leads to changes in the intergranular transition zones and regions adjoining them, which can alter the condition and the manner of precipitation of such phases which cause development of brittleness (Ref 1). In fact, as now can be seen, the visible

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distortions of the austenitic grain boundaries (Fig 3) cannot leave unaltered the nature of precipitation of any components responsible for the development of temper brittleness. The formation of embrittling components of a film-, plate-, or net-like appearance is excluded, which prevents the propagation of a brittle fracture crack along the austenitic grain boundaries after normal quenching. It should not be assumed, however, that a suppression of failure along the austenitic grain boundaries entirely excludes development of temper brittleness. Special experiments have shown that steel, having undergone thermomechanical treatment, remains sensitive, although only to a very slight extent, to cooling rate after high-temperature tempering. This may serve as the basis of a conclusion which is important in the theory of temper brittleness: processes causing the development of temper brittleness essentially along the austenitic grain boundaries, also take place throughout the grain bodies, but their intensity is insignificant. There are 3 figures and 4 Soviet references.

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(Note: This is a complete translation except for Fig.caps)

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Metal Physics, Ac.Sc. USSR)

SUBMITTED: December 21, 1957

18.7500
18.8200

67716

AUTHOR: Sokolkov, Ye. N. SOV/126-7-3-12/44

TITLE: Influence of Plastic Deformation in the Austenitic State on the Kinetics of the Development of Temper Brittleness of the Steel 30KhGSA (Vliyaniye plasticheskoy deformatsii v austenitnom sostoyanii na kinetiku razvitiya otpusknoy khrupkosti stali 30KhGSA)

PERIODICAL: Fizika metallov i metallovedeniye, Vol 7, Nr 3, pp 384-388 (USSR) 1959

ABSTRACT: Plastic deformation in the austenitic state leads to a considerable decrease in the development of temper brittleness in structural alloy steels if the worked austenite is not allowed to recrystallize (Refs.1-3). It has been assumed that one of the reasons of the suppression of temper brittleness development is a possible change in the kinetics of the precipitation of phases causing the brittleness (Ref.1). The authors have made a study of the influence of lengthy soaking during tempering on the development of brittleness in the steel 30KhGSA. The steel was heat-treated by normal quenching and tempering, as well as by a method in

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Influence of Plastic Deformation in the Austenitic State on the Kinetics of the Development of Temper Brittleness of the Steel 30KhGSA.

which quenching was preceded by plastic deformation in the austenitic state under conditions which excluded recrystallization of the worked austenite. To this end a big batch of specimens was treated by heating to 1250°C, cooling to 900°C, rolling, and quenching the specimens immediately after they had left the rolls. Rolling in all experiments was carried out with a reduction of area of 35% and at a speed of 1.5 m/min. Oil was used as the coolant. The control specimens without plastic deformation were also oil quenched after heating to 1250° and cooling to 900°C. The specimens after normal quenching, and those having undergone plastic deformation prior to quenching, were tempered at 550°C for 5, 20, 30 minutes, 1, 2, 4, 8, 16, 32, 64, 128, 256 and 512 hours, and subsequently water quenched. Toughness tests were carried out on notched specimens 10 x 10 x 60 mm. In Fig.1 the dependence of toughness and hardness of steel 30KhGSA specimens on the length of tempering at 550°C is shown (1 - after normal quenching: 2 - after plastic deformation and quenching). Fig.2 shows

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the same relationships for the same steel at the same temperature (1 - after normal quenching and tempering at 650°C, followed by slow cooling; 2 - after plastic deformation combined with quenching, and tempering at 650°C followed by slow cooling). Fig.3 shows the dependence of toughness for specimens of the same steel on testing temperature (1 - after normal quenching; 2 - after plastic deformation combined with quenching, and tempering at 550°C for 2 hours). In Fig.4 the same relationship as in Fig.3 is shown (1 - after normal quenching; 2 - after plastic deformation combined with quenching and tempering at 550°C for 512 hours. The results confirm the deduction about the stability of the brittleness-effect-decrease as a result of combining plastic deformation with quenching whereby recrystallization of the worked austenite is prevented. This enables the conclusion to be drawn that the observed decrease in temper brittleness is not the result of a change in the kinetics of the precipitation of

Card 3/4 phases or compounds which are responsible for the development

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of this type of brittleness. The results obtained confirm the assumption made earlier, that plastic deformation of steel of the austenitic state brings about such changes in the crystal lattice of intergranular transition zones and regions adjoining them as are capable of changing the condition and form of precipitation of phases and compounds which cause the development of brittleness (Ref.4). There are 4 figures and 4 Soviet references.

ASSOCIATION: Institut fiziki metallov, AN SSSR (Institute of the Physics of Metals, Ac. Sc. USSR)

SUBMITTED: November 16, 1957.

4

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22547

1.1710 also 4016, 1413, 1454

S/129/61/000/005/003/003
E073/E535

AUTHORS: Sokolkov, Ye. N., Petrova, S. N. and Chuprakova, N.P.

TITLE: Influence of Plastic Deformation in the Austenitic State on the Properties of Constructional Alloy Steels

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov, 1961, No.5, pp.12-14

TEXT: The authors investigated the influence of high temperature plastic deformation on the mechanical properties under tension at sub-zero temperatures. In earlier work (Ref.1: L. V. Smirnov, Ye. N. Sokolkov, V. D. Sadovskiy, Trudy instituta fiziki metallov; No.18, 1956; Ref.2: Ye. N. Sokolkov, L.V.Smirnov, Metallovedeniye i obrabotka metallov, No.3, 1957) it was established that thermomechanical treatment weakens the tendency to temper brittleness. M. M. Shteynberg and A. A. Popov (Ref.3: Zavodskaya laboratoriya, No.11, 1952) found that constructional alloy steel, which is in the temper brittle state, fractures along the boundaries of the austenitic grain as a result of tensile stresses applied at low temperatures. For the experiments a Cr-Mn-Si steel of a high sensitivity to temper brittleness was chosen (composition: 0.30% C, 1.06% Cr, 1.2% Mn, 1.05% Si, 0.02% P,

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0.023% S). Plastic deformation was carried out at 900, 1000, 1100 and 1200°C on a laboratory hand-operated rolling stand. The rolling speed was 5.7 m/min, the reduction was 30%. Blanks 10 x 10 x 55 mm were heated to 1250°C in graphite tubes and held at this temperature for one hour (the increased heating temperature ensured observation of failures); following that, the blanks were cooled with the furnace to 1200, 1100, 1000 and 900°C. A part of the specimens were then subjected to rolling from these initial temperatures, whilst another part was quenched in oil. For fixing the structures produced as a result of plastic deformation, after rolling the specimens were rapidly (0.3 to 0.4 sec) quenched. From both types of specimens tensile test specimens of 3.5 mm diameter were produced. Preliminarily all the blanks were tempered at 550°C for 2 hours. The tensile tests at -195°C were carried out in a special attachment fitted to the test machine ИМ-4Р (IM-4R). The results are plotted in Fig.1, the real breaking strength s_k, kg/mm^2, the elongation φ,%, δ,% vs. hot working temperature, °C; whereby the dashed lines apply to ordinary quenching (without hot working), whilst the continuous

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lines refer to the specimens which were subjected to thermo-mechanical treatment. It can be seen that the strength and ductility at -195°C increases most as a result of thermomechanical treatment at 900°C; mechanical deformation at higher temperatures leads to deterioration of the properties. Similar results were also obtained for the steels 20XH3 (20KhN3), 36XH8C (36KhN8S). The microstructure was also studied after each regime of thermo-mechanical treatment. After ordinary quenching, the fractures show boundaries of austenitic grains, whilst after thermomechanical treatment the fractures show intracrystalline planes and only in individual spots can austenite grain boundaries be detected. An increase in the temperature of the thermomechanical treatment to 1000°C and higher leads to a recrystallization of the work-hardened austenite which begins at the boundaries of the austenitic grains. With increasing recrystallization, the ductility and the strength decrease. The experiments have shown that as a result of the thermomechanical treatment the brittle strength of the austenite grain boundaries increases, reducing the temperature of transition to the embrittled state. There are 1 figure and 6 Soviet references:

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Influence of Plastic Deformation ... S/129/61/000/005/003/003
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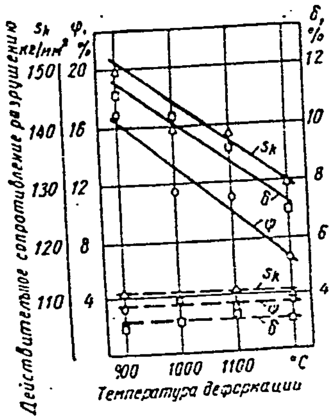
ASSOCIATION: Institut fiziki metallov AN SSSR
(Institute of Physics of Metals AS USSR)

Fig.1



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34534
S/659/61/007/000/021/044
D217/D303

18.1151

AUTHORS: Sadovskiy, V.D., Sokolkov, Ye.N., Lozinskiy, M.G., Petrova, S.N., Antipova, Ye.I., Gaydukov, M.G., and Mirmel'shteyn, V.A.

TITLE: Influence of thermo-mechanical treatment on the high temperature strength properties of austenitic steel

SOURCE: Akademiya nauk SSSR. Institut metallurgii. Issledovaniya po zharoprochnym splavam, v. 7, 1961, 202-209

TEXT: A complex alloy steel of the austenitic class, widely used in industry for manufacturing components for high temperature service, was studied. During ageing of this steel, the complex chromium and vanadium carbides responsible for its strengthening are precipitated. The material was heated to 1180 - 1200°C and rolled at 1000 - 1100°C at a speed of 5.7 m/min. After rolling, the billets were immediately water quenched in order to prevent recrystallization. The cross-section of the billets obtained was 11.5 x 11.5 mm their length, 70 mm, and the reduction due to rolling, 25 - 30 %. X

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Control billets were heated simultaneously with those chosen for thermo-mechanical treatment, and were subsequently quenched from the above temperature. All billets, whether thermo-mechanically treated or only heated and quenched, were aged to a hardness of 310 - 320 H_B. After heat treatment, specimens for two series of tests were made from the billets. One series was used for studying structure during high temperature extension in vacuo. This also enabled the degree of deformation to be determined and photographs of the same portion to be taken at various stages of testing. Testing was carried out in a IMASh-5M machine at 900°C and a stress of 9.5 kg/mm^2, using specimens of 3 x 3 mm cross-section, heated by direct passage of current. The second series of tests, in which K.I. Terekhov participated, consisted of the standard tests for long-term strength at 650°C and stresses of 35 and 38 kg/mm^2, as well as at 700°C and a stress of 32 kg/mm^2. For this purpose, specimens of working portion diameter of 5 mm and 50 mm length were used. The microstructure of each specimen was studied in conjunction with these tests, particularly any peculiarities in structure appearing after thermo-mechanical treatment as compared with normal quenching.

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Influence of thermo-mechanical ...

The distribution of deformation along the length of the specimen, the intercrystalline and crystalline plasticity and the formation and propagation of cracks during fracture were given particular attention. It was found that high-temperature plastic deformation of the steel investigated, under conditions in which recrystallization processes are suppressed (thermo-mechanical treatment), leads to a considerable increase in long-term strength. The beneficial action of thermo-mechanical treatment is associated with structural characteristics of the steel which arise during high temperature plastic deformation and are fixed by cooling at a sufficiently high rate. Such characteristics are the complex geometry of grain boundaries, grain fragmentation and further refinement of the fine crystal structure. These structural characteristics of the steel retarded the development of fracture during creep, since (a) the characteristic serrated grain boundary structure retards the amalgamation between micro- and macro-cracks; (b) breaking-up of the fine crystal structure, and an increase in the density of immobilized dislocations render plastic deformation within the grains more difficult. There are 5 figures and 16 references: 15 Soviet-bloc and

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: non-Soviet bloc. The reference to the English-language publication reads as follows: P.W. Davies and J.P. Dennison, J. Inst. Metals, 87, 4, 1958.

X

SOKOLKOV, E. N. [Sokolkov, Ye. N.]; PETROVA, S. N.; CIUPRAKOVA, N. P. [Chuprakova, N. P.]

Influence of austenite plastic deformation on the properties of the structural alloy steel. Analele metalurgie 15 no.4:124-127 O-D '61.

(Austenite) (Steel—Heat treatment)
(Deformations(Mechanics)

33464
S/129/62/000/001/007/011
E073/E335

18.1151 1416 1496

AUTHORS: Kishkin, S.T., Corresponding Member of the AS USSR, Lozinskiy, M.G., Doctor of Technical Sciences, Professor, Bokshteyn, S.Z., Doctor of Technical Sciences, Sokolkov, Ye.N., Candidate of Technical Sciences

TITLE: Influence of high-temperature plastic deformation on the mechanical properties of heat-resistant nickel-base alloys

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov, no.1, 1962, 38-40 + 1 plate

X

TEXT: Two Ni-Cr-base alloys were investigated: the low-carbon ЭИ437Б (EI437B) alloy of the standard composition and the ЭИ617 (EI617) alloy, containing 0.12% C and additions of W and Mo. The alloy EI437B was subjected to the following thermo-mechanical treatment: blanks of 16 mm diameter were first soaked for 8 hours at 1080°C and rolled at this temperature at a rolling speed of 4.5 m/min to 30% reduction. 0.2 to 0.3 sec after deformation, the blanks were quenched to supercool the austenite

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Influence of ...

and to retain the structure, produced as a result of high-temperature plastic deformation. The blanks were then aged at 700°C for 16 hours. Blanks of the alloy EI617 were heated to 1200°C and stamped in a press, so that an average reduction of 30% was achieved; this was followed by quenching in water. The blanks were then aged at 800°C for 16 hours. The results of static tensile and impact tests at room temperature are given in Table 1. Studies of the influence of thermomechanical treatment on the creep strength of austenitic steels revealed that recrystallization should be prevented during high-temperature plastic deformation since it would cancel out the beneficial effects of the thermomechanical treatment. Microstructural investigations correlated with the results of mechanical tests indicate that the increase in strength and ductility occurs even if recrystallization has not been fully suppressed. The increase in strength is attributed to an increase in the quantity of the carbide phase, to changes in the finely crystalline

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structure of the material and to texturing. The large increase in the ductility of the investigated alloys is obviously due to the absence of intercrystalline fracture. The following participated in the experiments: N.I. Korneyev; T.A. Gordeyeva, Ye.I. Razuvayev, O.N. Podvoyskaya, M.N. Kozlova, L.M. Strizhevskaya, T.A. Volodina, N.F. Lashko, E.V. Polyak, G.N. Korableva, A.V. Bulanov, M.I. Spektor and I.G. Skugarev. There are 2 tables and 7 references: 4 Soviet-bloc references and 3 non-Soviet-bloc. The three English-language references mentioned are: Ref. 4: E.B. Kula, J.M. Ohosi - "TASM", v.52, 1960; Ref. 5: D.J. Schmatz, J.C. Shyne, V.F. Zackay - Metal Progress, v.76, no. 3, 1959; Ref. 7: E.B. Kula, S.L. Lopata - Trans. AIME, v.215, 1959.

X

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Influence of ....

Table 1:

Alloy	Treatment	Mechanical Properties					
		$\sigma_{0.2}$, kg/mm²	σ_b, kg/mm²	δ, %	ψ, %	a_k, kgm/cm²	HB (d_{omn}, mm)
EI437B	Standard (reference specimens)	-	97.0	25.0	20.9	-	-
	TMO *	-	119	32.0	30.7	-	-
EI617	Standard (reference specimens)	71.7	103.7	14.6	10.1	1.8	3.6
	TMO*	93.8	129.6	31.2	25.9	7.8	3.35

* Plastic deformation of supercooled austenite followed by conventional hardening and tempering treatment.

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37728

S/180/62/000/002/001/018
E193/E383

1.1700

AUTHORS: Bokshteyn, S.Z., Kishkin, S.T., Lozinskiy, M.G. and Sokolkov, Ye.N. (Moscow)

TITLE: Thermomechanical treatment of a chromium-nickel-manganese austenitic steel

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Metallurgiya i toplivo, no. 2, 1962, 15 - 21

TEXT: The, so-called, "thermomechanical treatment" (TMO) consists essentially of combining plastic deformation at temperatures above the recrystallization temperature with quenching under conditions precluding recrystallization of the plastically deformed material. The effect of this treatment on the structure and properties of various materials has already been studied by other workers. Some additional data on TMO of austenitic steels are presented in the present paper, with particular reference to the properties of these steels after TMO to the ageing treatment and to some characteristics of the diffusion processes. The experiments were conducted on chromium-

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nickel-manganese austenitic steel ЭИ 481 (EI481) specimens, 13 and 60 mm in diameter, the former 150 and the latter 250 mm long. The plastic-deformation part of TMO was effected by rolling at 2.4 m/min in the case of specimens 60 mm in diameter and at 4.5, 7.5 and 13.5 m/min in the case of 13 mm diameter specimens. 25 and 30% reduction was given in each case. Recrystallization of the 13 mm diameter specimens was suppressed by immediate quenching in a water tank mounted on the rolls housing, the time interval between completion of the rolling operation and quenching amounting to 0.2 to 0.3 sec. Rapid cooling of the 60 mm diameter specimens was attained with the aid of a specially designed spraying device. Preheating of the test pieces for rolling was done in air in an electric furnace, the preheating temperature and time being 1 180 °C and 2 hours, respectively. TMO of small (13 mm diameter) test pieces was carried out after cooling them from 1 180 to 1 100 °C. In the case of large (60 mm diameter) test pieces TMO was applied at the preheating temperature and after cooling

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