

SHCHUKIN, YE. A. ---

Shchukin, Ye. A. — "Syria. (Economic-Geographic Characteristics)." Acad Sci USSR
Inst of Geography, Moscow, 1955 (Dissertation for the Degree of Candidate of
Geographical Sciences)

SO: Knizhnaya Letopis', No. 23, Moscow, June, 1955, pp. 87-104.

SHCHUKIN, (C 1)

DE SILVA, S.F.; SHMELEV, A.B.[translator]; PRONIN, A.A., redaktor; SHCHUKIN, Ye.A., redaktor; SHAPOVALOV, V.I., tekhnicheskiy redaktor.

[A regional geography of Ceylon. Translated from the English] Geografiia TSeilona. Perevod s angliiskogo A.B. Shmeleva. Red. i predisl. A.A.Pronina. Moskva, Izd-vo inostrannoi lit-ry, 1955, 318 p. (Ceylon--Geography) (MLRA 9:5)

GOUROU, Pierre; MAKAROVA, N.M.[translator]; SHMELEV, A.B.[translator];
SHCHUKIN, Ya.A., redaktor; IOVLEVA, N.A., tekhnicheskiy redaktor.

[Asia. Translated from the French] Azia. Perevod s frantsuzskogo
N.M.Makarovoi i A.B.Shmeleva. Predisl. Konstantina Popova. Moskva,
Izd-vo inostrannoi lit-ry, 1956. 466 p. (MLRA 9:5)
(Asia--Geography)

SHCHUKIN, Ye.A.

Division of Syria into economic districts. Izv.AN SSSR.Ser.geog.
no.6:59-69 N-D '56. (MIRA 10:1)

1. Institut vostokovedeniya Akademii nauk SSSR.
(Syria--Economic geography)

GAVRILOV, N.I.; GLUSHAKOV, P.I.[deceased]; KOSOLAPOV, B.Ye.;
NIKOL'SKIY, M.I.; SHCHUKIN, Ye.A.; ZABIROV, B.Sh., red.;
KOSTINSKIY, D.N., red; ZHURAVLEVA, G.P., mlad. red.;
GOLITSYN, A.V., red. kart; BURLAKA, N.P., tekhn. red.

[Countries of North and Northeast Africa; geographical information] Strany Severnoi i Severo-Vostochnoi Afriki; geograficheskie spravki. Moskva, Geografiz, 1962. 39 p. (MIRA 15:7)
(Africa, North--Geography, Economic)

SANIN, A.A. Primala uchastiye TITOVA, T.A., aspirantka; KOZODAYEV, M.S., red.; SERDYUKOV, A.R., red.; SHCHUKIN, Ye.D., red.; MURASHOVA, N.Ya., tekhn. red.

[Radio engineering methods for studying radiation] Radiotekhnicheskie metody issledovaniia izlucheniia. Pod red. M.S.Kozodaeva. Moskva, Gos.izd-vo tekhniko-teoret.lit-ry, 1951. 388 p.
(MIRA 15:1)

1. Moskovskiy Gosudarstvennyy universitet (for Titova).
(Amplifiers (Electronics)) (Pulse techniques (Electronics))

USSR/Metals - Ordering

Jun 52

"Texture of Magnesium, Zinc and Cadmium Layers
Obtained During Condensation of a Molecular Beam,"
N. T. Melnikova, Ye. D. Shchukin, M. M. Umanskii,
Moscow State U

"Zhur Eksper i Teoret Fiz" Vol XXII, No 6, pp 775-779

Investigates the structure of layers of various
hexagonal-system metals obtained by condensation
of a mol beam on a non-cooled or cooled to -70°C
background. A law, 1st observed for zinc, holds

217746

for all (Mg, Zn, Cd) metals. The law concerns
orientation of crystallites which is connected
with the direction of the mol beam and leads the
plate to quasi-monocryst state. Received 29 Sep
51.

SHCHUKIN, YE. D.

217746

SHCHUKIN, E. D.

27 4

~~An Investigation of Discontinuous Deformation (of Zinc Single Crystals) by Means of Electrical Conductivity. V. N. Roshaneky, Yu. V. Goryunov, and E. D. Shchukin (Fizika Metallor i Metallovedenie, 1958, 8, (1), 113-126).—[In Russian]. Single crystals of Zn deformed in tension show the discontinuities in strain known as the Ioffe effect ("The Physics of Crystals"; New York: 1928, p. 60). R. G. and S. describe an apparatus permitting rapid measurements of the elect. conductivity of the Zn specimens during extension. Oscillographic recording shows discontinuities in the elect. conductivity corresponding to discontinuities (Δl) of 0.5-35 μ in the length of the specimen over times (Δt) varying from 0.01 to 0.1 sec. Δl and Δt are plotted as functions of α , the crystal orientation; both increase between $0^\circ < \alpha < 60^\circ$ with a specially sharp rise between $30^\circ < \alpha < 40^\circ$. The mechanism whereby changes of length produce the observed changes of resistance is discussed on the basis of creation of defects and movement of dislocations on slip planes. Some oscillograms of resistivity changes show a structure more complex than the usual simple step—this is attributed to thermal effects on the slip planes involving heating and even melting of the surrounding lattice. The local rise in temp. is too small to be measured directly. 16 ref.—A. F. B.~~

plp

Chair Colloid Chem,
Moscow State U.

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SHUKIN, Ye. D.

^{CH}
SHUKIN, Ye. D., Cand Phys-Math Sci -- (diss) "Study of the
heterogeneity^{to} of plastic deformation of metallic monocrystals."
Mos, 1957. 15 pp (Inst of Phys Chem, Acad Sci USSR, Department
of Disperse Systems), 100 copies (KL, 52-57, 103)

100-100/40

AUTHOR: Shchukin, Ye. D., Pertsov, N. V., and Rozhanskiy, V. N.

TITLE: A Method for the Investigation of Irregularity of Plastic Deformation. (Metodika Issledovaniya Neravnomernosti Plasticheskoy Deformatsii.)

PERIODICAL: Pribery i Tekhnika Eksperimenta, 1957, No. 2, pp. 98 - 102 (USSR).

ABSTRACT: Jump-like deformation of metallic mono-crystals at constant loads is fully discussed in References 1 - 3. The results of previous investigations have shown that in order to obtain more accurate data for the investigation of the effects of avalanche shear, the sensitivity of the channel 1 and the frequency pass bands of the channel R should be increased. In the present article the authors describe a method of continuous registration of small sample deformations with an accuracy of down to 50 μ and frequency pass band of the channel 0 - 2000c/s, and of simultaneous small changes of the sample resistance with accuracy down to 0.5 x 10⁻⁸ ohm and frequency band from a fraction of a cycle to 1000c/s. A schematic diagram of the mechanical part of the apparatus is given in Figure 1. It is assembled on a vibration proof and temperature insulated plate, the sample used is a wire Card 1/2 0.5mm diameter, 3.30mm long. The channel of the register

A Method for the Investigation of Irregularity of Plastic Deformation. 120-2-27/37

(Fig. 2) uses a photo cell type StsV-3 (CIIIB-3) placed with its light source in the chamber 1. The channel for the registration of jump-like changes of the electrical resistance (channel R, Fig. 3) consists of a sensitive AC amplifier with a frequency band from 4-2000c/s and with the level of fluctuation noise as referred to the input, of the order of a few thousandths of μV . The experiments have shown that the instrument has a high degree of sensitivity and stability. A schematic diagram of the mechanical installation, the basic circuit diagram of channel 1, the basic circuit diagram of the channel R and a photograph of small jump-like deformations are given. There are 4 Slavic references.

SUBMITTED: November, 28, 1956.

ASSOCIATION: Institute of Physical Chemistry of the Academy of Sciences of the USSR. (Institut Fizicheskoy Khimii AN SSSR) Faculty of Chemistry of the Moscow State University imeni M. V. Lomonosov. (Khimicheskiy Fakul'tet MGU im. M. V. Lomonosova.)

AVAILABLE: Library of Congress.

Card 2/2

Shchukin, Ye D.

20-6-13/48

AUTHORS: Shchukin, Ye.D., Rozhanskiy, V.M., Goryunov, M...

TITLE: On the Modification of the Rheostat During the Occurrence of an Elementary Displacement (Ob izmenenii elektricheskogo soprotivleniya pri elementarnom sdvigoobrazovanii)

PERIODICAL: Doklady AN SSSR, 1957, Vol. 115, Nr 6, pp. 1101 - 1103 (USSR)

ABSTRACT: The investigations of the "elementary" displacements of about 500 - 2000 Å are the most interesting ones, which occur in a gliding zone. For this purpose the ability of the channel to record deformations was raised to 50 Å. The experiments were carried out with cadmium monocrystals of a diameter of 0,75 mm and with zinc monocrystals of 0,5 mm of diameter. These crystals were 15 - 20 mm long and the angle between the hexagonal axis and the direction of extension was 30°. The extension experiments were carried out at room temperature and led to an extension of 3 - 5 %. In connection with slight and slow deformations like these the total increase of the resistance was not remarkably higher than the geometrically conditioned increase. The results of the accurate measurements of the oscillographically registered cracks from $\delta l = 350 \text{ Å}$ upwards in the case of

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On the Modification of the Rheostat During the Occurrence of an Elementary Displacement

cadmium and zinc monocrystals are shown in a diagram. These data give evidence of the following fact: The streak of the effective values of $q = \delta R / \delta l \cdot 2r$ has an S-shaped form with the flexion in the area $\delta l \sim 500$ to 1000 \AA and with a total decrease up to 30% as compared with the geometrically conditioned values with $\delta l > 1000 \text{ \AA}$. This corresponds to a displacement by about 500 interatomic distances in the direction of the gliding (here R denotes the rheostat, l - the extension and r denotes the resistance of the unit of length of the not deformed sample.) A re-establishment of the order and a decrease of the defects of the structure within the area of the gliding corresponds to the large cracks which exceed a certain critical amount. It is especially referred to the paired cracks. Finally the authors give an explanation for the development of the phenomena here described. Despite the short duration of the cracks the importance of the vacancies in connection with the increasing resistance of the hardened metal and its relation to the dislocation mechanism of the deformation has to be considered. There are 2 figures and 6 references, 2 of which are Slavic.

Card 2/3

3/704011A, E, D.

20-5-11/48

AUTHORS: Rozhanskiy, V. N., Pertsov, N.V.,
Shchukin, Ye. D., Rebinder, P. A. Academician

TITLE: Effect of Thin Mercury Coatings on the Strength of
Metallic Monocrystals (Vliyaniye tonkikh rtutnykh pokrytiy
na prochnost' metallicheskich monokristallov).

PERIODICAL: Doklady AN SSSR, 1957, Vol. 116, Nr 5, pp. 769-771 (USSR)

ABSTRACT: At first the authors shortly report on respective literature.
In the present works the monocrystals of zinc, tin, cadmium
and lead (degree of purity 99.99 %, diameter 0.5 mm,
length about 10 mm) were investigated. As surface-active
substance served mercury which was applied in form of a
thin coating by means of immersing the sample into an
 $Hg_2(NO_3)_2$ -solution. The mercury covered the monocrystal
with an equal film of about 0.1μ thickness and was rapidly
saturated with the metal to be investigated. The investi-
gation of the strength properties of the amalgamated mono-
crystals in their expansion with constant velocity showed
that the strength of the zinc- and tin- monocrystals
covered with mercury was a few times less than the strength

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Effect of Thin Mercury Coatings on the Strength of
Metallic Monocrystals.

20-5-14/48

of the non-amalgamated monocrystals. Such an abrupt decrease of strength is obviously connected with the important decrease of surface tension at the metal/mercury boundary as well as with the decrease of the production operation of a new surface at the crack. The investigation of axial ground sections of amalgamated zinc-monocrystals according to their deformation showed the following: The cracks can develop on the surface as well as in the interior of the monocrystal, which can be seen in observing the axial ground sections. The development of the cracks in the inner part can be connected with a noticeable diffusion of mercury into zinc (at room temperature) with subsequent decrease of the surface tension on the developing inner separation surfaces. The rise of temperature up to 160° C annihilates the above-mentioned phenomena of catastrophic brittleness with the zinc-monocrystals investigated and reconstitutes completely the plasticity and the strength. Also the decrease of the deformation velocity causes phenomena which are similar to those developing with the rise of temperature. The strength of the body decreases with the

Card 2/3

SHCHUKIN, Ye. D., ROZHANSKIY, V. N., GURUNOV, G. V., and PERTSOV, N. V.

"Unhomogeneous Plastical Deformation and the Effect of Surface-Active Mediums on the Mechanical Properties of Crystals."

paper presented at the Conf. on Mechanical Properties of Non-metallic Solids, Leningrad, USSR, 19-26 May 58.

Moscow State Univ., Inst. of Physical Chem. Acad. Sci. USSR, Moscow.

BRYUKHANOVA, L.S.; SHCHUKIN, Ye.D.

Effect of mercury coating on the stability of zinc monocrystals
at low temperatures [with summary in English]. Inzh.-fiz.zhur.
i no.8:116-118 Ag '58. (MIRA 11:8)

1. Institut fizicheskoy khimii AN SSSR, Moskva.
(Zinc--Metallography)

SRCHUKIN, Ye. D.

"Study of the Non-Uniformities of the Plastic Deformation of Metallic Single Crystals," (Izucheniye neodnorodnostey plasticheskoy deformatsii metallicheskih monokristallov) Candidate of Physico-mathematical Sciences, Moscow, 1957. Ac.Sc. USSR. Institute of Physical Chemistry.

TITLE: Dissertations (Dissertatsii)

PERIODICAL: Metallovedeniye i Obrabotka Metallov, 1958, No. 2, P. 63 (USSR).

SOV/120-58-6-24/32

AUTHORS: Dekartova, N. V., Rozhanskiy, V. N. and Shchukin, Ye. D.

TITLE: Recording of the Damping of the Oscillations of a Torsional Pendulum of a Loop Oscillograph in the Measurement of Internal Friction (Zapis' zatukhaniya kolebaniy krutil'nogo mayatnika na shleyfovom ostsillografe pri izmerenii vnutrennego treniya)

PERIODICAL: Pribory i tekhnika eksperimenta, 1958, Nr 6, pp 107-109 (USSR)

ABSTRACT: The internal friction of metals is often measured by the damping of oscillations of a torsional pendulum (Refs. 1 to 4). The amplitude of these oscillations is usually measured with a lamp and scale arrangement. To record torsional oscillations, the present authors have used a special attachment which will record the oscillations within the range 0.1 - 10 c/s with an accuracy of about 3%. The pendulum is illustrated in Fig. 1, in which 1 is a quartz tube, 2 is a furnace, 3 is the specimen, 4 is a vacuum chamber for the pendulum, 5 is a mirror, 6 is a damper of transverse

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SOV/120-58-6-24/32

Recording of the Damping of the Oscillations of a Torsional Pendulum
of a Loop Oscillograph in the Measurement of Internal Friction

vibrations, 7 are loads, 8 is an aluminium rod, 9 is a window and 10 is a connection to the pump. When the mirror is at rest, the spot of light reflected off it is roughly in the middle of a photo-element which faces it. As the pendulum is set in motion, the spot will move across the photo-element and an alternating signal will appear across the load of the photo-element. This is then amplified and then recorded on a loop oscillograph. The circuit is shown in Figs.2 and 3 and an actual record of a typical oscillation is shown in Fig.4. There are 4 figures, no tables and 7 references, of which 3 are English and the rest Soviet.

ASSOCIATION: Khimicheskiy fakul'tet MGU (Chemistry Department of Moscow State University)

SUBMITTED: December 24, 1957.

Card 2/2

"The Emergence of Dislocations on the Crystal Surface as well as the Development of Fissures."

report presented at the Conference on Investigation of Mechanical Properties of Non-Metals, by the Intl. Society of Pure and Applied Physics and the AS USSR, at Leningrad, 19-24 May 1958.
(Vest. Ak Nauk SSSR, 1958, no. 9, pp. 109-111)

AUTHORS: Shchukin, Ye.D., Rebinder, P.A. SOV-69-20-5-18/23

TITLE: The Formation of New Surfaces During the Deformation and Rupture of a Solid in a Surface Active Medium (Obrazovaniye novykh poverkhnostey pri deformirovani i razrushenii tverdogo tela v poverkhnostno-aktivnoy srede)

PERIODICAL: Kolloidnyy zhurnal, 1958, Vol XX, Nr 5, pp 645-654 (USSR)

ABSTRACT: The adsorption of surface-active substances by a solid body which is being deformed, may influence its deformation and resistance properties. This is true for the deformation of monocrystals of tin, zinc, and other metals in solutions of non-polar vaseline oil. In comparison to the free surface energy of these monocrystals ($500-1,000 \text{ erg/cm}^2$), the reduction amounts to only some tens of erg/cm^2 . This effect is explained by the movement of dislocations and their interaction with the surface energy. The dislocation is a thermodynamically unstable defect. It is attracted to the surface and the attraction force is reversely proportional to the distance from the surface. Brittleness and a decrease in resistance may be observed in monocrystals of metals in the presence of a covering of a low-melting metal, like tin or mercury. The decrease of the free surface energy on the border between the metal and its saturated solution is con-

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The Formation of New Surfaces During the Deformation and Rupture of A Solid
in a Surface Active Medium

SOV-69-20-5-16/23

siderable. It amounts to hundreds of erg/cm^2 . The actual rupture stresses on the cleavage planes are lower than the calculated values. This is due to micro-cracks in the crystal. The change in deformation and resistance properties under the influence of adsorption is also observed in glass. It has been established that the presence of water vapor reduces the rupture stress of glass fibers. Under the influence of adsorption, the free surface energy of a solid body may be reduced to some tenths of erg/cm^2 . In such a case, a spontaneous dispersion of the body into particles of colloidal size with 10^{-6} cm in diameter takes place. There are 2 sets of graphs and 28 references, 19 of which are Soviet, 7 English, and 2 German.

ASSOCIATION:

Institut fizicheskoy khimii AN SSSR, Otdel dispersnykh sistem, Moskva (Institute of Physical Chemistry of the USSR Academy of Sciences, Department of Dispersed Systems, Moscow)

SUBMITTED:

June 16, 1958

1. Single crystals--Deformation
2. Metal crystals--Properties

.Card 2/2

SHOROKHA, L. D.; REBINDER, F. A.; BIRKMAN, V. I.; BARIKREV, G. M.;

"Deformation processes, the rheological conduct and the destruction of solids and metals."

report presented at the Fourth All-Union Conference on Colloidal Chemistry,
Tbilisi, Georgian SSR, 12-16 May 1958 (Koll zhur, 20,5, p.677-9, '58, Taubman, A.B)

AUTHORS: Likhutan, V. I., Shchukin, Ye. D. SOV/53-66-2-4/9

TITLE: Physico-Chemical Phenomena in the Deformation of Metals
(Fiziko-khimicheskiye yavleniya pri deformatsii metallov)

PERIODICAL: Voprosy fizicheskikh nauk, 1958, Vol 66, Nr 2, pp 213- 245
(USSR)

ABSTRACT: In the course of the past 10 years a new field of science was opened up by an association of Soviet scientists headed by P. A. Rebinder: the so-called physico-chemical mechanics, which is a field bordering upon those of physical chemistry, molecular physics, and the mechanics of materials. The main aims of this new field of science are: 1) Explanation of the laws and the mechanism of the production of solids of given structure and mechanical properties, and 2) the investigation of processes of deformation, of the working up and of the destruction of solids in consideration of the influence exercised by physico-chemical factors, the composition and structure of the body, of temperature and of the surrounding medium. Extensive experimental material is now available in this field upon the basis of which it is possible to develop a theory of the processes of production

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SCV/53-66-2-4/9

Physico-Chemical Phenomena in the Deformation of Metals

and destruction of solid materials as well as of the conditions for the best method of processing. Theoretical work is based upon the dislocation theory. The authors of the present paper give an extensive and, in parts, detailed survey of the principal results obtained by investigations carried out in this field during recent years; results obtained are discussed on the basis of numerous references to publications. The results of the physico-chemical mechanics of metals are also subjected to theoretical treatment (dislocation theory). The most frequently used materials for investigations were zinc and zinc monocrystals. There are 26 figures, 4 tables, and 69 references, 29 of which are Soviet.

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Shchukin, Ye. D.

20-2-19/60

AUTHORS: Shchukin, Ye. D. , Goryunov, Yu. V. , Pertsov, H. V. ,
Rozhanskiy, V. N.

TITLE: On the Nature of the Unhomogeneous Plastic Deformation of
Metal Mono-Crystals (O prirode neravnomernosti plasticheskoy
deformatsii metallicheskih monokristallov)

PERIODICAL: Doklady AN SSSR, 1958, Vol. 118, Nr 2, pp. 277 - 279 (USSR)

ABSTRACT: In a previous work the following was shown: The jumps of
deformation of 0,5 to 20 μ which usually can be observed in
the case of expansion of a zinc-crystal, have a very compli-
cated structure and are the sum of a series of elementary
jumps, which form in the various cross sections of the cry-
stal. The investigation of the elementary shifts made it ne-
cessary to diminish the inertia of the apparatus considerably
and to increase its sensitivity to 50 \AA . The mono-crystals
with the diameter of 0,4 to 0,8 mm, which were of very pure
(99,99 %) zinc, cadmium, tin, lead and aluminum, were stretch-
ed during constant stress and at room temperature, whereby
the stress was a bit higher than the stretching-strain limit.

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20-2-19/60

On the Nature of the Unhomogeneous Plastic Deformation of Metal Mono-Crystals

In all the cases of the test-pieces (save aluminum) together with the deformation also the change of the electric resistance of the test-piece was registered. In the case of stretching zinc, cadmium and tin many small jumps of 150 to 200 Å on to 2 000 Å with a duration of 1 - 3 to 30 microseconds were registered. Jumps until 10 000 - 15 000 Å were found rather seldom, and if they were found, they were usually of several small jumps. Also considerably less expressed jumps of 1 000 to 5 000 Å were observed. By careful microscopic examination of the deformed crystals was found out that those jumps of deformation result on shearing and not on twin-formation. The number of jumps, which can be observed, increases with the decrease of their size (at least on to 250 - 300 Å). Obviously there is no minimum size of the jumps, but a superior limit of the elementary shift. In the case of mono-crystals of aluminum and of lead a clearly marked formation of jumps was not observed. The results which were found out here prove the results on large jumps. The discontinuity of the flow and the quick jumps are to be regarded as a common feature which is produced by the nature of dislocation of the plastic deformation. There are 4 figures, and 6 references, 3 of which are

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20 -118 -6-15/43

AUTHOR: Shchukin, Ye. D.

TITLE: A Criterion of Crystal Deformation Capacity and Adsorption Effects (Kriteriy deformiruyemosti kristalla i adsorbtsionnyye efekty)

PERIODICAL: Doklady Akademii Nauk SSSR, 1958, Vol. 118, Nr 6, pp. 1105-1108 (USSR)

ABSTRACT: First the author shortly reports on previous works dealing with the same subject. According to the theory of Mott the local concentrations of the stresses in a crystal are caused by dislocation accumulations which are formed in front of various obstacles in the glide plane. In the case of existence of a shear stress τ and of n dislocations in the accumulation the force reaches the value $n\tau b$ per unit, of length, whereby b denotes unit translation. In reality n is limited by two factors: 1) If the leading dislocation is well fixed the dislocations will accumulate at the distance L in front of the obstacle

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$$n_1 \approx \pi (1-\mu)L \tau / Gb.$$

A Criterion of Crystal Deformation Capacity and Adsorption Effects^{20-118-6-15/43}

Here μ denotes the Poisson coefficient, G the shear modulus, and L denotes the diameter for smaller ($\lesssim 1$ mm) monocrystals or the grain size for the polycrystals, resp. 2) The obstacle is characterized by the potential barrier $U(x)$, its height U_{\max} determining the activation energy in the overcoming of the obstacle at $\mathcal{J} = 0$. The quantity $|\text{grad } U(x)|_{\max}/b^2 = \mathcal{J}_1(0)$

represents the local stress $n\mathcal{J}$ necessary for rupturing at $T = 0^\circ\text{K}$. The author then introduces the quantity $S = N/n$ which is important as criterion for the deformation capacity of a crystal. Here applies

$$N \approx 12\sigma/\mathcal{J} b, \quad n = \min\{n_1; n_2\}, \quad n_2 = \mathcal{J}_1/\mathcal{J},$$

σ denoting the specific free energy of the surface of the developing microfissure. Explicit terms for this criterion are given and discussed. A term is given for the critical temperature of the transition from brittleness to plasticity.

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20-118-6-15/43

A Criterion of Crystal Deformation Capacity and Adsorption Effect

In the case of weak (organic) adsorption active agents (which cannot render it brittle, but plastic under certain conditions) a slight modification of σ itself cannot displace considerably the branches of the criterion S. If, however, in the case of the given deformation conditions the interactions between the dislocations and the free surface of the crystal play an important rôle, even a slight decrease of σ can considerably increase the second branch S_2 of the criterion.

The corresponding energy barrier $U_{\max} = b\sigma \approx 0,5 \text{ eV}$ is due to the occurrence of an inter stage in the transition of a dislocation to the surface and is considerably steep. The generality of the scheme suggested here was limited by various conditions which then can also be omitted. There are 2 figures and 18 references, 6 of which are Soviet.

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A Criterion of Crystal Deformation Capacity and Adsorption Effects 20-113-6-15/43

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR
(Institute of Physical Chemistry, AS USSR)

PRESENTED: October 2, 1957, by P. A. Rebinder, Member of the Academy
of Sciences, USSR

SUBMITTED: September 22, 1957

Card 4/4

18.7400

77113
SOV/70-4-6-14/31

AUTHORS: Shchukin, Ye. D., Pertsov, N. V., Goryunov, Yu. V.

TITLE: Concerning the Change in Mechanical Properties, Structure, and Electrical Conductivity of Metallic Single Crystals Under the Influence of a Strongly Active Adsorptive Medium

PERIODICAL: Kristallografiya, 1959, Vol 4, Nr 6, pp 887-897 (USSR)

ABSTRACT: This article deals with changes in the mechanical strength and deformation characteristics of solids due to vanishingly small amounts of adsorbed surface-active matter, increased plasticity and flow rates, lowered yield limits of metals covered by organic compounds which are lightly surface-active, and increased brittleness of high-melting metals coated by low-melting metal melt such as of Zn and Cd coated by Hg or Sn. Possible explanations for these phenomena are cited from the works of Academician P. A. Rebinder and his school (Dokl. Acad. Sci. USSR, 111, 1284, 1956; and others). The authors studied the

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Concerning the Change in Mechanical Properties, 77113
Structure, and Electrical Conductivity of SOV/70-4-6-14/31
Metallic Single Crystals Under the Influence
of a Strongly Active Adsorptive Medium

physical properties and structures of polycrystalline specimens and artificially grown single crystals of Zn, Cd, Sn, Pb, and Cu of highly pure compositions, 0.5-1 mm in diameter and 10-25 mm long, with or without coating by molten Ga or Hg. The experimental data are presented in figures and tables below (Fig. 2c, 4, 5, 11). X-ray diffraction data disclosed that Ga-coating with subsequent Ga penetration into the crystals increases unit cell dimensions and leads to a gradual partition of Sn and Zn single crystals into an increasingly larger number of disoriented blocks, i.e., to the transformation of single crystals into polycrystalline specimens. Ga-coated Cd, and Hg-coated Zn crystals did not show partition into blocks even after long aging. Ga-coating improved the mechanical properties of polycrystalline Sn and Zn. The electric resistivities along the axes of high resistance of Sn and Zn single crystals dropped rapidly with the partition into blocks and increased along the

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Card 3/6

77113 SOV/70-4-6-14/31

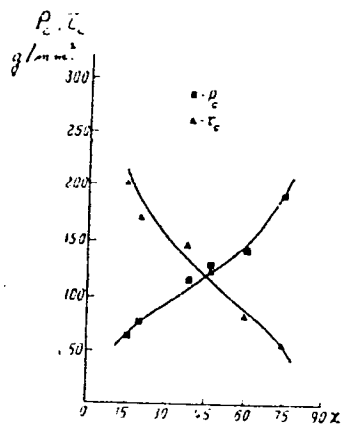


Fig. 2c. Ultimate tensile (p_c) and shear (τ_c) stresses as functions of the orientation of Zn single crystals coated by Ga-melt, at indoor temperature. χ denotes angle between basal plane and crystal axis at rupture point.

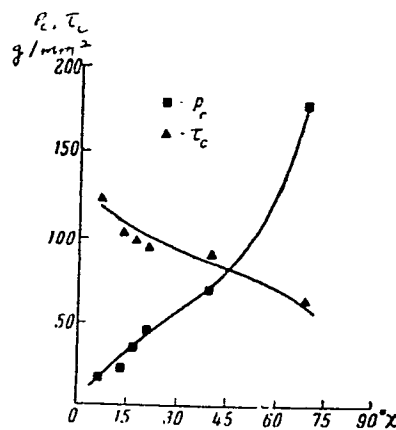


Fig. 4. Ultimate tensile (p_c) and shear (τ_c) stresses as functions of the orientation of Cd single crystals coated by Ga-melt, at indoor temperature. χ denotes angle between basal plane and crystal axis at rupture point.

77113 SOV/70-4-6-14/31

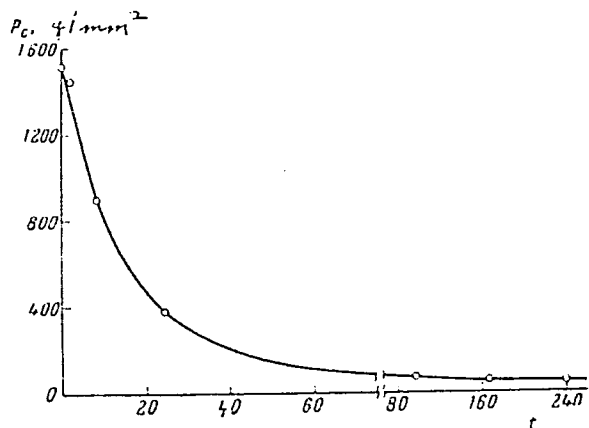


Fig. 5. Ultimate tensile stress P_c in a Sn single crystal as function of aging, after coating by Ga-melt at indoor temperature. Stretching at the rate of 2.4 mm/min of a crystal 13-14 mm long and 0.62 mm thick: $\lambda [001] \approx 45^\circ$; o denotes average of 3-4 measurements.
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Concerning the Change in Mechanical Properties,
Structure, and Electrical Conductivity of
Metallic Single Crystals Under the Influence
of a Strongly Active Adsorptive Medium

77113
SOV/70-4-6-14/31

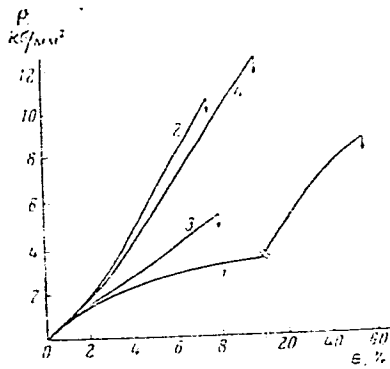


Fig. 11. Tension curves of single-crystal and polycrystalline Sn at temperature of liquid N. P is ultimate tensile stress; ϵ , elongation (%); (1) and (3), single-crystal and polycrystalline Sn, respectively, without Ga-coating; (2) and (4) the same with Ga-coating.

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Concerning the Change in Mechanical Properties, 77113
Structure, and Electrical Conductivity of SOV/7C-4-6-14/31
Metallic Single Crystals Under the Influence
of a Strongly Active Adsorptive Medium

low-resistance axes; both approached the resistivity of the respective polycrystalline specimens. Pb and Cd only slightly changed their resistivities. Improved mechanical properties of polycrystalline specimens seem to open a new way for development of high-strength alloys. A. I. Kitaygorodskiy and V. I. Likhtman are acknowledged for discussions. There are 11 figures; 2 tables; and 29 references, 24 Soviet, 3 U.K., 1 German, 1 Japanese. The U.K. references are: A. Deruyttère, G. B. Greenough, J. Inst. Metals, 64, 337, 1956; A. N. Stroh, Proc. Roy. Soc. A, 223, 404, 1954; A. N. Stroh, Philos. Mag., 3, 597, 1958.

ASSOCIATION: Moscow State University imeni M. V. Lomonosov
(Moskovskiy gosudarstvennyy universitet imeni M. V. Lomonosova)

SUBMITTED: September 2, 1959
Card 6/6

05276

SOV/170-59-7-7/20

18(4), 24(2)

AUTHORS: Kochanova, L.A., Andreyeva, I.A., Shchukin, Ye.D., Likhtman, V.I.

TITLE: Regularities in the Brittle Fracture of Pure and Alloyed Single Crystals of Zinc

PERIODICAL: Inzhenerno-fizicheskiy zhurnal, 1959, Nr 7, pp 45 - 52 (USSR)

ABSTRACT: The authors studied regularities in the fracture of pure and alloyed single crystals of zinc along the cleavage plane (0001). Pure crystals were taken of 3 kinds: containing 99.999% of elemental zinc, containing 99.99% of it and commercial zinc; those of alloyed specimens contained 0.2 and 0.5% of cadmium. Experiments were carried out in two versions: in the absence of an active absorption medium at a temperature of -196°C and with a thin mercury film of about 5μ thick applied to the specimen, at room temperature. Crystals were produced by the zonal crystallization method and were 0.54 to 0.9 mm in diameter and about 10 mm long. The fracture of crystals was performed on the Polyany device at a constant stretching rate of 10 to 15% per minute. The authors formulated a "condition of the constancy of the product of normal by shearing stresses", which is expressed by Formula 1 $p_{\sigma} \cdot \tau_{\sigma} = \text{const} = K^2$. By analyzing a considerable amount of experimental data the authors have established that

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SOV/170-59-7-7/20

Regularities in the Brittle Fracture of Pure and Alloyed Single Crystals of Zinc

this condition is fulfilled within a wide range of orientations of single crystals for both pure and alloyed specimens. As the quantity of the admixture increases, the value of K also increases. The authors explain this by a hypothesis on the origination of heterogeneities in the shearing process and occurrence of plastic deformation during a phase immediately preceding fracture. The value of K for amalgamated specimens is twice as low compared to . non-amalgamated ones, both for pure and alloyed crystals. This is explained by the lowering of the surface energy of zinc in the presence of mercury. The condition formulated by the authors agrees well also with the experimental data of the other investigators in this field, such as Deruyttere and Greenough [Ref 5], and is consistent with the theory of P.A. Rebinder [Refs 7-10] on the effect of adsorption-active media

Card 2/3

05276

SOV/170-59-7-7/20

Regularities in the Brittle Fracture of Pure and Alloyed Single Crystals of Zinc

on deformation and strength properties of solid bodies.

There are: 4 graphs, 2 tables and 13 references, 12 of which are Soviet and 1 unidentified.

ASSOCIATION: Institut fizicheskoy khimii AN SSSR (Institute of Physical Chemistry of the AS USSR), Moscow.

Card 3/3

24(2)

AUTHORS: Shchukin, Ye. D., Lichtman, V. I. SOV/20-124-2-18/71TITLE: On the Brittle Rupture in Single Crystals of Zinc
(O khрупkom razryve monokristallov tsinka)PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 124, Nr 2, pp 307-310
(USSR)

ABSTRACT: If in a body there is a crack of the magnitude c , the relation $p_c = \alpha \sqrt{E\sigma/c}$ holds for the dangerous tension vertical to the surface of the crack; α here denotes a certain dimensional coefficient which does not differ considerably from 1. Under the action of the tension τ the crystal is assumed to be shifted by the amount Δ , but shifting is not supposed to propagate over the entire cross section because of the presence of a sufficiently solid obstacle 0 in the slip plane. Shear is then localized to a limited interval and the field of tension existing in the region surrounding this defect can then be compared with the elastic field of an incision which is parallel to the applied tension. The maximum expanding tensions act along a line forming the angle θ with the plane of the incision. An expression is written down for the reduction of

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On the Brittle Rupture in Single Crystals of Zinc

SOV/20-124-2-13/71

elastic energy as a result of the opening of the crack. If, in the slip plane, shifts that have not been carried out accumulate within the above interval, it may be that in the crystal a crack corresponding to equilibrium is formed. The author is interested in the limiting case of the largest possible of such cracks. Such a case may arise if, before the aforementioned "impenetrable obstacle", the interval, with high concentration of the shifts not carried out, attains the dimensions of the entire slip plane with respect to order of magnitude. A formula is written down for the maximum amount of tension. A quite similar result is obtained also on the basis of the theory of dislocations. The relations written down in the present paper are considerably simplified in the case of zinc single crystals, because one and the same basis plane is at the same time the only slip plane and the only distinctly marked plane of cleavability. The crack will develop above all in that direction of \oplus in which the local concentration of the expanding tensions is greatest in a homogeneous isotropic medium.

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On the Brittle Rupture in Single Crystals of Zinc

SOV/20-124-2-13/71

In the case of zinc this angle θ will not be so large.
In conclusion, diagrams for the brittle rupture of
amalgamated zinc single crystals at room temperature are given
and discussed in short. There are 4 figures and 12 references,
6 of which are Soviet.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute for
Physical Chemistry of the Academy of Sciences, USSR)

PRESENTED: September 6, 1958, by P. A. Rebinder, Academician

SUBMITTED: June 7, 1958

Card 3/3

5(4)

AUTEORS:

Kochanova, L. A., Andreyeva, I. A., SOV/20-126-6-44/67
Shchukin, Ye. D.

TITLE:

On the Brittle Rupture of Pure and Alloyed Zinc Single Crystals (O khрупkom razryve chistykh i legirovannykh monokristallov tsinka)

PERIODICAL:

Doklady Akademii nauk SSSR, 1959, Vol 126, Nr 6, pp 1304-1307 (USSR)

ABSTRACT:

In the papers (Refs 1-4) the authors investigated the rupture of pure zinc single crystals along the cleavage face (0001) and found that the product of normal and cleavage tensions is constant - $p_c \tau_c = \text{const} = K^2$. The results are given for technical zinc and for zinc alloyed up to 0.5 % with Cd and compared with the results obtained for pure zinc (Table 1). Figure 1 shows the values of rupture tension for pure zinc at -196°C and various angles between crystal axis and face (0001) as well as the effect of a mercury film upon the strength at $+20^\circ \text{C}$. Table 1 shows that K increases with increasing amount of additions. Figure 2 shows the values of rupture tension τ for amalgamated and non amalgamated pure

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On the Brittle Rupture of Pure and Alloyed Zinc
Single Crystals

SOV/20-126-6-44/67

zinc single crystal in dependence on the crystallographic shear a . The characteristic break of the deformation curve at a_0 (flow limit) as well as the increase in strength for $a < a_0$ connected with the latter are due to the increase of the incomplete shears (dislocation accumulation). a_0 decreases with increasing amount of alloy components. Table 1 gives the degree of inhomogeneity $f = a_0/a'_0$ (a'_0 refers to pure zinc). As shown by figures 3 and 4, the experimental results are in good agreement with those obtained by A. Deruyttière and G. B. Greenough (Ref 5). $p_c \tau_c = K^2$ holds for both amalgamated and not amalgamated zinc single crystals of varying purity. The values for K are reduced by 50 % as a result of the reduction of the free surface activity σ . The authors thank V. I. Likhtman for his advice. There are 4 figures, 1 table, and 13 references, 12 of which are Soviet.

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On the Brittle Rupture of Pure and Alloyed Zinc
Single Crystals

SOV/20-126-6-44/67

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute of
Physical Chemistry of the Academy of Sciences, USSR)

PRESENTED: February 17, 1959, by P. A. Rebinder, Academician

SUBMITTED: February 10, 1959

Card 3/3

24(2), 18(6)

AUTHORS:

Goryunov, Yu. V., Pertsov, N. V., Shchukin, Ye. D., Rebinder, P. A., Academician

SOV/20-128-2-13/59

TITLE:

Variation in the Structural and Mechanical Properties of the Single Crystals of Tin Under the Influence of a Strongly Adsorptionactive Medium

PERIODICAL:

Doklady Akademii nauk SSSR, 1959, Vol 128, Nr 2, pp 269 - 272 (USSR)

ABSTRACT:

This article deals with the influence exercised by a thin liquid gallium film upon the mechanical and structural properties of the single crystals of tin and upon their electrical conductivity. Differently oriented single crystals of tin (degree of purity 99.999 %, diameter 0.5 - 1 mm, length 10-25 mm) were bred by the method of zone crystallization. The liquid metallic gallium was mechanically applied to the surface of the samples in a quantity of from tenths of a milligram to 5-10 mg. As in the case of Zn-Hg and other pairs mentioned already earlier, plasticity and strength of the single crystals of tin decrease abruptly as soon as the gallium has been applied to the sample surface. However, they decrease even

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Variation in the Structural and Mechanical Properties of the Single Crystals of Tin Under the Influence of a Strongly Adsorption-active Medium SOV/20-128-2-13/59

more in the course of time. After a few days, the sample is pulverized by the pressure of a finger-nail. A diagram illustrates the results obtained by measurement of the true tensions of the break resulting from an elongation of the gallium-coated single crystals of tin at a constant velocity of $\sim 20\% \text{ min}^{-1}$ as a function of the period of time passed since the coating of the samples with gallium. The extreme relative prolongations increased by 30% (as a maximum value) immediately after the samples had been coated with gallium. This percentage dropped to some per cent after the samples had been exposed to room temperature for 24 hours, and after some days it was only very small. The strength of single crystals coated with gallium amounts to 1.5 kg/mm^2 approximately immediately after the coating, and drops to 50 g/mm^2 after 7-10 days. X-ray pictures taken before and after the coating showed that after the coating the single crystal gradually decomposes into distinctly disoriented blocks. After some days the initial stains on the X-ray picture vanish almost completely, and the picture resembles that of a polycrystalline metal. At a sufficient quantity of gallium and sufficiently long action of the

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Variation in the Structural and Mechanical Properties of the Single Crystals of Tin Under the Influence of a Strongly Adsorption-active medium SOV/20-128-2-13/59

latter on the single crystal of tin, this phenomenon extends throughout the entire crystal volume. In the case of samples oriented in such a manner that their original resistance is only small (i.e. at large angles $\lambda_{[001]}$ between the tetragonal axis and the sample axis), resistance increases in the course of time, while it gradually drops after the coating of samples with high original resistance (if the tetragonal axis is near the sample axis). Gallium (or gallium saturated with tin) is a strong adsorbent for tin. During elongation in liquid nitrogen the strength of samples coated with gallium really increases as compared to single crystals without coating. The authors thank Professor V. I. Likhtman, who contributed to a discussion of the results of this article. There are 4 figures, 2 tables, and 27 references, 26 of which are Soviet.

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Variation in the Structural and Mechanical Properties SOV/20-128-2-13/59
of the Single Crystals of Tin Under the Influence of a Strongly Adsorption-
active Medium

ASSOCIATION: Otdel dispersnykh sistem Instituta fizicheskoy khimii Akademii
nauk SSSR (Institute for Disperse Systems of the Institute
of Physical Chemistry of the Academy of Sciences, USSR) Kafedra
kolloidnoy khimii Moskovskogo gosudarstvennogo universiteta
im. M. V. Lomonosova (Chair of Colloid Chemistry of Moscow
State University imeni M. V. Lomonosov)

SUBMITTED: June 5, 1959

Card 4/4

32803
S/137/61,000/012/124/149
AGOE/A101

18.9500

1521

AUTHORS: Reinder, P.A., Likotman, V.I., Shchukin, Ye.D., Kochanova, L.A.,
Fersov, N.V., Goryunov, Yu.V.

TITLE: Regularities and the mechanism of the effect of small surface ac-
tive admixtures on deformation and strength properties of single
crystal metals

PERIODICAL: Referativnyy zhurnal. Metallurgiya, no. 12, 1961, 34-35, abstract
12Zh254 ("Tr. In-ta fiz. metallov, AN SSSR", 1960, no. 23, 147-161)

TEXT: Experiments were made with differently oriented Zn and Cd single
crystals of 1 mm in diameter, coated with a thin film of surface active Sn and
Hg metals. It is shown that at temperatures over T_g of "base metal-coating"
eutectics, the presence of a molten surface-active metal layer strongly reduces
deformability and strength of the specimen and promotes brittle failure. The
brittle effect of the surface active metal is mainly a function of temperature
and the deformation rate. Embrittlement and reduced strength are not connected
with corrosion processes but are caused by a decrease of the work which is
necessary for the development of crack nuclei, due to the adsorption of surface-
Car: 1/2

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Regularities and the mechanism ...

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A006/A101

active metal atoms on the internal micro-surfaces. At a drop of the test temperature below T_g of the "base metal-coating" eutectics, the embrittling effect vanishes gradually, due to a reduced mobility of adsorption-active atoms. The embrittling effect vanishes also at sufficiently high temperatures and low tension rates, when the resorption of deformation micro-heterogeneities and local stresses prevents the failure nuclei to develop into dangerous cracks, even at a considerable decrease of free surface energy. There are 21 references.

X

V. Stepanov

[Abstracter's note: Complete translation]

Card 2/2

85202

S/074/60/029/010/003/004
B013/B075

18 7510

AUTHORS: Likhtman, V. I. and Shehukin, Ye. D.
TITLE: Surface Phenomena in Processes of Deformation and Destruction of Metals
PERIODICAL: Uspekhi khimii, 1960, Vol. 29, No. 10, pp. 1260-1284

TEXT: The subject of the present survey is the so-called Rebinder effect, in which small quantities of surface active substances contained in the medium or in the body itself, play a part during the deformation and destruction of solid bodies. This effect is caused by a decrease of the free energy on new surfaces, which are formed during the deformation or destruction of solid bodies due to reversible (physical) adsorption. Adsorption essentially promotes the formation of these new surfaces and decreases the effort necessary for the deformation or destruction of bodies (Refs. 1-17). The authors point out that the adsorption-dependent change of mechanical properties of the bodies is by no means related to corrosion processes or to the dissolution of the body. The action of adsorption on the deformation and stability properties of solids is of

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Surface Phenomena in Processes of Deformation and Destruction of Metals S/074/60/029/010/003/004
B013/B075

practical importance for metal working (Refs. 23, 26, 27), for powder production (Refs. 7, 8), etc. Investigation of these phenomena represents part of the new branch of science - the physico-chemical mechanics of solids. This field of research being developed by P. A. Rebinder and his collaborators has its origin at the boundary between molecular physics, solid-state physics, physical chemistry, and the mechanics of the continuous spectrum. The aim of this branch of science is the production of bodies with given structure and properties as well as the development of rational methods for the mechanical working of solid bodies by using physico-chemical factors (Refs. 6, 29). Monocrystals of metals are most suitable for investigation purposes. For these objects it is of special importance to apply the recent theory of dislocations to their present stage of development. By this means the possibility is also offered to analyze the mechanism of media acting on the deformation and stability characteristics of bodies (Refs. 13-15, 19, 30). Some of these experiments are taken into special consideration: 1) Plastification of metal monocrystals under the action of organic surface-active media (Refs. 3-5, 9, 10, 13, 14, 16, 19, 23, 24, 31-42). Experimental data confirm not only the adsorption character of this effect but show also the same rules as with the adsorption at liquid boundary surfaces. The plastifying effect

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Surface Phenomena in Processes of Deformation S/074/60/029/010/003/004
and Destruction of Metals B013/B075

which is extremely complicated and varied, is connected with a whole spectrum of activation energies and can be observed in different temperature ranges as well as at different rates of deformation. 2) Decrease of the free surface energy under the action of melting of more easily meltable metals than the material concerned (Refs. 6, 11, 12, 14, 15, 17, 19, 21, 22, 24, 25, 29, 30, 43-60, 65, 66). The rules governing the action of these highly surface active media were studied in the Otdel dispersnykh sistem Instituta fizicheskoy khimii AN SSSR (Department for Disperse Systems of the Institute of Physical Chemistry AS USSR) and at the kafedra kolloidnoy khimii MGU (Chair of Colloidal Chemistry of Moscow State University). It was shown that under the effect of an intensely absorptive medium a highly plastic monocrystal qualitatively changes its mechanical properties and becomes brittle. Embrittlement depends on temperature and rate of deformation. By comparing the investigated pairs metal-coating with binary meltability diagrams, a semi empirical rule could be set up, which indicates whether the metal concerned is, with respect to another, more difficultly meltable one, intensely surface-active or not. 3) Shift of the cold-brittleness limit in the presence of melted, highly adsorptive coatings toward higher temperatures (Refs. 15, 19, 23,

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Surface Phenomena in Processes of Deformation and Destruction of Metals S/074/60/029/010/003/004
B013/B075

24 42; 60). It can be assumed that the natural and the forced limit of cold brittleness have the same character. Its relative position on the temperature scale depends only on the variability of the parameter σ .
4) Spontaneous dispersing, occurring at a considerable decrease of the free surface energy of the solid body with its low effective solubility in the respective medium (Refs. 13, 14, 24, 52, 62, 64). As Rebinder has shown, dispersion takes place in colloidal particles δ_p of 10^{-6} cm, i.e., of the order of magnitude of the structure microunit^m. However, the possibilities of this process are restricted by the equilibrium between the colloidal particles and the substance being in the state of an effective solution, by the presence of a charge on the particle surface, as well as by the micro-structure of the solid concerned. Table 1 contains the maximum values of the plastifying effect and the corresponding concentration of surface active components for different organic surface-active media. Table 2 contains the experimental values of K and of the characteristic shift α_0 , which corresponds to the fraction on curve $\tau(\alpha)$ for zinc monocrystals of different purity degrees without coating (at a temperature of liquid nitrogen) and with mercury coating (at room temperature) (Ref. 49). In Table 3 the rate of stabilized creeping of zinc mono-
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Surface Phenomena in Processes of Deformation S/074/60/029/010/003/004
and Destruction of Metals B013/B075

crystals without coating (é) and with tin coating (é) is given (Ref. 23).
S. T. Kishkin and Ya. M. Potak are mentioned. There are 13 figures,
3 tables, and 66 references; 53 Soviet, 1 US, 11 British, 2 German, and
1 Japanese.

ASSOCIATION: Otdel dispersnykh sistem Instituta fizicheskoy khimii
AN SSSR
(Department for Disperse Systems of the Institute of
Physical Chemistry AS USSR)

VX

Card 5/5

S/020/60/133/01/19/070
B014/B011

AUTHORS: Kochanova, L. A., Shchukin, Ye. D., Likhtman, V. I.,
Rebinder, P. A., Academician

TITLE: Origin and Development of Cracks in Deformed Crystals²¹

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 133, No. 1,
pp. 71-73

TEXT: By way of introduction, the authors subdivide the cracking of a crystal on stretching into two stages depending on the course of deformation. In the stage A there occurs a slow formation and a gradual growth of the cracks at sites with high tension; in the stage B the crack quickly extends over the entire cross section of the crystal. The authors discuss the basic role of shear in stage A, and explain the origin of microcracks in this stage by the unification of dislocations and the formation of hollow nuclei. The mechanism of the development of cracks is closely examined, and V. N. Rozhanskiy (Ref. 7) is mentioned in a discussion of the position of the cracks in the lattice. The most probable arrangement is regarded to be the serial arrangement of dislocations in a lattice plane, which develop to

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✓B

Origin and Development of Cracks in Deformed Crystals S/020/60/133/01/19/070
B014/B011

a crack on further deformation. Formula (1) is given for the length c of a crack, and formula (2) for the normal tension. From these formulas the authors derive the condition for the constancy of the product from normal tension and shear stress; this constancy is well proven by experiments. The authors tested the independence of expression (1) of expression (2). For this purpose they studied the development of cracks in amalgamated zinc single crystals. Microscopic analyses revealed inner cracks in the crystal plane (0001) of all samples. Relation (1) and (2) by Griffith were tested experimentally, and a few relative results are given. The authors state finally that the results obtained by them prove the universal character of the scheme worked out by them for the analysis of a crack development. There are 3 figures and 14 references: 10 Soviet, 3 British, and 1 Japanese.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR
(Institute of Physical Chemistry of the Academy of Sciences, USSR)

SUBMITTED: April 7, 1960

Card 2/2

✓ B

83131

S/020/60/133/005/008/019

B019/B054

18.8200

AUTHORS: Shchukin, Ye. D., Kochanova, L. A., Likhtman, V. I.

TITLE: Some Special Features of Brittle Destruction of Metallic Crystals

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 133, No. 5,
pp. 1064 - 1066

TEXT: In the introduction, the authors refer to some of their own previous papers (Refs. 1 and 2). There, it had been clearly established that in the rupture of amalgamated single zinc crystals a spread of rupture stresses occurs along the basic plane (0001). If, for a given angle χ_0 between the plane (0001) and the sample axis, $P_{\min}(\chi_0)$ and $P_{\max}(\chi_0)$ are the minimum and maximum rupture stresses for the angle χ_0 , then the relative quantity $(P_{\max} - P_{\min})/P_{\max}$ strongly increases with increasing χ_0 . For $\chi_0 > 50^\circ$, this quantity remains below 10%. for $\chi_0 < 30^\circ$, it attains a value of more than 25%. To clarify these relations, the

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Some Special Features of Brittle Destruction
of Metallic Crystals

S/020/60/133/005/008/019
B019/B054

authors carried out microscopic investigations of the basic planes (0001) of the fragments obtained in the rupture of many amalgamated single zinc crystals. The diameter of the single crystals L_0 was about 1 mm, χ_0 was between 20 and 70°. Many steps were found (Fig. 1) in the surfaces of fracture which were caused by cracks on the transition from one (0001) plane into the other. Thorough investigations showed that the main steps appear in the places of origin of rupture cracks. In previous papers (Refs. 3 and 4), the authors gave a detailed theory of the origin of cracks, and here they quote formula (1) obtained here:

$$(p_c \tau_c)_A^{1/2} / (p_c \tau_c)_B^{1/2} \equiv (P_c \sin^{3/2} \chi \cos^{1/2} \chi)_A / (P_c \sin^{3/2} \chi \cos^{1/2} \chi)_B = \sin^{1/2} \chi_0$$

Here, p_c is the normal stress to the basic plane, τ_c is the shearing stress, the indices A and B refer to the type of fragment, and P_c is the break stress. Fig. 2 shows the experimental data, corresponding to (1), for six differently oriented samples. It appears that (1) is fulfilled in a wide range of orientation with an error of about 10%. From the results obtained, the authors infer the difference between the roles played by the

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83131

Some Special Features of Brittle Destruction of Metallic Crystals S/020/60/133/005/008/019
B019/B054

outer and helical dislocations in the mechanism of destruction. By a further investigation of normal and shearing stresses in the rupture of a crystal it should be possible to solve a number of problems which are connected with the temperature- and velocity dependence of destruction. There are 2 figures and 11 references: 8 Soviet, 2 German, and 1 US.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute of Physical Chemistry of the Academy of Sciences, USSR)

PRESENTED: April 7, 1960, by P. A. Rebinder, Academician

SUBMITTED: March 29, 1960

Card 3/3

846

24,7500 (1043, 1145, 1160)

S/020/60/135/001/016/030
B006/B056

AUTHOR: Shchukin, Ye. D.

TITLE: A Possible Mechanism of Slideline Forming in the Absence of Localized Dislocation Sources

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 135, No. 1, pp. 61-64

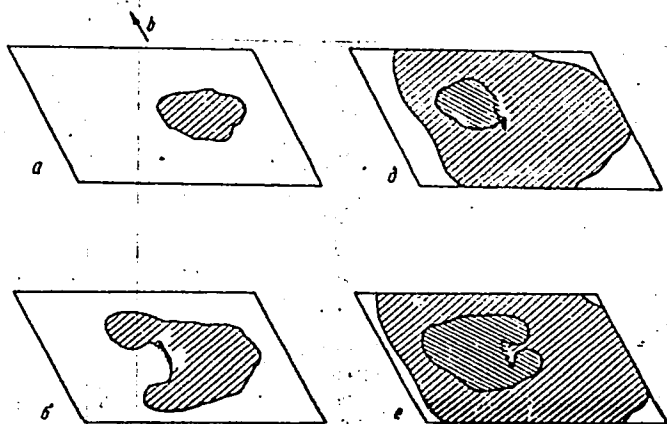
TEXT: The problem of increasing dislocations during deformation of crystals has already repeatedly been dealt with, but hitherto no definite solution could be found. Already 10 years ago, Frank and Read suggested the model of localized sources of dislocations which has repeatedly been used without, however, the occurrence of such sources having satisfactorily been proven experimentally. The author of the present paper now suggests another process of increasing dislocations. One of the possible variants is shown in Fig. 1. Under a stress applied to a crystal, a dislocation loop is assumed to spread, and part of it is assumed to go over to a slide plane located parallel in the immediate proximity, where, proceeding from this new loop, a dislocation field again spreads. This process is described in great detail, but on the basis of a denotation

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84663

A Possible Mechanism of Slideline Forming in the S/020/60/135/001/016/030
Absence of Localized Dislocation Sources B006/B056

ABCD, which has obviously been forgotten in Fig. 1.

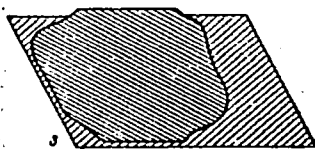
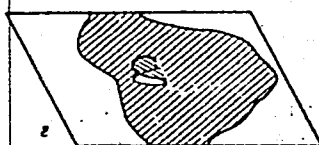
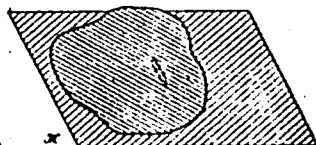
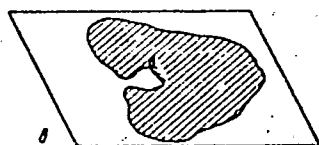


35
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81:663

S/020/60/135/001/016/030
B006/B056



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Card 3/4

84663

A Possible Mechanism of Slideline Forming in the Absence of Localized Dislocation Sources	S/020/60/135/001/016/030 B006/B056	35
A possible variant of the process of the splitting off of a dislocation loop of a parallel slide plane located nearby. I = the area covered by the dislocation loop in the initial plane; II = the area covered by the dislocation loop in the neighboring (higher) plane. The arrow indicates the direction of the Burgers vector b. The author finally thanks V. I. Likhtman and V. L. Indenbom for valuable advice. There are 1 figure and 13 non-Soviet references.		40
ASSOCIATION:	Institut fizicheskoy khimii Akademii nauk SSSR (Institute of Physical Chemistry of the Academy of Sciences USSR)	45
PRESENTED:	June 14, 1960, by P. A. Rebinder, Academician	50
SUBMITTED:	June 7, 1960	55
Card 4/4		

20797

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1418, 1136, 1143, 2807

S/181/61/003/003/023/030
B102/B205

AUTHORS: Kochanova, L. A., Shchukin, Ye. D., and Likhtman, V. I.

TITLE: Mechanism of coarse destruction of metallic crystals

PERIODICAL: Fizika tverdogo tela, v. 3, no. 3, 1961, 902-910

TEXT: Studies conducted by the authors in their laboratory have shown that the mechanical properties of metals can be strongly influenced by placing them in highly adsorbing media (fusion of fusible metals). Such a treatment results in a considerable decrease in plasticity and strength. In the papers of Academician P. A. Rebinder et al. on the effect produced by adsorption from the ambient medium upon the mechanical properties of solids, these effects have been ascribed to the considerable decrease in free surface energy on the boundary between the deformed metal and its saturated solution in the other liquid metal. This effect of the metal melt occurs immediately. Experiments have shown that the rule governing the deformation and coarse destruction of metals is not altered by the presence of the liquid metal. The study of the mechanism of coarse destruction of metals is, however, considerably facilitated by the use of active metal melts. The present

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S/181/61/003/003/023/030
B102/B205

Mechanism of ...

paper includes a detailed discussion of experimental data relating to this subject. The data were obtained at room temperature for amalgamated single crystals of zinc. Theoretical investigations have shown that the destruction (rupture on elongation) of single crystals of metals can be divided into two stages: Stage A: More or less slow formation and extension of "embryonic" cracks at points of elevated concentration of stresses, caused by inhomogeneities of plastic deformation. In this stage, the shear stress τ plays the most significant role. The growth of the cracks is accompanied by the occurrence of new dislocations. Stage B: Rapid extension of an unbalanced crack over the entire cross section of the crystal. This process is predominated by the normal stress p . The critical relation between normal stress and shear stress is given by $p_c \tau_c = \gamma^2 G \sigma / L$, where γ is a dimensionless coefficient which differs only slightly from 1; G is the shear modulus, L the cross section of the single crystal, and σ the specific free surface energy. Furthermore, the relations

$$c_{\max} \sim \frac{\tau^2 L^2}{2E\sigma} = \frac{\beta \tau^2 L^2}{G\sigma} \quad (1) \quad \text{and} \quad p_c = \alpha (E\sigma/c_{\max})^{1/2} = \alpha' (G\sigma/c_{\max})^{1/2} \quad (2) \quad \text{hold;}$$

c is the length of the crack, E the elastic modulus, and β a dimensionless Card 2/4

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S/181/61/003/003/023/030
B102/B205

Mechanism of ...

coefficient of the order of unity. The two last-mentioned relations which characterize A and B, respectively, were experimentally verified independently of each other. This was done by a study of the formation of cracks on an increase in p and τ . The specimens (amalgamated single crystals of zinc) had a purity of 99.99%, a diameter of 1 mm, a length of 10 mm, and showed different angles of inclination of the basal planes toward the axis of the specimens. The rate of elongation was constant and amounted to 12%/min. The stresses were determined from the relations

$\tau_c = P_0 \sin \chi_0 \cos \chi$, $p_c = P_0 \sin \chi_0 \sin \chi$, where P_0 is the tensile stress referred to the initial cross section, and χ is the angle of inclination of the basal plane toward the axis of the specimen for a given deformation ϵ . The validity of the function $c_{\max}(\tau)$ was proved by a series of specimens with

$\chi_0 = 21^\circ$, and specimens with χ_0 varying from 16° to 67° showed the correctness of the relation (2) by Griffith. A study of cracks of destroyed specimens has shown that the predominant role in the formation of destructive cracks is presumably played by angular or screw dislocations. X

V. N. Rozhanskiy is mentioned. There are 5 figures and 31 references: 21 Soviet-bloc and 10 non-Soviet-bloc.

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S/181/61/003/003/023/030
B102/B205

Mechanism of ...

ASSOCIATION: Otdel dispersnykh sistem Instituta fizicheskoy khimii AN
SSSR Moskva (Department of Disperse Systems of the Institute
of Physical Chemistry of the AS USSR, Moscow)

SUBMITTED: July 28, 1960

X

Card 4/4

SHCHUKIN, Ye.D.; SMIRNOVA, N.V.

Initial plastic deformation of metal crystals. Kristallografiia
6 no.5:787-789 S-0 '61. (MIRA 14:10)

1. Institut fizicheskoy khimii AN SSSR.
(Deformations (Mechanics)) (Metal crystals)

S/020/51/136/006/021/024
B101/B203

~~18.8200~~ also 1448

AUTHORS: Summ, B. D., Goryunov, Yu. V., Pertsov, N. V., Shchukin, Ye. D., and Rebinder, P. A., Academician

TITLE: Cracking in a bent zinc plate with local application of a liquid surface-active metal (mercury)

PERIODICAL: Doklady Akademii nauk SSSR, v. 136, no. 6, 1961, 1392-1395

TEXT: The authors deal with the problem of changing the mechanical properties of metals by the action of surface-active metals. The present paper reports on the action of small mercury drops on cracking in a bent zinc plate. Industrial zinc of the thickness $\delta = 0.8-3$ mm and the width a of up to 50 cm was bent by a force F , as is shown in Fig. 1. In the place of Hg application, the stress p_m was only about 7-8 kg/mm² (tensile strength of Zn about 18 kg/mm²). In the absence of Hg, no considerable residual deformations occurred after 10 min; at a higher load, the zinc could be bent at right angles. If, however, at a p_m of about 7 kg/mm², an Hg drop (mass m about 0.2-40 mg) was applied to the zinc surface

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I

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20644

Cracking in a bent zinc plate with local...

S/020/61/136/006/021/024
B101/B203

X

polished by etching, a crack formed which, in a short time (1-2 sec), adsorbed the entire Hg, and rapidly extended perpendicular to p_m . The rate of extension decreased gradually, and was already very low after 5-10 min. The crack extended over the greater part of its length through the entire thickness δ of the plate. The final length L of the crack depended on the quantity of Hg. On the basis of concepts of the migration of Hg along the cracked surface and the diffusion of Hg into the cracked surface, the authors derived for the length L :

$L = A\delta^{-2/3} m^{2/3}$ ($A = \text{const}$). This equation was confirmed experimentally. Cracking showed three stages. At the first stage, the rate of cracking is constant and independent of m , the mass of the Hg drop. Hg is adsorbed, and distributed over the crack. With increasing volume of the crack, the Hg is no longer sufficient to fill it. This is the beginning of the second stage. Hg is distributed as a liquid phase only on the crack surface. The Hg migrates to the place of destruction, and diffuses into the crack surface at the same time. At the third stage, no more liquid Hg is present. The slow growth of the slit takes place through migration, the Hg adsorbed on the slit wall being redistributed.

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20044

S/020/61/136/006/021/024
B101/B203

Cracking in a bent zinc plate with local...

According to the authors' opinion, a detailed analysis of migration and diffusion, and the reduction in strength of metals under the action of surface-active melts, can be studied by means of such experiments. Furthermore, the kinetics and migration of adsorptive atoms will be studied. There are 4 figures and 4 Soviet-bloc references.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova (Moscow State University imeni M. V. Lomonosov). Institut fizicheskoy khimii Akademii nauk SSSR (Institute of Physical Chemistry of the Academy of Sciences USSR)

SUBMITTED: November 5, 1960

Card 3/4

SUMM, B.D.; GORYUNOV, Yu.V.; PERTSOV, N.V.; SHCHUKIN, Ye.D.

Spread of mercury over a free zinc surface in connection with a study of strength reduction due to adsorption. Dokl.AN SSSR 137 no.6:1413-1415 Ap '61. (MIRA 14:4)

1. Moskovskiy gosudarstvennyy universitet imeni M.V.Lomonosova.
Predstavleno akademikom P.A.Rebinderom.
(Mercury) (Zinc)

SHCHUKIN YE. D.

PHASE I BOOK EXPLOITATION

SOV/6247

Likhtman, Vladimir Iosifovich, Yevgeniy Dmitriyevich Shchukin, and Petr Aleksandrovich Rebinder

Fiziko-khimicheskaya mekhanika metallov; adsorbtsionnyye yavleniya v protsessakh deformatsii i razrusheniya metallov (Physicochemical Mechanics of Metals; Adsorption Phenomena in Processes of Metal Deformation and Fracture). Moscow, Izd-vo AN SSSR, 1962. 302 p. Errata slip inserted. 7000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut fizicheskoy khimii.

Resp. Ed.: P. A. Rebinder, Academician; Ed.: N. G. Yegorov; Tech. Eds.: L. V. Yepifanova and Yu. V. Rykina.

PURPOSE: This book is intended for scientific research workers and engineers concerned with problems in the physicochemical mechanics of metals.

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Physicochemical Mechanics (Cont.)

SOV/6247

COVERAGE: The book reviews the results of investigations of the adsorption effect, which, in its various manifestations, leads to a decrease in metal strength and facilitation of metal deformation. This general effect comprises the effects of several physicochemical factors affecting the mechanical properties of strained solid bodies; in the opinion of the authors, it deserves the special attention of researchers and production engineers, since a knowledge of it will enable them to control the processes of plastic deformation and fracture of metal and, consequently, to control the treatment of solids and particularly of metals. The whole complex of peculiar physicochemical phenomena which decrease strength through adsorption clearly reveals the effect of surface energy and its changes on the behavior of the strained solid body, which as a rule possesses various structural defects. The authors express their thanks to Academician V. I. Spitsin of the Institute of Physical Chemistry, Academy of Sciences USSR, as well as to Candidates of Chemical Sciences N. V. Smirnova, S. Kh. Zakiyeva, and to Engineer Z. M. Zanozina for their cooperation and assistance. There are 295 references, mostly Soviet.

Card 2/7

S/170/62/005/007/009/010
B104/B112

AUTHORS: Lebedeva, E. M., Shchukin, Ye. D.

TITLE: Destruction of metals along grains and grain boundaries
in the presence of highly adsorption-active metallic melts

PERIODICAL: Inzhenerno-fizicheskiy zhurnal, v. 5, no. 7, 1962, 86-90

NOTE: Results of research on the destruction of polycrystalline specimens of zinc, calcium, and tin in the presence of gallium and mercury, carried out in the years 1956-1961 at the Institute of Physical Chemistry of USSR under the direction of Academician P. A. Rebinder, are reported. Particular attention is paid to the development of transverse cracks in grains which do not occur in the absence of adsorption-active metals. The decrease in strength is due not to intercrystalline corrosion but to a decrease in the surface energy of the metals. There are 2 figures. ✓

ASSOCIATION: Institut fizicheskoy khimii AN SSSR, g. Moskva
(Institute of Physical Chemistry AS USSR, Moscow)

DATE RECEIVED: October 14, 1961

Card 1/1

1962

S/126/62/014/005/008/015
E193/E585

AUTHORS: Summ, B.D., Goryunov, Yu.V., Pertsov, N.V., Traskin, V.Yu.
and Shchukin, Ye.D.

TITLE: Propagation of cracks in zinc plates deformed in the
presence of an isolated molten drop of a surface-active
metal

PERIODICAL: Fizika metallov i metallovedeniye, v. 14, no. 5,
1962, 757 - 765

TEXT: In continuation of earlier work (B.D. Summ et al - DAN
SSSR, 1961, 156, 1592) the present authors studied the effect of
locally applied drops of molten mercury and gallium on the resis-
tance of zinc to fracture. The experiments with mercury were
conducted at room temperature on technical grade, 98.7% pure, zinc
specimens, 0.8 - 5.0 mm thick and up to 50 cm wide. Specimens of
this type, gripped at one end in the horizontal position, could be
bent through 90° without formation of visible cracks in the absence
of a surface-active substance. If, however, a drop (0.2 - 40 mg)
of mercury was placed on the upper surface of the test piece in
its central line, 15 - 30mm from the fixed end, a crack was formed
Card 1/4

Propagation of cracks

S/126/62/014/005/008/015
E195/E385

beneath the mercury drop when the bending moment reached a value producing a constant tensile stress of $7 - 8 \text{ kg/mm}^2$ (in the absence of mercury this stress was barely sufficient to cause a slight plastic strain). The crack absorbed all the liquid mercury in a fraction of a second and continued to increase at a progressively diminishing rate in the direction normal to the tensile stress its length (in the case of a 40 mg mercury drop) after 1, 5 and 240 sec being, respectively, 15, 52 and 120 mm. Depending on the mass m of the mercury drop, the time t required for the crack to reach its final length L varied from 15 min (for larger drops) to several days (for small drops). With increasing m and decreasing thickness d of the specimen, L increased; the variation in L could be described by $L \sim m^{2/5}$ at a constant d . According to the present authors the magnitude of L was determined by two competing processes: a) spreading of the mercury drop on the walls of the crack from the point of application towards the ends of the crack and b) penetration of the mercury into the metal through the walls of the crack. Equations were derived describing the kinetics of these processes. Analysis of these equations showed that the latter process was not due to

✓

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Propagation of cracks

S/126/62/014/005/008/015
E195/E385

accelerated volume diffusion alone but was a result of several processes which included the following: formation and growth of a network of ultramicroscopic cracks on the walls of the main crack; spreading of mercury in these cracks by the mechanism of both capillary flow and two-dimensional migration; formation of two-dimensional defects on the walls of the main crack and spreading of mercury on these defects by the mechanism of two-dimensional migration; volume diffusion. If a bending moment considerably longer than the minimum required to trigger-off the process of crack-formation was applied to the zinc plate, microscopic cracks branching-off the main crack were formed; as a result, the final length of the main crack decreased with increasing applied stress. This effect was particularly noticeable in experiments conducted at a constant load as opposed to those conducted at a constant tensile stress. The experiments with gallium were conducted at 35 - 36 °C. In this case, there was a time lag between the application of stress and formation of a crack in the zinc specimen, the time lag decreasing with increasing stress. The rate at which gallium filled the crack was relatively slow and the rate of growth sharply decreased from the moment at which the entire volume of the

Card 3/4

f

Propagation of cracks

S/126/62/014/005/008/015
E193/E363

gallium drop was drawn from the specimen surface into the crack. Cracks formed under the action of liquid gallium had a stronger tendency to branch off and the relationship between L and m was described by $L \sim m^{0.5}$. These differences were attributed to the fact that the surface energy of zinc was decreased more by gallium than by mercury and that liquid gallium - in contrast to mercury - did not spread on a flat zinc surface except by the mechanism of surface diffusion. Exploratory experiments of a similar nature were also conducted on cadmium. No crack-formation was observed, in this case, in the presence of liquid mercury. Cracking of cadmium in contact with liquid gallium occurred only at high loading rates: even then, a crack was formed only if the cadmium specimen had been in contact with liquid gallium for at least 20 - 30 min before the stress was applied. There are 5 figures.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. N.V.
Lomonosova (Moscow State University im. N.V.
Lomonosov)

SUBMITTED: March 3, 1962

Card 4/4

41338

S/O20/62/146/003/016/019
B101/B144

11/2/00

AUTHORS: Goryunov, Yu. V., Pertsov, N. V., Summ, B. D., Shchukin, Ye. D.

TITLE: Effect of the microrelief on the rules governing the propagation of liquid metal on a solid metal surface

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 146, no. 3, 1962, 638-641 ✓

TEXT: When the propagation of mercury on a backing of crystalline zinc freed from the oxide film by NH_3 was being studied, two types of propagation dependent on the microrelief were observed for the first time: wetting and diffusion. These processes differ essentially in their mechanisms. On a smooth zinc surface the mercury forms as a drop with the edge of contact $\vartheta = 70^\circ$. A dull spot propagates from the periphery of the drop, showing the time dependence $r \sim t^{0.5}$ which is characteristic of diffusion processes. The mass m of the drop does not affect the propagation velocity. For smooth zinc lamellas dipped obliquely into mercury, this velocity does not depend on the angle of inclination. The rate of

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Effect of the microrelief ...

S/020/62/146/003/016/019
B101/B144

diffusion increases with rising temperature owing to the temperature dependence of the diffusion coefficient: $D_{surf} \sim \exp(-U/kT)$, where U = activation energy. On zinc surfaces roughened by etching with HNO_3 the mercury drop forms no constant edge of contact, and the spot propagates by the movement of the liquid Hg layer. The rise of Hg on rough surfaces depends on the angle of inclination of the surface and on the mass of the drop. $r = (6m\Delta\sigma/\pi\eta\delta)^{1/4}t^{1/4} = At^{1/4}$ holds, which is in good agreement with the experimentally determined dependence $r \sim t^{0.3}$. $\Delta\sigma = \sigma_{32} - \sigma_{12} - \sigma_{31}$, where σ_{12} , σ_{32} , σ_{31} are the specific free surface energies of the liquid at its interface with the medium, the solid at its interface with the medium and the solid at its interface with the liquid, respectively; η = viscosity of Hg, δ = density of Hg. If the smooth surface has a groove in the form of an isosceles triangle with the interior angle α , the Hg will flow along the groove if $\theta < (180 - \alpha)/2$. Examination of the profilograms of differently roughened surfaces confirmed that wetting occurred instead of diffusion if $\alpha \sim 160^\circ$. Conclusions: On an ideally smooth surface, and under the action of surface tension alone, a thin liquid layer will not spread as the migration of liquid atoms

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Effect of the microrelief ...

S/020/62/146/003/016/019
B101/B144

reduces the surface energy of the solid ahead of the propagation front. If a surface has no microrelief, no wetting will occur. Similar studies might be of value for analyzing the propagation of liquids on liquid surfaces. There are 4 figures.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova
(Moscow State University imeni M. V. Lomonosov) *f*

PRESENTED: May 23, 1962, by P. A. Rebinder, Academician

SUBMITTED: May 15, 1962

Card 3/3

SECHUKIN, YE. D.

Dissertation defended for the degree of Doctor of Physicomathematical Sciences at the Institute of Physical Chemistry of 1962:

"Investigation of Regularities and the Mechanism of the Effect of Adsorptional-Active Metal Melts on the Mechanical Properties of Solid-Metals."

Vest. Akad. Nauk SSSR. No. 4, Moscow, 1963, pages 119-145

S/070/63/008/001/011/024
E132/E460

AUTHORS: Shchukin, Ye.D., Kochanova, L.A., Pertsov, A.V.

TITLE: The temperature at which the transition from
brittleness to plasticity occurs when the strength is
lowered by absorption effects

PERIODICAL: Kristallografiya, v.8, no.1, 1963, 69-74

TEXT: It was shown earlier that single crystals of Zn, coated
with a thin layer of Hg, show a brittle fracture
at room temperature for very low strains because of the reduction
in strength by the absorption effect. Without Hg, brittle
fracture occurs only at low temperatures. The brittleness is
related to the stability of a crack. Here, rods of Zn of
varying purity, with and without amalgamation, have been pulled at
a constant rate of deformation (10%/min) at temperatures from
-200 to +200°C. The plasticity (limiting crystallographic slip)
and strength $K = (p_c t_c)^{1/2}$ where p_c is the critical normal
strain and t_c the critical shear strain, are plotted against
temperature. It seems that the differences are connected with the
greater strength of the pinning of dislocations in amalgamated
Card 1/2

S/070/63/008/001/011/024
E132/E460

The temperature at which ...

crystals as a result of the absorption on to the dislocations of atoms of Hg. However, the matter is not simple and it may be that Hg only fixes dislocations near growing cracks into which Hg atoms penetrate from the surface, the effects in the bulk of the material being small. Similar phenomena have been observed with Zn crystals coated with Ga but an accompanying development of plasticity did not take place. There are 4 figures. ✓

ASSOCIATION: Institut fizicheskoy khimii AN SSSR
(Institute of Physical Chemistry AS USSR)

SUBMITTED: February 14, 1962

Card 2/2

PERTSOV, A. V. ; PERTSOV, N. V. and SHCHUKIN, Ye. D.

"About the Spontaneous Inner Dispersion of Metals Subjected to the Action of Metal Fusions Considerable Lowering Surface Tension."

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

GORYUNOV, Yu.V.; SUMM, B.D.; SHCHUKIN, Ye.D.; REBINDER, P.A., akademik

Role of kinetic factors in the reduction of metal strength
by adsorption. Dokl. AN SSSR 153 no.3:634-637 N '63.

(MIRA 17:1)

1. Moskovskiy gosudarstvennyy universitet im. M.V. Lomonosova.

REBINDER, P.A., akademik; SHCHUKIN, Ye.D.; MARGOLIS, L. Ya.

Mechanical strength of porous disperse bodies. Dokl. AN SSSR
154 no. 3:695-698 Ja '64. (MIRA 17:5)

1. Institut fizicheskoy khimii AN SSSR i Institut khimicheskoy
fiziki AN SSSR.

PERTSOV, A.V.; MIRKIN, L.I.; PERTSOV, N.V.; SHCHUKIN, Ye.D.

Spontaneous dispersion under conditions of a strongly reduced free inter-
phase energy. Dokl. AN SSSR 158 no.5:1166-1168 0 '64.

(MIRA 17:10)

1. Moskovskiy gosudarstvennyy universitet im. M.V.Lomonosova. Pred-
stavleno akademikom P.A.Rebinderom.

SECRET

Certain problems involved in the physicochemical theory of the stability of finely dispersed porous materials: catalysts and sorbents. *Kin. i kat.* 6 no.4:641-650 JI-Ag '65. (MIRA 18:9)

1. Institut fizicheskoy khimii AN SSSR.

L 62537-65 EWP(c)/EWP(k)/EWT(d)/EWT(m)/EWP(i)/ETG(m)/EWP(b)/T/EWP(l)/EWP(e)/EWP(v)

Pf-l/Pq-l WW/JAJ/WH

ACCESSION NR: AP5012647

UR/0369/65/001/002/0127/0133

AUTHOR: Shchukin, Ye. D.; Kochanova, L. A.; Zanozina, Z. M.

40
33
B

TITLE: The effect of microscopic surface flaws on the strength of glass

SOURCE: Fiziko-khimicheskaya mekhanika materialov, v. 1, no. 2, 1965, 127-133

TOPIC TAGS: glass, glass property, breaking strength, flaw detection

ABSTRACT: The authors review previously published material on breaking of non-crystalline materials, especially glass, under loading. The effect of structural defects in glass is studied by creating artificial microscopic defects in the surface layer, lowering the resistance of the samples tested. Indentations were made in the center of 25 x 25 mm samples 1.3-1.4 mm thick and the resistance of the samples was measured. When indentations are made at various distances from the center, the resistance of the sample grows with an increase in distance. The nature of distortion is studied microscopically. Two methods are described to separate the effect of cracks and of the indentation itself from effects of residual deformation and stresses. The use of the simple method of imposing artificial indentations can be used to evaluate real defects in glass and help to determine equivalent charac-

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L 62537-65

ACCESSION NR: AP5012647

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teristics and investigate the role of local concentrations of deformations and stresses in the breaking of glass. Analogies may be drawn between the principles and mechanism of the breaking of crystalline and non-crystalline bodies. The possibilities of expanding these analogies are discussed. "The authors give sincere thanks to F. F. Vitman and V. I. Likhtman for much valuable advice during this work, and to G. V. Kurdyumov, Yu. A. Osip'yan, V. A. Indenbom and V. I. Shelyubskiy for participating in discussion of the results." Orig. art. has: 4 figures, 2 tables.

ASSOCIATION: Institut fizicheskoy khimii AN SSSR, Moscow (Institute of Physical Chemistry, AN SSSR)

SUBMITTED: 15Oct64

ENCL: 00

SUB CODE: MT

NO REF SOV: 012

OTHER: 003

Mc
Card 2/2

L 58557-65 EWP(e)/EWT(m)/EWP(i)/EWP(b) Pg-4 WH

ACCESSION NR: AP5007560

S/0020/65/160/005/1061/1064

AUTHORS: Shchukin, Ye. D.; Kochanova, L. A.; Zanozina, Z. M. 26
B

TITLE: Some regularities in the influence of defects on the strength of glass

SOURCE: AN SSSR. Doklady, v. 160, no. 5, 1965, 1061-1064

TOPIC TAGS: glass, glass flaws, glass strength

ABSTRACT: The purpose of this investigation was to obtain a quantitative description of the effect of defects in the structure of glass,¹⁵ by producing in its surface layer artificial microscopic defects causing a decrease in the strength of the sample, thereby imitating real defects. Particular interest was attached to defects characterized by the concentration of residual deformations and accordingly by the stress concentration, so as to trace the influence of such defects on the strength of samples. The defects were produced by pricking with a diamond indenter. Tests made on various samples,

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L 58557-65

ACCESSION NR: AP5007560

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both accompanied and unaccompanied by annealing, and also samples in which no other flaws existed other than those produced artificially, have shown that real defects existing in glass and determining its resistance to failure are equivalent to indentations made artificially by a diamond, within a definite load interval. The results make it possible therefore not only to estimate the effect of real defects of the glass structure and express them in quantitative manner, but also to investigate the role that local concentration of strains and stresses can play in processes that lead to the failure of glass. The results have a bearing on efforts made by others to produce high-strength glass. The authors thank F. F. Vitman and V. I. Likhtman for valuable advice and G. V. Kurdyumov, Yu. A. Osip'yan, V. L. Indenbom, and V. I. Shelyubskiy for participating in a discussion of the results. This report was presented by P. A. Rebinder. Original article has: 3 figures and 2 tables

ASSOCIATION: Otdel dispersnykh sistem Instituta fizicheskoy khimii Akademii nauk SSSR (Division of Disperse Systems, Institute of Physical Chemistry, Academy of Sciences SSSR)

Card 2/3

L 58557-65

ACCESSION NR: AP5007560

SUBMITTED: 18Sep64

ENCL: 00

SUB CODE: MT

NR REF SOV: 007

OTHER: 001

Card 3/3 *dar*