57-9-32/40

The Relaxation of Non-Oriented Microstrains. Part II

ASSOCIATION: Institute for Machine Science, AN USSR, Moscow (Institut mashinovedeniya AN SSSR, Moskva)

SUBMITTED: October 10, 1956

AVAILABLE: Library of Congress

Card 2/2

AUTHORS: Rovinskiy, B.M. and Kostyukova, Ye.P. 70-3-3-30/36

TITLE: A Simple Method for the Precision Determination of the Lattice Parameters of a Polycrystalline Substance Without an Internal Standard Substance (Prostoy bezetalonnyy metod pretsizionnogo opredeleniya parametrov reshetki polikristallicheskikh veshchestv)

PERIODICAL: Kristallografiya, 1958, Vol 3, Nr 3, pp 382 - 383 (USSR)

ABSTRACT: For precision back reflection methods, there is some doubt as to the effective specimen film distance which is not removed by using a standard substance as the effective penetration depths are unknown. The ratio of the observed diameters of two rings $D_1/D_2 = f(a)$ where a is the lattice period. Values of this ratio of from 1.090 to 1.140 have been already given (Zh.Tekh.Fiz., 1940, Vol 10, p 525) but insufficiently accurately. A is the effective specimen-film distance. $D_1/2A = f(a)$. A is plotted against a for the two wavelengths of the K alpha doublet and the value of a where these curves cross is chosen. If D_1 and D_2 can be measured to 0.01 mm and A is about 50 mm, then an accuracy of 0.00003 Å can be achieved.

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70-3-3-30/36

A Simple Method for the Precision Determination of the Lattice Parameters of a Polycrystalline Substance Without an Internal Standard Substance

There are 3 figures and 2 Soviet references.

ASSOCIATION: Institut mashinovedeniya AN SSSR
(Institute of Mechanical Engineering, Ac.Sc.USSR)

SUBMITTED: November 13, 1957

Card 2/2

SOV/24-58-4-18/39

AUTHORS: Rovinskiy, B.M. and Rybakova, L.M. (Moscow)

TITLE: The Relationship Between Crystal Size and Yield Point and Metal Hardness (O zavisimosti predela tekuchesti i tverdosti metalla ot velichiny blokov)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, 1958, Nr 4, pp 100 - 101 (USSR)

ABSTRACT: A study is made of the effect of size (ε) of the crystal grains and non-uniformity ($\eta = \Delta d/d$) of the interplanar distance in the crystal lattice during permanent deformation on yield point (σ_s) and Brinell hardness (H_B) of metals. The experimental data used in the study have been taken from an earlier investigation by the present authors and from investigations by other authors, in particular Ball (Ref 1) and Hall (Ref 5). The data are for a low-carbon steel and pure aluminium. The various data for σ_s and H_B are plotted against $\eta^{1/2}$ and $\varepsilon^{-1/2}$ and the plots are found to be straight lines. The authors' straight line for σ_s versus $\varepsilon^{-1/2}$ passes through the origin of the co-ordinate system, indicating that σ_s approaches zero as the grain size

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The Relationship between Crystal Size and Yield Point and Metal Hardness

increases. Hall's straight line is criticised for not passing through the origin and it is suggested that this line could be made to do so and still pass through the experimental points.
The fact that the plot of σ_s vs. $\eta^{1/2}$ is also a straight line passing through the origin is used to conclude that $\varepsilon\eta$ = const. Doubts are expressed regarding the validity of the general view that the development of non-uniformity of lattice parameters during plastic deformation of metal is caused by the development of micro-stresses. It is further argued that Hall's view that the mosaic structure of grains is not affected by their size is incorrect.
The plots of H_B vs. $\varepsilon^{-1/2}$ and H_B vs. $\eta^{1/2}$ are straight lines intersecting the axis of ordinates at a point $H_{B(O)}$ above the origin. From the various curves a relationship is derived for H_B and σ_s :

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The Relationship Between Crystal Size and Yield Point and Metal Hardness

$$H_B = H_{B(0)} + C\sigma_s$$

where $C = \varepsilon^{1/2}\eta^{1/2}k$ and k is a constant depending on units.

There are 1 figure and 7 references, 1 of which is Soviet and 6 English.

ASSOCIATION: Institut mashinovedeniya AN SSSR (Institute of Mechanical Engineering of the Ac.Sc.USSR)

SUBMITTED: January 20, 1958

Card 3/3

SOV/120-58-5-31/32

AUTHORS: Lyuttsau, V. G., Rovinskiy, B. M.

TITLE: Prevention of the Blocking of Very Small Apertures Obtained by Firing Metallic Foils (Predokhraneniye ot zaplyvaniya ver'ma malykh otverstiy, poluchayemykh prokalivaniyem metallicheskikh fol'g)

PERIODICAL: Pribory i tekhnika eksperimenta, 1958, Nr 5, p 109 (USSR)

ABSTRACT: The authors have described a method for preparing very small apertures for shadow X-ray microscopy, using a camera obscura (Ref.3). Using the PMT-3 instrument, in which the diamond indentor was replaced by an electrolytically sharpened steel or tungsten needle, the end point of which consisted of a cone having an angle of 10-15° and an end point curvature of 0.1 μ, it was possible to prepare apertures 0.6-0.8 μ in diameter in a gold foil 20 μ thick. However, experiments have shown that such very small apertures produced in relatively soft metals do not last very long. After two to five hours they tend to "fill up" and during this process their form gradually changes and becomes either elliptical or even more complicated. The form of the aperture is apparently determined by the orientation of the crystallite in

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Prevention of the Blocking of Very Small Apertures Obtained by Piercing Metallic Foils

which the apertures are produced. In order to prevent the gradual filling up of such a small aperture, a plate with a freshly made aperture was soaked in a very diluted solution of celluloid in acetone and was then dried in air. In this way a celluloid wall is produced across the aperture and this prevents the filling up process. This procedure leads to apertures which although covered by celluloid are nevertheless transparent to visible light and X-rays and also preserve their original circular form. Such apertures are not suitable for electron beams. There are no figures, but 3 references, of which 2 are Soviet, 1 is English.

ASSOCIATION: Institut mashinovedeniya AN SSSR (Institute of Mechanical Engineering of the Academy of Sciences, USSR)

SUBMITTED: November 13, 1957.

SOV/126-6-5-17/43

AUTHORS: Rybakova, L.M., and Rovinskiy, B.M.

TITLE: Structural Changes in Metals During Very Small Rates of Deformation (O strukturnykh izmeneniyakh v metallakh pri ochen' malykh skorostyakh deformirovaniya)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol 6, Nr 5, pp 874 - 878 (USSR)

ABSTRACT: The difference between structural changes taking place during creep and those due to deformation in tensile tests is quantitative in nature. Work done in the past on the change in structure in relation to rate of deformation includes electron microscopic investigations of slip lines in monocrystals of aluminium deformed at different rates (Ref 2). Polycrystalline material was investigated by Pashkov (Ref 3). An X-ray investigation of the influence of the rate of deformation has been carried out by Braudenberger (Ref 4). Davidenkov (Ref 5) investigated the structural changes in steel and copper specimens which had been statically and dynamically compressed. All these investigations, however, are concerned only with static and dynamic deformation. Only recently has the influence of a deformation rate 40 to

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Structural Changes in Metals During Very Small Rates of Deformation

50 times less than static been investigated (Ref 7). The results of this investigation do not agree with the krown experimental facts. In Figures 1 and 2 the change of the half-length of the interference line for Steel 40 and Ni in relation to the extent of total deformation at normal and very low deformation rates is shown by crosses and points, respectively. In Figures 3 and 4, four sets of X-ray photographs are shown, two for Steel 40 and two for Ni of specimens deformed in accordance with the strain curves of Figures 1 and 2 (i.e. at normal and slow rates of deformation). Whereas, in undeformed specimens the interference spots appear clearly defined, with progressive deformation they become diffuse, the diffuseness increasing more rapidly with normal rates of deformation than with slow rates. The lower degree of diffuseness obtained with slow deformation is due to relaxations of micro-stresses within the grains accompanying slow deformation and is brought about by mutual displacement of grains or grain fragments. Such displacement has been observed in plastic deformation as well as in creep (Ref 8). In order to elucidate this phenomenon more fully, a microscopic

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Structural Changes in Metals During Very Small Rates of Deformation

investigation using the scratch method was carried out in which the specimens were scratched in a direction perpendicular to that of deformation. Micro-photographs of slowly deformed specimens showed scratch fractures in the grain boundaries and slip lines in grain bodies more clearly than those of rapidly deformed ones, thus confirming earlier reports of displacement of grains and grain fractures. There are 4 figures and 9 references, 7 of which are Soviet and 2 German.

ASSOCIATION: Institut mashinovedeniya AN SSSR
(Institute of Machine Theory of the Ac.Sc.USSR)

SUBMITTED: February 18, 1957

Card 3/3

7(6) SOV/32-24-11-16/37

AUTHORS: Rovinskiy, B. M., Sinayskiy, V. M.

TITLE: Preparation of the Plot "Load-Deformation of the Crystal Lattice" by the Method of Continuous Registration (Polucheniye diagramm "nagruzka-deformatsiya kristallicheskoy reshetki" metodom nepreryvnoy registratsii)

PERIODICAL: Zavodskaya Laboratoriya, 1958, Vol 24, Nr 11, pp 1367 - 1370 (USSR)

ABSTRACT: In contrast to the usual method, by which the deformation of the sample takes place stepwise and with each change of the load the sample is X-rayed, the method reported here employs continuous X-raying on a moving film. The corresponding deforming load is recorded simultaneously and automatically on the X-ray film. The film holder with its film is turned by two SD, -2 synchronous motors. The steel case with the film holder is attached to the columns of the IM -12A machine, to which the X-ray tube is also conveyed (Diagram, Figure). When a BSVL tube is used an exposure time of about one hour is needed.

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Correspondingly, the velocity at which the film turns and the velocity of deformation must be regulated to this period. From an X-ray picture of a finely granulated, cylindrical (diameter 15 mm) duraluminum sample which had been distended 0,3% and of layers of lines (511)(333) in the absorption of the K_α radiation of copper it is apparent that on the two symmetrical fields of the X-ray plate the K_{α_1} and K_{α_2} doublet forms two curves which can be divided into four parts. The first section corresponds to the condition of the load, the second to the elastic distension, the third to the transition of the deformation into the plastic region, and the fourth part to the decomposition of the sample. In this last section the lattice parameter shows a greater value than in the initial condition, which points to a residual deformation of inverse sign. Among the advantages of the method described is the possibility to observe single crystals by X-raying coarsely crystalline samples.

Inst Machine Studies AS USSR

Rovinsky, B.M.

24(6) PHASE I BOOK EXPLOITATION SOV/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,

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Academy of Sciences, USSR) in commemoration of the 80th birthday of Nikolay Nikolayevich Davidenkov, Member of the Ukranian 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.

TABLE OF CONTENTS:

PLAVNIK, G.M. (Moskva); PLUTALOVA, L.A. (Moskva); ROVINSKIY, B.M. (Moskva)

X-ray examination of structural changes in graphite antifriction materials suojected to friction. Izv.AN SSSR. Mekh. i mashinostr. no.4:179-184 Jl-Ag '63. (MIRA 17:4)

1. Institut mashinovedeniya AN SSSR.

ROVINSKIY, B.M., LYUTTSAU, V.G. and AVDEYENKO, A.I.

"Mi ture (sic) Point X-Ray Sources for Point Projection Microscopy and Diffraction Examinations,"

A paper presented at Second International Symposium on X-Ray Microanalysis Stockholm 13-18 Jun 59/Soviet Interest in New Techniques for Measuring Density of Ultra Soft X-Rays in Outer Space.

SO; B 3,136,088 31 Jul '59

SOV/180-59-1-10/29

AUTHORS: Kostyukova, Ye.P., and Rovinskiy, B.M. (Moscow)

TITLE: Change in the Substructure of Cold-Deformed Aluminium in Annealing (Izmeneniye substruktury kholodno-deformirovannogo alyuminiya pri otzhige)

PERIODICAL: Izvestiya Akademii Nauk, SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1959, Nr 1, pp 55-59 (USSR)

ABSTRACT: On annealing the structure of a deformed metal changes from a thermodynamically unstable to a stable state in two ways: by recrystallization in situ (Refs 1 and 2) or by primary recrystallization (Refs 2 and 3). The authors describe their investigation of substructural changes in 99.99% pure aluminium. A back-reflection X-ray method was used, with a beam from a broad focal spot passed through a very narrow cross-shaped diaphragm. With such diaphragms interference spots from perfect crystals are cruciform; from imperfect crystals complex spots are obtained whose nature and dimensions depend on their substructure. The distribution of spots is shown schematically in Fig 1. Plate specimens were cut from an ingot, annealed at 350°C for two hours and rolled to 5, 15 and 30% deformation. Fig 2 shows the patterns

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Change in the Substructure of Cold-Deformed Aluminium in Annealing

obtained after annealing the deformed specimens for two hours at 250, 300, 350, 400, 500 and 600°C: the lower the deformation the higher the temperature to which the continuous-line background persists. Fig 3 gives a more complete picture (magnification X 2), showing differences in the spot shapes at a given temperature and different deformations and the changes that occur as the temperature is increased. In this figure some vertically-extended spots are visible and to elucidate their origin the authors obtained patterns from specimens rotated through 90° (rolling direction horizontal). This gave spots extended horizontally and the authors conclude that extended spots are due to crystallites in which recrystallization in situ has occurred. They consider that such recrystallization is the primary and main process even at the highest annealing temperature. True primary crystallization becomes appreciable only with increasing deformation. It produces perfect crystals whose structural nature changes with increasing annealing temperature. Fig 4 shows an interference spot from a

Change in the Substructure of Cold-Deformed Aluminium in Annealing

single specimen successively annealed at 250, 350, 400, 500 and 600°C, the increasing angular width of the spot being associated with the increasing number of sub-grains composing the crystallite.

Card 3/3 There are 4 figures and 6 references, 3 of which are Soviet and 3 English.

SUBMITTED: August 15, 1958

SOV/180-59-2-10/34

AUTHORS: Gal'perin, M.Ya., Kostyukova, Ye.P., and Rovinskiy, B.M. (Moscow)

TITLE: Change in the Substructure of Metals in Repeated Cyclic Loading (Izmeneniye substruktury metallov pri mnogokratnom tsiklicheskom nagruzhenii)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye tekhnickeskikh nauk, Metallurgiya i toplivo, 1959, Nr 2, pp 56-61 (USSR)

ABSTRACT: Increasing attention has been given recently to the substructure of crystal grains. Rovinskiy and Rybakova (Ref 5) and others (Ref 4) have shown that the yield-point strength and hardness increase with decreasing sub-grain size. The present work deals with substructural changes in 99.99% pure aluminium and electrolytic nickel during repeated cyclic loading at 25 cycles/second on a type MUP-150 machine. Fig 1 shows the form of the test pieces. Aluminium test pieces were annealed for two hours at 450 - 500 or 600 °C to obtain weakly- or strongly-developed substructures, respectively. Nickel test pieces were vacuum annealed for two hours at 900°C. The strain during tests was determined with a type EIDU-IMASh meter with the aid of wire strain gauges glued

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Change in the Substructure of Metals in Repeated Cyclic Loading

to the specimen. The substructure was studied by the X-ray back-reflection method using a type BSV-I tube with a copper anode and linear focus (Fig 2). Figs 3 - 7 give patterns obtained after various numbers of cycles (up to 10^7). Figs 3 and 7 related to aluminium previously annealed at 450 °C tested under repeated and variable sign bending, respectively, and stresses of 1.55 and 1.75 kg/mm^2, respectively. Figs 4 and 6 related to the repeated bending at stresses of 1.55 and 1.75 kg/mm^2, respectively, of aluminium previously annealed at 600 °C, and Fig 5 to that of aluminium at a stress of 1.75 kg/mm^2, previously annealed at 500 °C. The mechanical properties of aluminium with weakly- and strongly-developed substructures were compared: the results showed the superiority of the latter material. The work showed that in cyclic deformation the grain substructure of both aluminium and nickel became more complicated, this occurring in the early stages and ceasing after a definite number of cycles. The changes which occur in cyclically loaded aluminium depend on the nature of the substructure in the original grain; the

Change in the Substructure of Metals in Repeated Cyclic Loading

less pronounced this is, the greater are the changes. There is a definite relation between the hardening of the specimen in the initial stage of cyclic deformation and the development of its substructure. Substructural changes do lead directly to fatigue failure.
There are 7 figures and 14 references, 4 of which are Soviet, 9 English and 1 German.

ASSOCIATION: Institut Mashinovedeniya AN SSSR (Machinery Institute of the AS USSR)

SUBMITTED: March 15, 1958

SOV/180-59-4-14/48

AUTHORS: Gal'perin, M.Ya., Kostyukova, Ye.P. and Rovinskiy, B.M. (Moscow)

TITLE: The Influence of Cyclic Loading on the Structure of Deformed Pure Metals

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Metallurgiya i toplivo, 1959, Nr 4, pp 82-87 (USSR)

ABSTRACT: X-ray studies of structural changes occurring in 99.99% aluminium and electrolytic nickel were carried out. Samples were annealed preliminarily deformed to 1, 2 or 4% and subjected to cyclic stressing by bending. X-ray pictures are shown for the annealed sample, the sample after deforming and the sample after various numbers of cycles in Fig 2, 3, 4 and 5 for aluminium and Fig 7 for nickel. The annealed samples of both aluminium and nickel give sharp interference spots corresponding to simple structures with fairly perfect crystallites. After the preliminary deformation the spots are more diffuse because there are subgrains present and the subgrains themselves are not perfect. The behaviour of nickel under subsequent cyclic loading is different from that of aluminium. For aluminium the sharpness of the spots

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The Influence of Cyclic Loading on the Structure of Deformed Pure Metals

reappears. This restoration is greater, the greater the amplitude of the stresses and the smaller the preliminary deformation. No restoration is observed in the X-ray picture of nickel. It is thought that the difference in behaviour occurs because aluminium has a low temperature of recrystallization. The increase in perfection of the subgrains is thought to be a thermal process causing recrystallization "in situ" to take place. There are 7 figures and 10 references, 3 of which are Soviet, 6 English and 1 German.

SUBMITTED: April 23, 1959

Card 2/2

SOV/126-7-1-11/28

AUTHORS: Rovinskiy, B.M., Samoylov, A.I. and Rovenskiy, G.M.

TITLE: Crystal Lattice Distortions in Nickel-Based Alloys at Temperatures of 20-500°C (Iskazheniya kristallicheskoy reshetki v splavakh na nikelevoy osnove pri temperaturakh 20-500°)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1959, Vol 7, Nr 1, pp 79-90 (USSR)

ABSTRACT: The authors used samples of pure electrolytic nickel and nickel alloyed with aluminium, chromium, cobalt and iron. The composition of these alloys is given in Table 1. The alloys were prepared in an induction furnace filled with an inert gas. The melts were subjected to homogenising annealing and were hot-forged. After forging they were again annealed at 900°C and then cold-forged in three mutually perpendicular directions in order to decrease the dimensions of crystal grains. After cutting into plane-parallel plates, the samples were again annealed at temperatures gradually increasing to 550°C (50°C higher than the temperatures later employed in X-ray studies). The crystal lattice distortions were studied by X-ray reflection at

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Crystal Lattice Distortions in Nickel-Based Alloys at Temperatures of 20-500°C

temperatures of 20, 200, 350 and 500°C. A KROS-1 camera with an exposure standard (Fig.1) was used. Relative integral intensities of reflections from (331) and (420) planes were found using a microphotometer MF-4. The lattice constant of nickel and nickel alloys in the region 20-500°C was determined to within ± 0.001 Å. The relative hardness of nickel and its alloys was also measured between 20 and 500°C (Fig.8). The results obtained are shown in graphs (Figs.2-11) and tables (2-4). On addition of up to 12.4 at. % of Al, 24.0 at. % of Cr, 10.4 at. % of Co and 6.7 at. % of Fe, the distortion of the nickel lattice was found to be proportional to the amount of the alloying element present. At room temperature the distortion is greatest on addition of aluminium, and least on addition of chromium. At 500°C the greatest distortion is still produced by aluminium, but the least distortion is obtained on addition of cobalt. The dependence of the characteristic temperature of alloys on the amounts of alloying elements is shown in Fig.5. It was found that the characteristic

Crystal Lattice Distortions in Nickel-Based Alloys at Temperatures of 20-500°C

temperature of alloys cannot be obtained by simple addition of the characteristic temperatures of their components. The state of the lattice at the absolute zero is discussed. It was found that the "zero" energy in alloys depends on the amount of the admixture and the nature of the alloying element. There are 11 figures, 4 tables and 12 references, of which 10 are Soviet, 1 English and 1 a translation from English into Russian.

ASSOCIATION: All-Union Scientific Research Institute for Aircraft Materials (Vsesoyuznyy nauchno-issledovatel'skiy institut aviatsionnykh materialov)

SUBMITTED: October 28, 1957

SOV/48-23-5-3/31

9(6)
AUTHORS: Rovinskiy, B. M., Lyuttsau, V. G., Avdeyenko, A. I.

TITLE: X-ray Shadow Microscopy (Rentgenovskaya tenevaya mikroskopiya)

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1959, Vol 23, Nr 5, pp 545 - 551 (USSR)

ABSTRACT: In the first part of the present paper the authors discuss the methods of preparing X-ray silhouettes. Four graphs serve as a basis (Fig 1). The first of the methods dealt with here is the "contact method", in which the X-ray film is in contact with the sample under investigation. The resolving power attains here a maximum of 1μ. The second method is the one introduced by Cosslett and Nixon, in which, as is known, an electron beam is focused by means of electromagnetic lenses onto the anode, and from which the X-rays then depart. The resolving power attains here 0.1 to 0.2μ. The third method is the one described by the authors, which consists essentially of a tapered anode as point source of the X-rays. A resolving power up to 0.6μ is attained therewith. The last method described goes under the name of camera obscura. Here, the X-ray light originating from an areal source enters

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X-ray Shadow Microscopy

a chamber, containing sample and film, through a small stop. By this method the authors attained a resolving power below 1μ. In the years 1952 - 1953 the authors worked in the IMASh AS USSR on the development of X-ray shadow microscopes. It is pointed out that this type cannot cope with the resolving power offered by electron microscopes. A new model is described in the second part of this paper, complying with the third principle described above. A graphic section is shown and details are discussed. The maximum magnification made possible by this instrument, is 650fold; the negatives, however, may be magnified photographically up to 2000fold. The resolving power attains from 0.2 to 0.5μ. For an exemplification, two pictures of a net are shown, the first of which exhibits a 400fold magnification, and the second, by photographic methods, a 2000 fold magnification. The final part of the paper is devoted to the range of applicability of these microscopes; in this connection two pictures are shown depicting mineral samples, one of an insect preparation, two of histological preparations, and two pictures of metallic alloys. The conditions are specified under which each of

them was taken; magnifications are in the range of 80fold to 800fold. There are 7 figures and 14 references, 7 of which are Soviet.

ASSOCIATION: Institut mashinovedeniya Akademii nauk SSSR (Institute of Machine Construction of the Academy of Sciences, USSR)

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SOV/32-25-10-28/63

28(5)

AUTHOR: Rovinskiy, B. M., Professor, Doctor of Physical and Mathematical Sciences

TITLE: The Problem of the Classification and Manifestation of Residual Stresses. (Answers to the Article by Academician N. N. Davidenkov Published in Nr 3 of the Periodical for 1959 Have Arrived at the Editorial Office of the Periodical "Zavodskaya Laboratoriya". These Answers Are Given Below in the Form of a Discussion). III.

PERIODICAL: Zavodskaya laboratoriya, 1959, Vol 25, Nr 10, pp 1228-1230 (USSR)

ABSTRACT:

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The author points out that N. N. Davidenkov's (Ref 1) division of residual stresses into three classes is inaccurate and incomplete (Ref 2), and that the third class having no physical sense is to be excluded from any classification of stresses. It is pointed out that the stresses in state of equilibrium in the macrovolume cannot be specified except for by the general classification of stresses (Ref 3), and the terminology of the Komissiya po tekhnicheskoy terminologii AN SSSR (Commission for Technical Terminology of the AS USSR), and can be termed "macrostresses" only in some cases. The stresses of "second class"

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The Problem of the Classification and Manifestation of Residual Stresses. (Answers to the Article by Academician N. N. Davidenkov Published in Nr 3 of the Periodical for 1959 Have Arrived at the Editorial Office of the Periodical "Zavodskaya Laboratoriya". These Answers Are Given Below in the Form of a Discussion). III.

should be better termed "microstresses" or crystallite stresses". The "stresses" in state of equilibrium in submicrovolumes should be termed "lattice deformations". Terms like "deformations of 3rd class" and "deformations of 2nd class" should be avoided since they are not scientifically founded. In an X-ray visualization of stresses, the appearance of a line shifting should really not be applied to the classification of stresses. On considering that an extension of X-ray lines also depends on the size of blocks and other factors, the inexpediency of a stress classification on the basis of X-ray phenomena becomes even more evident. As the weakening of the line intensity in (Ref 1) is referred to "stresses of 3rd class", it is not dealt with (for the above-mentioned reasons). There are 4 Soviet references.

PLAVNIK, G.M.; ROVINSKIY, B.M.

Investigating the submicroporosity of low absorbing materials by the method of multiple small-angle scattering of the X-rays. Fiz.tver.tela 2 no.6:1099-1106 Je '60. (MIRA 13:8)

1. Institut mashinovedeniya AN SSSR, Moskva.
(X-ray crystallography)

24547

S/179/61/000/002/015/017
E073/E535

18 8200 also 2807

AUTHORS: Rovinskiy, B.M. and Sinayskiy, V.M. (Moscow)

TITLE: The relation between oriented micro-stresses and residual irreversible deformation in metals

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Mekhanika i mashinostroyeniye, 1961, No.2, pp.146-147

TEXT: The results are described of experimental investigation of the residual deformation of the lattice, and consequently of the oriented micro-stresses, on the magnitude of residual irreversible deformation of specimens made of steel 45 in pure compression and tension. After machining, the specimens were annealed in a vacuum furnace at 780°C and then deformed by means of the test machine ИМ-12А (IM-12A). One series of specimens was subjected to pure compression, the other to pure tension. The rate of deformation was 2 mm/min. The residual deformation of the lattice was measured by X-ray diffraction and is shown graphically as a function of the residual irreversible deformation of the specimens. The residual deformation of the lattice is taken as a measure of the

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oriented micro-stresses; it shows a maximum value at about 1% residual (plastic) deformation of the specimens. On further increase of the plastic deformation of the specimens, the residual deformation of the lattice falls continuously. The oriented micro-stresses are therefore at a maximum at plastic deformations of about 1%. Therefore, plastic deformations approaching 1% should be avoided if oriented micro-stresses have an adverse effect. There are 1 figure and 6 references: 3 Soviet and 3 non-Soviet.

ASSOCIATION: Institut mashinovedeniya Akademii nauk SSSR (Institute of Science of Machines. Academy of Science, USSR)

SUBMITTED: December 9, 1960

Card 2/2

S/126/61/011/002/016/025
E193/E483

AUTHORS: Rovinskiy, B.M. and Lyuttsau, V.G.

TITLE: Dependence of the Relaxation Stability of Metals and Alloys on the Atomic Bonding Forces and Lattice Distortions, and Correlation of the Relaxation Stability With Hardness

PERIODICAL: Fizika metallov i metallovedeniye, 1961, Vol.11, No.2, pp.285-289

TEXT: It has been shown earlier by the present authors (Ref.1-4) that the relaxation of both the initial stresses σ and the residual, oriented stresses is described by the equation

$$\varepsilon_t = \varepsilon_0 \exp\left\{-\left[k_1 t^p\right]\right\} \qquad (1)$$

where ε_0 and ε_t denote the relative elastic deformation of the material, measured, respectively, on the application of the load and after time t during which the test piece deformed elastically; k_1 and p are parameters which characterize the intensity of the relaxation processes. k_1 being dependent on the

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magnitude of the stress and p depending on the nature, structure and state of the material. The non-dimensional parameter p, to which earlier a term "plasticity index" was ascribed (Ref.1), appears to be a universal characteristic of the mechanical properties of metals; the object of the present work was to establish the relationship between p on one side, and the so-called lattice rigidity coefficient K, the degree of lattice distortion and hardness on the other. To this end, data obtained earlier by the present authors (Ref.1-4) on pure metals (Ni, Al, Cu) and alloys (Cu-Al, Ni-Al, Ni-Cr, Ni-Fe, Ni-Cu), tested between 18 and 400°C were analysed. Since p in Eq.(1) varies between 0 and 1, $R = (1/p) - 1$ (varying between 0 and ∞) was taken as the measure of the relaxation stability in the present work. The following conclusions were reached. (1) The relaxation stability R of pure metals varies linearly with K^2; this law, however, does not apply to alloys. (2) The relationship between R and Brinell hardness number is also linear. (3) The increase in the relaxation stability and hardness of alloys is brought about by static lattice distortions, caused by the introduction of the alloying elements atoms. (4) The decrease in the relaxation

stability and hardness of pure metals at elevated temperatures is caused by an increase in the intensity of the thermal vibrations of atoms in the lattice. There are 5 figures and 7 Soviet references.

ASSOCIATION: Institut mashinovedeniye AN SSSR
(Institute of Science of Machines AS USSR)

SUBMITTED: July 26, 1960

Card 3/3

L 20728-66 EWP(k)/EWT(m)/EWP(t) JD/HW

ACC NR: AP6011998 SOURCE CODE: UR/0126/65/019/004/0596/0601

AUTHOR: Rovinskiy, B. M.; Rybakova, L. M.

ORG: Institute of Machine Science, Moscow (Institut mashinovedeniya)

TITLE: Width of diffraction lines on x-ray diffraction patterns of cold-deformed metals

SOURCE: Fizika metallov i metallovedeniye, v. 19, no. 4, 1965, 596-601

TOPIC TAGS: x ray diffraction analysis, elastic deformation, material deformation, flow stress

ABSTRACT: An approximate dependence of the true width of diffraction lines on the block size ε and non-homogeneous elastic deformation of the lattice η is obtained, where $\varepsilon\eta$=const ($0 < \varepsilon\eta < d$). It is shown that the true line width on X-ray diffraction patterns of cold-deformed metals is in direct relationship to the residual deformation and the true flow stress (for single-axis extension). Orig. art. has: 2 figures, 10 formulas, and 1 table. [JPRS]

SUB CODE: 20, 11 / SUBM DATE: 22Jan64 / ORIG REF: 005 / OTH REF: 003

Card 1/1

UDC: 539.292: 548.4

L 24471-66 EWT(m)/EWP(w)/T/EWP(t) IJP(c) JD/GS
ACC NR: AT6010574 (N) SOURCE CODE: UR/0000/65/000/000/0054/0063

AUTHOR: Rybakova, L. M.; Merenkova, R. F.; Rovinskiy, B. M. 27 B+1

ORG: State Scientific Research Institute of the Science of Machines (Gosudarstvennyy nauchno-issledovatel'skiy institut mashinovedeniya) 18

TITLE: Electron microscopic and metallographic analysis of the nature of structural fractures during cyclic deformation

SOURCE: AN UkrSSR. Mekhanizm plasticheskoy deformatsii metallov (Mechanism of the plastic deformation of metals). Kiev, Naukova dumka, 1965, 54-63

TOPIC TAGS: copper, iron, cyclic test, material deformation

ABSTRACT: The authors study the kinetics of structural changes which take place within a metal subjected to cyclic deformation. Electron and optical microscopes were used for the study. Copper and Armco iron specimens were studied. The copper specimens were subjected to pulsating cyclic deformation with a constant deformation amplitude of 1%. The specimens were tested to complete fracture (600 cycles) and up to a given number of cycles (1, 2, 3, 10, 50, 150 and 400) at a loading frequency of 12 cycles per minute. The iron specimens were tested by a method described in

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L 24471-66

ACC NR: AT6010574

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another work (Rovinskiy, B. M., Rybakova, L. M., Izv. AN SSSR, metally, 1965, 5, 3) with a deformation amplitude of 4%. Isolated pores and cracks are observed in the earliest stages of cyclic deformation (1 or 2 cycles). Damage at this stage of deformation has no effect on the mechanical behavior of the specimen as a whole. After 10 cycles, the copper specimen shows localized fractures where three grains meet and between a twin layer and the boundary of the adjacent grain. A photomicrograph of a specimen after 50 cycles of deformation shows a marked tendency for individual micropores to fuse into cracks along grain boundaries, especially adjacent to twins. The part played by twin boundaries in cyclic deformation is discussed. A network of fractured grain boundaries is observed after 150 cycles. No slip lines or fractures are observed within the grains themselves until approximately 2/3 of the fracture life of the specimen. The structure shows signs of fracturing in zones of stable slipping after 400 cycles. The density of iron specimens decreases during cyclic deformation reaching a value of 0.03 g/cm^3 at the end of the second stage. The fracture surface has a typical fatigue structure with two zones: zones of fast and slow propagation of the main crack. Orig. art. has: 6 figures.

SUB CODE: 11/ SUBM DATE: 05Sep64/ ORIG REF: 002/ OTH REF: 005

Card 2/2 dda

by Z. G. Pinsker ("Basis of diffractional methods of investigation of perfect crystals"), B. M. Rovinskiy and L. M. Rybakova ("Investigation of dependence of mechanical properties on characteristics of structure of metals"-), L. M. Utovskiy and P. M. Usikov ("Application of microscopy in investigation of structure of alloys"), A. A. Predvoditelev and N. A. Tyapunina ("Role of reproduction of dislocations in process of plastic flow"), A. V. Pertsov, N. V. Pertsov and E. D. Shukin "Self-producing internal dispersion of metals under action of strongly superficially-active metallic melting") and I. L. Mirkin ("Problems of structural investigations, advanced by requirements of progress of technology").

reports presented at the 3rd Intervuz Conference on Strength and Ductility of Metals, Petrozavodsk State University, 24-29 June 1963.
(reported in Fizika Metallov i Metallovedeniye, Vol. 16, No. 4, 1963, p 640.
JPRS 24,651 19 May 1964.

ROVINSKIY, B. M.; LUTSAU, V. G.; KOSTYUKOVA, Ye. P.

"Substructure and dislocation distribution in polycrystalline aluminum."

report submitted for 6th Gen Assembly, Intl Union of Crystallography, Rome, 4 Sep 63.

Inst of Machine Sciences, Moscow.

LUTSAU, V. G.; ROVINSKIY, B. M.

"The relation between substructure and concentration inhomogeneities in alloys."

report submitted for 6th Gen Assembly, Intl Union of Crystallography, Rome, 9 Sep 63.

Inst of Machine Sciences, Moscow.

ROVINSKIY, B. M. and RYBAKOVA, L. M.

"Study of Dependence of Mechanical Properties on Metal Structure Characteristics."

report presented at the 3rd Conference of Higher Educational Institutes on Strength and Plasticity of Metals, Petrozavodsk State University, 24-29 June 1963.

SINAYSKIY, V.M. (Moskva); ROVINSKIY, B.M. (Moskva)

Residual stresses occuring during metal grinding. Izv.AN SSSR.-Otd.tekh.nauk.Mekh.i mashinostr. no.3:142-145 My-Je '63.
(MIRA 16:8)

(Strains and stresses) (Grinding and polishing)

18.8100
2.2100

81622

S/181/60/002/06/10/050
B122/B063

AUTHORS: Plavnik, G. M., Rovinskiy, B. M.

TITLE: Investigation of the Submicroporosity of Low-absorbing Materials by the Method of Multiple Small-angle X-Ray Scattering

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 6, pp. 1099 - 1106

TEXT: By way of introduction, the authors discuss the experimental conditions required for the application of Lambert's and Guinier's simple relation for the calculation of the "radius of inertia" R of the non-homogeneous regions $\frac{\Delta(L^2)}{\Delta m} = 0.004 \frac{\lambda^2 \rho}{R^2}$ with the aid of multiple small-angle scattering (L - integral width of the multiple scattering curve, m - mass of the sample per irradiated unit area in g/cm^2, ρ - density of the material). It was established in this connection that the formula is well applicable when using thick samples so as to attain a complete scattering of the primary beam in the sample by sufficiently frequent scattering; this is facilitated by the use of materials with high scattering power.

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Investigation of the Submicroporosity of Low-absorbing Materials by the Method of Multiple Small-angle X-Ray Scattering

S/181/60/002/06/10/050
B122/B063

Again, high scattering power is secured by the use of materials with large R. However, a comparison between the results of the usual small-angle scattering and those by Lambert and Guinier is not so easy. In this connection, the paper under review reports on studies made on nonannealed, low-absorbing BeO, which exhibits a considerable inner submicroporosity (fluctuation of pore size from 20 to 250 A). With a view to simplifying the determination of L, the authors developed a method allowing the direct determination of L from the measurement of the scattering intensities I_i, I_o from two different distances from the counter (one being in the immediate vicinity to the counter) (Figs. 1 and 2). The setup described was connected to a YPC-50M (URS-50I) apparatus. Scattering curves were repeatedly drawn of 11 samples with a thickness ranging from 0.06 to 0.80 g/cm^2, and the curves $(L_o/L_i)^2_{(integr)}$ (1), L_o/L_i (2), and I_o/I_i (3) were drawn as functions of m (Fig. 4). In the case of a small m, curves 1 and 2 were found to differ from one another. In the case of larger m and prevailing of multiple scattering, the intensity distribution curve assumes a Gaussian

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Investigation of the Submicroporosity of Low-absorbing Materials by the Method of Multiple Small-angle X-Ray Scattering

character, and the two curves run in parallel in their linear part. The radius R is determined from the slope of these straight lines (R = 270 A). A maximum pore radius of 235 A results from the usual small-angle scattering from thin samples. The multiple X-ray small-angle scattering simplifies and facilitates the determination of the porosity of a material, and is well applicable for the determination of the radii R of non-homogeneous regions larger than 100 A. Comparative data by S. M. Astrakhantsev and Ya. S. Umanskiy (Ref. 8) (the former also supplied the beryllium samples) were also used to interpret the results (Table). There are 4 figures, 1 table, and 9 references: 2 Soviet, 2 American, 1 French.

ASSOCIATION: Institut mashinovedeniya AN SSSR, Moskva (Institute of Machine Construction of the AS USSR, Moscow)

SUBMITTED: August 31, 1959

Card 3/3

LYUTTSAU, V.G.; ROVINSKIY, B.M.

Dependence of the substructure on nonuniform concentration in alloys.
Kristalografiia 8 no.5:742-746 S-O '63. (MIRA 16:10)

ROVENSKIY,B.M.; KOSTYUKOVA, Ye.P.; LYUTTSAU, V.G.

Substructure and distribution of dislocations in single-crystal and polycrystalline aluminum. Kristallografiia 8 no.4:657-662 Jl-Ag '63. (MIRA 16:9)

(Aluminum) (Dislocations in crystals)

ROVINSKIY, B.M. (Moskva); RYBAKOVA, L.M. (Moskva)

Stresses and irreversible deformations in plastic metals caused by simple stretching. Izv.AN SSSR.Otd.tekh.nauk.Mekh.i mashinostr. no.5: 68-74 S-O '62. (MIRA 15:10)
(Strains and stresses) (Deformations (Mechanics))

ROVINSKIY, B.M.; LYUTTSAU, V.G.

X-ray microdefectoscopy. Zav.lab. 29 no.1:38-41 '63. (MIRA 16:2)
(Materials—Testing) (X-ray microscopy)

L 10138-63 EWP(r)/EWT(d)/EWT(m)/BDS

ACCESSION NR: AP3000900 S/0179/63/000/002/0184/0187

AUTHOR: Rovinskiy, B. M.; Rybakova, L. M. (Moscow) 52

TITLE: On the relation between the hardness and the true stresses and the residual deformation under simple tensile stretching.

SOURCE: AN SSSR. Izv. Otd. tekh. nauk. Mekhanika i mashinostroyeniye, no. 2, 1963, 184-187

TOPIC TAGS: hardness, true stresses, residual deformation, simple tension, simple stretching, Cu, Al, Ni, Armco Fe, Steel 45, hardness vs. true stresses, hardness vs. residual deformation, Brinell testing

ABSTRACT: This report on the results of an experimental program refers to the authors' studies (Akad. nauk SSSR, Izv., Otd. tekh. nauk., Mekhanika i mashinostroyeniye, no. 5, 1962, 68, and ibid., no. 4, 1958, 100) in which it was shown that there is a relationship between the true stresses in specimens made of plastic metals under simple tension at a prescribed stretching rate and the irreversible residual deformation, and also a linear relationship between the

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L 10138-63

ACCESSION NR: AP3000900

hardness of the metal thus deformed, as established by means of the Brinell indentation test, and the true stress and the residual deformations. Tests ere made with MO copper, AO aluminum, NO nickel, Armco iron, and Steel 45. These materials were tested after various types of heat treatment (all specified). Hardness-versus-true-stress diagrams were constructed. The diagrams confirm the relationship previously obtained from X-ray investigations. It is noted that aluminum, iron, and Steel 45 exhibit two differently sloping rectilinear segments in the graphs; the discontinuity points between these segments confirm previously obtained experimental data. The hardness-versus-redidual deformation to the 0.5 power exhibit single straight-line graphs. The present paper does not develop the problem of the discontinuity between the two straight-line segments in the hardness-vs.-true-stress diagrams any further leaves this to a subsequent specialized study. The specific value of the slope of the hardness-vs. ture-stress lines is examined, and it is concluded that their slope is a direct function of the method of the hardness measurement. There are 6 numbered equations, 6 figures, and 1 table.

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L 10138-63
ACCESSION NR: AP3000900

ASSOCIATION: none

SUBMITTED: 07May62 DATE ACQ: 12Jun63 ENCL: 00

SUB CODE: MD,AP,MA NR REF SOV: 003 OTHER: 000

Card 3/3

ROVINSKIY, B.M.

Weakened surface layer. Trudy Sem.po kach.poverkh, no.5:7-11 '61. (MIRA 15:10)
(Surfaces (Technology))

ROVINSKIY, B.M.; LYUTTSAU, V.G.

Hardness relaxation of cold-worked metals and the dependence of hardness on lattice distortions. Fiz. met. i metalloved. 13 no.5: 724-727 My '62. (MIRA 15:6)

1. Institut mashinovedeniya AN SSSR.
(Metals---Cold working)
(Hardness)
(Crystal lattices---Defects)

S/032/63/029/001/010/022
B104/B186

AUTHORS: Rovinskiy, B. M., and Lyutsau, V. G.

TITLE: X-ray microflaw detection

PERIODICAL: Zavodskaya laboratoriya, v. 29, no. 1, 1963, 38-41

TEXT: Two radiographic methods of detecting flaws measuring less than 0.1 - 0.2 mm in metals are described. First method: camera obscura (fig.1). The diameter (2) in the W or Au plate is 0.005 mm, the plate thickness 0.2 mm. The enlargement ranges from 10 to 20. Second method: x-ray projector (Fig. 2). The electrons coming from the wire electrode (1) are concentrated on the tip of the point anode (2) through the electrostatic lens (3). The x-rays then move oppositely to the direction of the electron motion. (1) is a loop of a thin W wire. Using the first method, defects of a size no greater than 10μ can be traced, and using the second method even defects of 1μ can be detected. There are 6 figures.

ASSOCIATION: Institut mashinovedeniya
(Institute of the Science of Machines)

X-ray microflaw detection

S/032/63/029/001/010/022
B104/B186

Fig. 1 scheme of the first method. Legend: (1) x-ray tube; (2) aperture of the camera obscura; (3) object; (4) plate.

Fig. 3 scheme of the x-ray microprojector. Legend: (1) cathode; (2) point anode; (3) electrostatic lens with window; (4) object; (5) plate.

FIG. 1

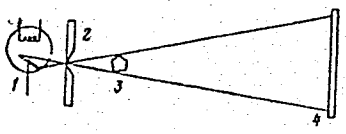
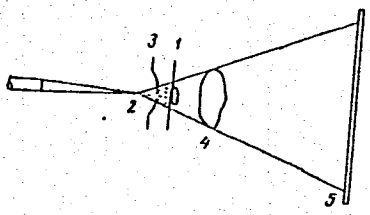


FIG. 3



Card 2/2

KOSTYUKOVA, Ye.P.; ROVINSKIY, B.M.

Determination of substructure characteristics of crystallites of coarse-grained materials. Izv. AN SSSR. Ser. fiz. 26 no.3: 331-339 Mr '62. (MIRA 15:2)

(X-ray crystallography)

S/179/62/000/005/004/012
E191/E135

AUTHORS: Rovinskiy, B.M., and Rybakova, L.M. (Moscow)

TITLE: On the stresses and irreversible deformations in ductile metals in simple extensions

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Mekhanika i mashinostroyeniye, no.5, 1962, 68-74.

TEXT: An experimental study was made on cylindrical specimens with symmetrically arranged flats of commercially pure, vacuum annealed Cu, Al, Ni, Armco iron and 0.45% carbon steel, to obtain more reliable data than hitherto on the relation between the true stress and the residual (irreversible) deformation. All tests were conducted at the same rate of deformation on a tensile test machine; these were so arranged that the true stress could be plotted against the residual relative elongation and against the residual relative reduction of area. Simultaneously, hardness tests and metallographic examination were also carried out. Several graphs are reproduced wherein the true stress is plotted against the square root of the residual relative elongation

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[illegible] by a [illegible]

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plastic term. It is shown that, from the initial values of the coefficient of plasticity and of the hardness, the limiting values can be easily obtained. The mechanical condition of a material can be described by the relative hardness and the relative plasticity.
There are 7 figures and 2 tables.

SUBMITTED: May 7, 1962

Card 3/3

S/179/62/000/003/010/015
E191/E435

AUTHORS: Rovinskiy, B.M., Sinayskiy, V.M. (Moscow)

TITLE: On the effect of the rate of deformation on the magnitude of the residual oriented microstresses

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Mekhanika i mashinostroyeniye, no.3, 1962, 159-160

TEXT: The magnitude of oriented microstresses has been previously related to the equivalent yield stress under reversed loading. Oriented microstresses have been shown to be mainly responsible for the reduction of the fatigue strength due to even a small prior plastic deformation. Standard cylindrical 0.45% carbon steel test pieces, provided with precisely machined longitudinal flat lands, to facilitate X-ray investigation, were examined. Carefully conducted tests in tensile testing machines covered a range of plastic deformation between 1.2 and 1.5% and a range of rates of deformation up to 30 mm/min. The magnitude or oriented microstresses increases several times within this range of speeds. To avoid oriented microstresses, which always have an adverse

On the effect of the rate ... S/179/62/000/003/010/015
E191/E435

effect, minimum rates of deformation and materials with the least non-uniformity of structure should be used. There is 1 figure.

SUBMITTED: February 16, 1962

Card 2/2

18.1250

39510
S/123/62/000/014/005/020
A004/A101

AUTHORS: Rovinskiy, B. M., Lyuttsau, V. G., Geveling, N. N.

TITLE: Investigation of the relaxation resistance of nickel-base alloys

PERIODICAL: Referativnyy zhurnal, Mashinostroyeniye, no. 14, 1962, 23, abstract 14A150 (In collection: "Issled. po zharoprochn. splavam". V. 7, Moscow, AN SSSR, 1961, 122 - 128)

TEXT: The authors report on the results of investigating the relaxation of oriented residual micro-stresses in Ni-base alloys with Cr, Fe, Co and Al additions at temperatures in the range of from 20 to 400°C. The authors measured by the x-ray diffraction method the residual deformation of the lattice, originating as a result of tensions exceeding the elasticity limit (5 - 10%) and subsequent unloading of the specimens, and also changes in the residual deformations taking place in the course of time. It is proved that the optimum increase in the relaxation resistance of alloys is obtained with Fe, while Cr yields the poorest results. The relaxation resistance decreases with a temperature increase; this takes place abruptly in pure Ni and in the least degree in Ni-alloys with 12.4 atomic % Al.
[Abstracter's note: Complete translation]

Card 1/1

S/126/62/013/005/012/031
E073/E535

AUTHORS: Rovinskiy, B.M. and Lyuttsau, V.G.

TITLE: Relaxation of the hardness of cold-worked metals and dependence of the hardness on crystal lattice distortions

PERIODICAL: Fizika metallov i metallovedeniye, v.13, no.5, 1962, 724-727

TEXT: The spontaneous decrease (relaxation) in hardness of cold-worked, 99.99% purity, aluminium (at room temperature) and 99.92% purity copper (at 80°C) was studied. Specimens 20 x 20 x 20 mm were machined and heat-treated so as to obtain uniform grain size. After determining the hardness in the initial state, the specimens were deformed by successive compression in three mutually perpendicular directions until a total reduction of 50% was reached in each of the directions. Then, the hardness was again determined both immediately and at certain time intervals up to a total of 5000 hours. During 500 hours the hardness of aluminium dropped from 39.0 to 29.9 and that of copper from 80.0 to 66.8 Brinell units. The hardness of the specimens

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in the initially annealed state was 20 and 38 units for the aluminium and copper, respectively. The obtained hardness relaxation curves are similar to curves of the relaxation of lattice distortions in cold-worked metals. The obtained results are plotted in graphs, $\ln(H_t/H_o)$ vs. $f(t)$, where H_o and H_t - hardness directly and after a time t after cold-working the metal, respectively. It is assumed that the hardness relaxation is caused by two simultaneous, independent processes which can be expressed by means of the equation

$$H_t = H_o \exp\left[-k_H t - \left(\frac{1}{a+bt^{3/2}} - c\right)\right],$$

where k_H - speed of hardness relaxation caused by one of the processes; b and c - constants of the second process ($a = 1/c$). For one process, expressed by

$$k_H t = f(t) \text{ and } \left(\frac{1}{a + bt^{3/2}} - c\right) = f(t),$$

the relaxation times are 940 and 1400 hours for the aluminium and copper, respectively. For the second process the hardness relaxation is virtually complete after 100 hours for both aluminium and copper. Comparison of the relaxation curves of the hardness and of the residual lattice distortions, determined from measuring the integral Debye line intensity, shows complete agreement for aluminium. For copper agreement is not so good and this is attributed to differences in measuring conditions (additional influence of heating and cooling cycles). There are 4 figures and 1 table.

ASSOCIATION: Institut mashinovedeniya AN SSSR
(Institute of Science of Machines AS USSR)

SUBMITTED: December 7, 1960 (initially)
December 12, 1961 (after revision)

ROVINSKIY, B.M.; LYUTTSAU, V.G.

Relaxation of distortions in the lattice of cold-deformed metals. Fiz. met. i metalloved. 12 no.3:305-313 S '61. (MIRA 14:9)

1. Institut mashinovedeniya AN SSSR.
(Crystal lattices) (Deformations (Mechanics))

ROVINSKIY, B.M.; LYUTTSAU, V.G.; GEVELING, N.N.

Relaxation resistance of nickel-base alloys. Issl. po zharopr. splav. 7:122-128 '61. (MIRA 14:11)
(Nickel alloys--Testing) (Strains and stresses)

Investigating the relaxation ...

examination. The X-ray method was also used for investigating stress relaxations. This consisted of measuring the residual lattice deformation after extension (or compression) beyond the elastic limit and subsequent unloading of the specimens, and its change with time. -For this purpose, the specimens, after being X-rayed, were deformed in the original unstressed state in a normal tensile testing machine up to 5 - 10 % elongation which, after unloading, gave the required residual plastic lattice deformation, [Abstractor's note: 'Elastic lattice deformation' in the original article appears to be an error]. The curves for the relaxation of residual orientated microstresses in pure nickel and Ni-Cr, Ni-Al, Ni-Co and Ni-Fe alloys, obtained by precise lattice period measurements at room temperature and elevated temperatures, can be described by the equation $\varepsilon_t = \varepsilon_o \exp - [k_1 t]^p$, where ε_o and ε_t = percentage macroscopic elastic deformation of specimen immediately after loading and after time t, respectively; k_1 and p are constants characterizing the intensity of relaxation, k_1 being determined by the level of stress, and p by

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the nature and state of the material. The value of p characterizes quantitatively the relaxation resistance of pure nickel and of the investigated alloys both at room and elevated temperatures. The relaxation resistance of alloys is higher than that of the pure metal, since it increases with an increase of the alloying element. Addition of Fe increases the relaxation resistance of Ni most effectively, and the addition of Cr, least effectively. The relaxation resistance of Ni and its alloys decreases with increase in temperature, the decrease being most drastic in the case of pure Ni and least in the case of a nickel alloy containing 12.4 at.% Al. There are 6 figures and 3 references: 2 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: E. A. Owen, Y.H. Liu and D.P. Morris, Phil. Mag., 39, 1948.

ROVINSKIY, B.M., doktor fiz.-matem.nauk; LYUTTSAU, V.G., kand.tekhn.nauk

Conference on the nondestructive methods of material research.
Vest. AN SSSR 31 no.10:120-121 O '61. (MIRA 14:9)
(Quality control--Congresses)

ROVINSKIY, B.M.; RYBAKOVA, L.M.

Effect of preliminary cyclic heat treatment and plastic deformation on metal strength and durability. Fiz. met. i metalloved. 9 no. 4:606-612 Ap '60. (MIRA 14:5)

1. Institut mashinovedeniya AN SSSR.
(Copper—Heat treatment) (Copper—Fatigue)

ROVINSKIY, B.M.; RYBAKOVA, L.M.

Time strength relation in dynamic tension. Fiz. met. i metalloved. 9 no. 4:598-605 Ap '60. (MIRA 14:5)

1. Institut mashinovedeniya AN SSSR.
(Strains and stresses) (Creep of metals)

ROVINSKIY, B.M. (Moskva); SINAYSKOY, V.M. (Moskva)

Relationship between oriented microstresses and irreversible residual deformation in metals. Izv.AN SSSR.Otd.tekh.nauk.Mekh.i mashinostr. no.2:146-147 Mr-Ap '61. (MIRA 14:4)

1. Institut mashinovedeniya AN SSSR.
(Strains and stresses)

ROVINSKIY, B.M.; LYUTTSAU, V.G.

Dependence of the relaxation stability of metals and alloys on binding forces and distortions in the lattice and the correlation of the relaxation stability with hardness. Fiz. met. i metalloved. 11 no. 2:285-289 F '61. (MIRA 14:5)

1. Institut mashinovedeniya AN SSSR.
(Crystal lattices) (Metallography)

GAL'PERIN, M.Ya. (Moskva); ROVINSKIY, B.M. (Moskva); SINAYSKIY, V.M. (Moskva)

Effect of preliminary plastic deformations caused by stretching on the fatigue strength of steel. Izv.AN SSSR.Otd.tekh.nauk.Mekh.i mashinostr. no.3:161-162 My-Je '61. (MIRA 14:6)

1. Institut mashinovedeniya AN SSSR.
(Steel--Fatigue)

ROVINSKIY, B.M. (Moskva); RYBAKOVA, L.M. (Moskva)

Stresses, deformations and structural changes in commercial iron during cyclic plastic deformation. Izv. AN SSSR. Met. no.3:101-112 My-Je '65. (MIRA 18:7)

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S/126/61/012/003/001/021
E021/E180

18 6200

AUTHORS: Rovinskiy, B.M., and Lyuttsau, V.G.

TITLE: Relaxation of distortions in the lattice of cold worked metals

PERIODICAL: Fizika metallov i metallovedeniye, v 12, no.3, 1961, 305-313

TEXT: The spontaneous increase in intensity of Debye lines, indicating relaxation of distortions in the lattice, was investigated. Homogeneous fine grained, cubical samples were prepared from 99.99% aluminium and electrolytic (99.92%) copper. X-ray photographs showed that the samples possessed no texture. An X-ray photograph was taken of each specimen. The specimens were then slowly compressed in three mutually perpendicular directions in several operations, giving a total reduction of about 50%. The hardness of aluminium and copper increased by a factor of two, which showed the presence of considerable lattice distortions. Further X-ray photographs were then taken over a period of 500 hours. The integral intensities of the (420) aluminium and (400) copper lines were measured. After deformation,

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the intensity of the aluminium line decreased by 45% and that of the copper line by 41-45%. After a further 500 hours the intensities of the lines were restored near to their original values. At the same time the intensity of the background decreased. These results were interpreted as meaning that lattice defects developed during cold working are healed after a time and that the distortion is therefore relaxed. The data were analysed and it was shown that the curves of relaxation of distortion could be explained by two independently occurring processes. The first of these processes takes place at a constant rate, and is completed in 940 and 1480 hours for aluminium and copper respectively. The second process takes place intensively at first and then the rate sharply decreases. This process is almost complete after 100 and 200 hours for aluminium and copper respectively. Hardness measurements confirmed that relaxation takes place with time. The results of studies of relaxation by hardness measurements will be the subject of a separate report. There are 5 figures and 13 references: 7 Soviet (two of them Russian translations from non-Soviet publications) and 6 non-Soviet.

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Relaxation of distortions in the ... S/126/61/012/003/001/021
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The four most recent English language references read as follows:

Ref.1: D. Bowen, R.R. Eggelston and R.H. Kropschot.
J. Appl. Phys., 1952, Vol.23, 630.
Ref.5: B.E. Warren and B.L. Averbach.
J. Appl. Phys., 1949, Vol.20, 1066;
P.S. Weiss and I.R. Slark.
J. Appl. Phys., 1952, Vol.23, 1379.
D. Michell and E. Lowegrove.
Phil. Mag., 1960, Vol.5, No.53, 499.
Ref.7: F.R.L. Schoening and N.I. van Niekerk.
Acta met., 1955, Vol.3, No.1, 10.
Ref.11: M.S. Paterson,
J. Appl. Phys., 1952, Vol.23, No.8, 805.

ASSOCIATION: Institut mashinovedeniya AN SSSR
(Institute of Science of Machines, AS USSR)

SUBMITTED: January 11, 1961

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28971
S/179/61/000/003/014/016
E073/E535

AUTHORS: Gal'perin, M.Ya., Rovinskiy, B.M. and Sinayskiy, V.M. (Moscow)

TITLE: On the influence of preliminary tensile plastic deformation on the fatigue strength of steel

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Mekhanika i mashinostroyeniye, 1961, No.3, pp.161-162

TEXT: Most authors mention only an increase in the fatigue strength as a result of increasing work hardening produced by applying tension. N. I. Chernyak (Ref.1: "Fatigue strength of preliminarily stretched steel". Symposium Tr. In-ta stroitel'noy mekhaniki AN UkrSSR, 1953) found that a small amount of plastic deformation by tension does not increase but lowers the fatigue of steel. For ε^p = 1.0-2.0% a minimum fatigue strength is reached, then the fatigue strength increases and for ε^p = 12% it reaches a value corresponding to that of undeformed steel. The work described in this paper was carried out for the purpose of

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determining the relation between the magnitude of oriented residual microstresses occurring during plastic deformation in tension and the drop in the fatigue limit. Medium carbon steel, Steel 45, of 25 mm diameter was used in the tests, the mechanical characteristics of which were as follows:

$$\sigma_s = 39.8 \text{ kg/mm}^2, \quad \sigma_B = 66.0 \text{ kg/mm}^2$$

$$\delta_5 = 22.2\%, \quad \Psi = 4.89\%, \quad a_k = 9.1 \text{ kgM/cm}^2, \quad H_B = 152$$

Several batches of specimens, 12 in each batch, were produced. The shape of the specimens was such that the same specimens could be used without further machining for the fatigue tests. The gauge length was 22f mm, the 20 mm long central section of which had a diameter of 8 mm, Fig.1. After machining to the desired size and surface quality the specimens were annealed in vacuo at 780°C for two hours and then allowed to cool together with the furnace. Following that, they were stretched at a rate of 2 mm/min within a range of 0 to 10%. For the gauge length the

error in measuring the length did not exceed 0.03%. The fatigue tests were carried out with a loading frequency of 3000/min for a total duration of 10^7 cycles. Prior to the fatigue tests, the oriented microstresses were determined by X-ray methods; two X-ray diffraction patterns were taken from the same spot, one before and one after loading. The obtained results are plotted in Fig.2 and it can be seen that the maximum drop in the fatigue strength was achieved in the range of preliminary deformations of 1 to 2%, which is in good agreement with the results obtained by Chernyak (curve 3). The deviation between his results and the results of the authors of this paper (curve 1) is attributed to the fact that Chernyak did not anneal his specimens after machining. Fig.2 also gives the relation between the magnitude of the oriented microstresses σ_R (kg/mm^2) and the magnitude of preliminary deformation (curve 2). It can be seen that this curve has a minimum approximately for the same range of plastic deformation as was observed for curve 1. The curves 1 and 2 show similarity for small plastic deformations; the influence of work hardening starts to manifest itself at ε^p = 2% which leads

to an increase in the fatigue strength. The obtained results confirm the assumption of the decisive role of residual oriented microstresses on the fatigue strength. This is in good agreement with data published earlier by the authors (Ref.6: Izv.AN SSSR, OTN, Mekhanika i mashinostroyeniye, 1961, No.2) on the relation between oriented microstresses and the residual plastic deformation. However, it is not as yet possible to propose a simple mechanical model of the phenomenon since the magnitude of the oriented microstresses is much greater than the drop in the fatigue limit. There are 2 figures and 6 Soviet references.

ASSOCIATION: Institut mashinovedeniya AN SSSR
(Institute of Machine Science AS USSR)

SUBMITTED: January 18, 1961

ROVINSKIY, E.V.

PHASE I BOOK EXPLOITATION SOV/4229

Madorskiy, Yakov Yudovich, and Efraim Vol'fovich Rovinskiy

Teoriya aviatsionnykh dvigateley, chast' 1: Osnovy termodinamiki i gazovoy dinamiki (Theory of Aircraft Engines. Pt. 1: Fundamentals of Thermodynamics and Gas Dynamics) Moscow, Voyenizdat, 1960. 211 p. No. of copies printed not given.

Ed.: M.S. Pisarev, Engineer-Colonel of Supplies; Tech. Ed.: T.F. Myasnikova.

PURPOSE: This book is intended as a textbook for students at technical aviation schools. It may also be useful to the flying and technical personnel of the VVS (Air Forces), GVF (Civil Air Fleet), and DOSAAF (All-Union Voluntary Society for the Promotion of the Army, Air Forces, and Navy), and to other readers interested in the theory of jet engines.

COVERAGE: This volume constitutes the first part of a 2-part work on the theory of aircraft engines. Part I presents the fundamentals of thermodynamics and gas dynamics; Part II will discuss the theory of jet engines. Chapters I, III, and IV were written by E.V. Rovinskiy; Chapters II, V, VI, VII, and VIII by Ya. Yu. Madorskiy. A section on possible atomic aircraft engines is included in the

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general discussion of aircraft engines. The authors thank Docent Yu.M. Mayzel', Candidate of Technical Sciences. The work of G.I. Petrov and Ye. P. Ukhov is referred to in the discussion of shock waves and diffuser design. There are 13 Soviet references.

TABLE OF CONTENTS:

ROVINSKIY, B.M.; KOSTYUKOVA, Ye.P.

Some applications of the graphic analysis method of determining lattice parameters. Kristallografiia 8 no.2:264-268 Mr-Ap '63. (MIRA 17:8)

ROVINSKIY, B.M.; RYB[illegible], I.M.

Investigating the dependence of mechanical properties on the characteristics of metal structure. Fiz. met. i metalloved. 17 no.4:553-563 Ap '64. (MIRA 17:8)

1. Institut mashinovedeniya, Moskva.

ACCESSION NR: AR4042235 S/0124/64/000/006/V077/V078

SOURCE: Ref. zh. Mekhanika, Abs 6V640

AUTHOR: Rovinskiy, B. M.; Lyuttsau, V. G.

TITLE: Certain results of study of stress relaxation in metals and alloys

CITED SOURCE: Sb. Relaksats. yavleniya v met. i splavakh. M., Metallurgizdat, 1963, 275-289

TOPIC TAGS: stress relaxation, metal, alloy, relaxation curve, reverse x ray method, deformation, elastic deformation

TRANSLATION: Describes new methods of obtaining relaxation curves by measurements of transverse deformation of a test piece whose initial longitudinal deformation remains constant, and a reverse x-ray method of transverse elastic deformation of lattice (at room and elevated temperatures). The latter is an adequate method of load measurement, necessary for maintaining given initial deformation with strict constant longitudinal deformation of test piece. Analyzes the relaxation

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ACCESSION NR: AR4042235

curve equation and considers structural changes in metal during stress relaxation. The x-ray method shows that,in the process of stress relaxation,structure perfection of reflecting crystallites decreases and coherent constraint in them is disturbed. Simultaneously there occurs a turn of grains and their mutual displacement. Thus, basic mechanism of stress relaxation in metal (at room temperature) is elasto-plastic, a shear mechanism. Stress relaxation is noticeably influenced by magnitude of grain, degree of preliminary plastic flow, content of impurities, test temperature, distortion of lattice,and level of constraining forces. Hardness of HB metal, similar to relaxation stability, is determined, on the one hand, by substructure and, on the other, by constraining forces and distortions of lattice. Therefore, among these mechanical characteristics a correlation is observed. Bibliography: 13 references

SUB CODE: MM, AS ENCL: 00

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GRIGORENKO, L.F.; PLITALOVA, L.A.; ROVINSKIY, B.M.

Structural changes in graphite materials due to wear. Dokl. AN SSSR 160 no.4:807-810 F '65. (MIRA 18:2)

1. Gosudarstvennyy nauchno-issledovatel'skiy institut mashinovedeniya. Submitted September 4, 1964.

ROVINSKIY, B.M.; RYBAKOVA, L.M.

Width of the diffraction lines on X-ray patterns of strain-hardened metals. Fiz. met. i metalloved. 19 no.4:596-601 Ap '65. (MIRA 18:5)

1. Institut mashinovedeniya, Moskva.

L 43884-65 EPF(c)/EPR/EWG(j)/EWP(z)/EWT(m)/EWP(i)/EWP(b)/T/EWA(d)/EWP(e)/EWP(t)
Pr-4/Ps-4 WH/WW/JD/MJW/DJ

ACCESSION NR: AP5006853 S/0020/65/160/004/0807/0810

AUTHOR: Grigorenko, L. P.; Plutalova, L. A.; Rovinskiy, B. M.

TITLE: Structural changes occurring in graphite material during wear

SOURCE: AN SSSR. Doklady, v. 160, no. 4, 1965, 807-810

TOPIC TAGS: graphite lubricant, graphite antifriction material, wear of graphite/ Ag-1500

ABSTRACT: The article is devoted to an estimate of the influence of various materials of the metallic counterbody on the character of destruction of graphite material during the course of intense wear in vacuum (1 x 10^{-5} mm Hg). Anti-friction graphitized material Ag-1500 was used as the graphite material, and copper M-3, steel kKh18N9, and chromium were used as the counterbodies. The structural changes occurring during the intense wear were investigated by x-ray diffraction of the powder produced by the wear. The equipment and the procedure are briefly described. The method is based on the appreciable difference in the x-ray pattern of the initial graphite and of the powder produced by the friction, the interference lines becoming broader and much weaker in the latter case. A greater decrease occurs

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ACCESSION NR: AP5006853 2

in the intensities of reflections corresponding to three-dimensional refraction, with the maxima of two-dimensional refraction changing less. This is evidence of azimuthal disorientation of graphite lattices and a relative shift of the graphite layers. The results indicate that the mechanism of destruction of the graphite material during friction is the same for all counterbodies, although a quantitative difference does exist in the critical pressure at which intense wear sets in. This report was presented by A. A. Blagonravov. Orig. art. has: 2 formulas and 2 tables.

ASSOCIATION: Gosudarstvennyy nauchno-issledovatel'skiy institut mashinovedeniya (State Scientific Research Institute of the Science of Machines)

SUBMITTED: 18Aug64 ENCL: 00 SUB CODE: MT

NR REF SOV: 003 OTHER: 002

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L 04290-67 EWT(m)/T/EWP(t)/ETI IJP(c) JD

ACC NR: AP6018949 (N) SOURCE CODE: UR/0126/66/021/006/0929/0934

AUTHORS: Rovinskiy, B. M.; Sinayskiy, V. M.; Gal'perin, M. Ya.

ORG: NII for Machine Design (NII mashinovedeniya)

TITLE: Investigation of the stability of defects arising in metals due to metal fatigue

SOURCE: Fizika metallov i metallovedeniye, v. 21, no. 6, 1966, 929-934

TOPIC TAGS: aluminum metallurgy, copper, x ray diffraction study, x ray scattering, metal crystal

ABSTRACT: The stability of fatigue defects in metals was studied on both aluminum and copper specimens. The study supplements the results of an earlier investigation by B. M. Rovinskiy and V. G. Lyutsau (FMM, 1961, 12, 305). The work was carried out by measuring the change in x-ray scattering by the metal specimens in the fatigued and relaxed state. The effect of aging on the plasticity and durability of cyclically deformed copper was also studied. The experimental data obtained in this part of the investigation were treated after the method of N. N. Davidenkov and G. T. Nazarenko (ZhTF, 1953, 23, 741). The experimental results are presented graphically (see Fig. 1). It was found that the intensity of scattered x-rays is notably dependent on deformation of the crystal lattice (caused by the cyclical deformations) and on aging (connected with the relaxation of the deformed crystal

UDC: 539.43:539.292

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ACC NR: AP6018949

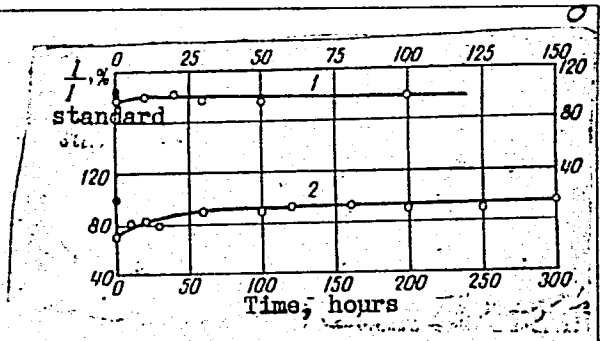

Fig. 1. Integral intensity of the Debye line (400) of cyclically deformed copper as a function of aging period. Solid dots represent the relative scattered intensity for the specimens in the initial state. 1 - 10^7 cycles σ_{max} = 10 kg/mm^2; 2 - 10^6 cycles σ_{max} = 16 kg/mm^2; aging temperature - 80C.

lattice). The authors conclude that the vacancy and micropore defects heal with time, provided that the latter are smaller than λ (critical), that vacancies are precipitated on pores and cracks in excess of λ (critical), and that a general coagulation of micropores smaller than λ (critical) takes place in the aged specimens. Orig. art. has: 4 graphs.

SUB CODE: 11/ SUBM DATE: 02Jul65/ ORIG REF: 005/ OTH REF: 002

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