Thermoelastic Phenomena in Synthetic Rubbers at Adiabatic Deformation Reaching the Break. 57-10-15/33

tion a reduction of the heat emission was observed within the range of strong tensions a short time before the break, caused by the solidification of the material.
There are 2 figures, 1 table, 5 Slavic references.

ASSOCIATION: Leningrad Polytechnical Institute imeni Kalinin M. I. (Leningradskiy politekhnicheskiy institut imeni M. I, Kalinina).

SUBMITTED: April 18, 1957.

AVAILABLE: Library of Congress.

Card 2/2

Kuvshinskiy, Ye.V.

AUTHORS: Votinov, M. P., Sul'zhenko, L. L., Kuvshinskiy, Ye.V. 57-10-16/33

TITLE: Thermoelastic Phenomena in Rubbers out of Natural Caoutchous at Cyclic Deformation (**Termouprugiye** yavleniya v rezinakh iz natural'nogo kauchuka pri tsiklicheskom deformirovanii)

PERIODICAL: Zhurnal Tekhn. Fiz., 1957, Vol. 27, Nr 10, pp. 2307-2313 (USSR)

ABSTRACT: The thermoelastic properties of the natural caoutchouc were investigated according to the method of the adiabatic expansion in the cycle: expansion- shrinking. The deformation velocity amounted to 100 % per second. The patterns differed by vulcanization mode and the kind of the dispersed filler. It is shown that the initial stages of the extension in the case of non-filled ($\lambda \leqslant 4,5$) and filled ($\lambda \leqslant 1,8$ to 4) rubbers are characterized by a heat emission equivalent to the deformation work. The further deformation is accompanied by an emission of the surplus heat effected by the crystallization of the rubber. Furthermore it is shown that the beginn of crystallization and its degree depends in the case of a given prolongation on the vulcanization process as well as on the nature of the dispersing filler. Rubbers of greater inflexibility crystallize not so well. The active filler- and the channel soot supports the crystallization to a greater extent than chalk and silica gel. A deformation velocity of 100% per second guarantees the aciabatic course of the measu-

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Thermoelastic Phenomena in Rubbers out of Natural Caoutchous at Cyclic Deformation. 57-10-16/33

rements without additional measures. It is determined that the mistakes in the quantitative analysis of the processes in rubbers in the case of adiabatic extension are connected with the ignorance of the real amount of the specific heat and with the inexactness in the determination of the prolongation in the case of shrinking which is especially essential. There are 3 figures and 5 Slavic references.

ASSOCIATION: Polytechnical Institute imeni Kalinin M. I., Leningrad (Politekhnicheskiy institut imeni M. I. Kalinina, Leningrad)

SUBMITTED: April 18, 1957

AVAILABLE: Library of Congress.

Card 2/2

Kuvshinskiy, Ye. V.

AUTHORS: Votinov, M. P., and Kuvshinskiy, Ye. V. 57-11-17/33

TITLE: Regularities of the Transformation of Work into Heat at Adiabatic Deformation of Rubbers Obtained from Butyl-Caoutchouc (Zakonomernosti prevrashcheniya raboty v teplo pri adiabaticheskom deformirovanii rezin iz butil-kauchuka).

PERIODICAL: Zhurnal Tekhn. Fiz., 1957, Vol. 27, Nr 11, pp. 2554-2572 (USSR).

ABSTRACT: The thermoelastic properties of rubber produced from butyl-caoutchouc according to the method of abiabatic extension were investigated. The authors show that in the case of non-filled rubbers the begin of crystallization occurs at an extension degree of $\lambda > 7$. Vulcanization products with a gas-soot filling do not crystallize at a deformation of up to $\lambda \approx 9,6$. The initial stages of deformation are accompanied by a cooling-down of 1°C. The analysis given here made it possible to prize the regularities in a rubber produced from butyl-caoutchouc without filler in the case of extension as well as to determine the lack of crystallization processes in rubbers with soot filling up to 9-fold extension.
There are 1 figure and 3 Slavic references.

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57-11-17/33

Regularities of the Transformation of Work into Heat at Adiabatic Deformation of Rubbers Obtained from Butyl-Caoutchouc.

ASSOCIATION: Polytechnical Institute imeni M. I. Kalinin (Politekhnicheskiy institut imeni M. I. Kalinina).

SUBMITTED: April 23, 1957.

AVAILABLE: Library of Congress.

Card 2/2

KUVSHINSKIY, E. V., LEBEDEV, G. A., ZAKHAROV, S. K. and BESSONOV, M. I.

"Mechanical Rupture of Hard Polymer Materials."

report presented at the Conf. on Mechanical Properties of Non-Metallic Solids, Leningrad, USSR, 19-26 May 1958.

Inst. High Molecular Compounds, Acad. Sci. USSR, Leningrad.

SOV/57-58-8-[illegible]/37

AUTHORS: Sidorovich, A. V., Kuvshinskiy, Ye. V.

TITLE: Determination of Dynamic Mechanical Characteristics of Materials by the Excitation of Bending Vibrations in a Thin Plate Restrained at One End(Opredeleniye dinamicheskikh mekhanicheskikh kharakteristik materialov metodom vozbuzhdeniya kolebaniy izgiba v tonkoy plastine, zazhatoy odnim kontsom)

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1958, Nr 8, pp 1759 - 1767 (USSR)

ABSTRACT: In this paper a theory of the determination of dynamic mechanical characteristics of materials from vibration tests with a thin plate restrained at one end is developed. Existing theories are based upon the assumption that the tangent of the loss angle is small and that the dynamical modulus and the loss angle vary with frequency as in a Kelvin (Kel'vin)-Foykht body (Refs 1 and 2). Since materials were to be investigated which exhibit a great loss angle and the dynamical characteristics of which gradually vary with the frequency, a theory had to be developed neglecting the frequency dependence of these properties within the limits of the half width of the resonance curve. Equations describing the resonance curves

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Determination of Dynamic Mechanical Characteristics of Materials by the Excitation of Bending Vibrations in a Thin Plate Restrained at One End

SOV/57-58-8-25/37

of materials with a loss angle as high as tgδ = 1 were deduced. The functional relations of this quantity with the half-width of the resonance curve and with the ratio of resonance amplitudes $\left|\frac{Y_0}{Y_1}\right|_{\text{resonance}}$ were determined. In order to specify the limits of applicability of the formulae deduced the errors in the determination of the loss angle and of the dynamic modulus of two models were analyzed. These models are the Kelvin-Foykht and the Maxwell (Maksvell) body which represent diametrically opposite cases of a pronounced variation of the properties with the frequency. Since all formulae were deduced under the assumption that tgδ and the absolute value of the dynamic modulus $|E_d|$ is independent of the frequency it was desired to know the conditions which actually permit to neglect the frequency dependence. This is the case within a variation of

Card 2/4

Determination of Dynamic Mechanical Characteristics of Materials by the Excitation of Bending Vibrations in a Thin Plate Restrained at One End SOV/57-28-8-23/37

$tg\delta \leqslant 0,6$ whereas outside of this limit this is justifiable only after a critical analysis of the frequency dependence. The maximum error encountered in a Maxwell body at $tg\delta = 0,6$ is 9,3%. A method for the linearization of the resonance curves is presented. From the analysis of the errors it can be concluded that this method seems acceptable for the linearization of the two models in question at least for values of $tg\delta$ not exceeding 0,6. There are 4 figures, 5 tables, and 2 references, 0 of which is Soviet.

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy AN SSSR Leningrad (Institute of High-Molecular Compounds, AS USSR, Leningrad)

SUBMITTED: August 2, 1957

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Determination of Dynamic Mechanical Characteristics of Materials by the Excitation of Bending Vibrations in a Thin Plate Restrained at One End SOV/57-58-6-25/3

Card 4/4

AUTHORS: Volodin, V. P., Kuvshinskiy, Ye. V. SOV/57-28-7-10/35

TITLE: The Influence of Vulcanization on the Dielectric Properties of Rubbers on the Basis of SKS-30A Rubber (Vliyaniye vulkanizatsii na dielektricheskiye svoystva rezin na osnove kauchuka CKC-30A)

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1958, Vol. 28, Nr 7, pp. 1424 - 1427 (USSR)

ABSTRACT: The variation of the dielectric properties on the basis of the divinyl styrene rubber SKS 30A during the sulfur vulcanization in the presence of the accelerator diphenyl guanidine was observed. For this purpose a series of vulcanizers were investigated which differed according to their sulfur content and vulcanization time. The amount of the conditional-equilibrium-modulus E_{y-p} was assumed to be characteristic for the vulcanization depth. It is determined according to the stress which remains after the relaxation for one hour at 60°C. The possibility of using this amount for this purpose was proved already earlier by the authors (Ref 1). The investigation of the dielectric properties of the vulcanizers was carried out by means of an audio-frequency bridge. It is shown that with the increase of the

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The Influence of Vulcanization on the Dielectric Properties of Rubbers on the Basis of SKS 30A Rubber SOV/[illegible] 7-10/35

vulcanization depth the vitrification temperature $T_{з}$ rises which is confirmed by the immediate measurements of this quantity carried out at the VNIISK imeni Lebedev. The increase of the vulcanization depth leads to the increase of the maximum value for tgδ. This effect is explained by the fact that the number of the adhesion places - of the polar sulfur bridges - rises with the increase of the vulcanization depth. It is shown that the "activation energy" of the dielectric relaxation process in the investigated temperature range is equal in the case of all vulcanizers (28 ± 2 kcal/mole), i.e. does not depend on the vulcanization depth. Maxima of tgδ were detected as well in the range of high temperatures. These are especially visible in the case of rubbers which are to a small extent vulcanized, and vanish in the case of rubbers which are to a great extent vulcanized. These maxima also shift with the frequency alteration according to the temperature scale. In order to detect this phenomenon measurements of tgδ were carried out in the case of rubber mixtures with single ingredients which belong to the

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dispensing of the vulcanizers (stearic acid, magnesium oxide, rubberax, diphenyl guanidine, sulfur). On this occasion it was found that the occurrence of a high maximum value of tgδ in the range of positive temperatures is caused by the presence of diphenyl guanidine in rubber. The presence of other ingredients in rubber up to four parts by weight does not influence considerably the temperature dependence of tgδ. The experiments showed that diphenyl guanidine has a high electric conductivity which is to a great extent dependent on the temperature. The presence of such a substance in the rubber in dispersed state is bound to lead to the development of the "unusual" temperature dependence, i.e. to the "Wagner" losses (Ref 3) which according to their nature are conduction losses. The vanishing of the "Wagner" losses with the increase of the vulcanization depth is connected with the progressive decomposition of the diphenyl guanidine. Thus the investigation of the dielectric properties of rubbers at different vulcanization stages offers the possibility of investigating the kinetics of the sulfur vulcanization process and to observe especially the consumption of the

The Influence of Vulcanization on the Dielectric Properties of Rubbers on the Basis of SKS-30A Rubber

SOV/57-27-7-10/35

accelerator the diphenyl guanidine There are 4 figures, 2 tables, and 3 Soviet references.

ASSOCIATION: Leningradskiy politekhnicheskiy institut im. M I Kalinina (Leningrad Polytechnical Institute imeni M I Kalinin)

SUBMITTED: July 11, 1957

1 Rubber--Dielectric properties 2 Vulcanizates--Test results

Card 4/4

SOV/57-28-7-16/35

AUTHORS: Volodin, V. P., Kuvshinskiy, Ye. V.

TITLE: On the Effect of "Negative Friction" in Plants Using the "Method of Force and Velocity" and the Means for Its Elimination (Ob effekte "otritsatel'nogo treniya" v ustanovkakh, realizuyushchikh metod "sily i skorosti", i puti yego ustraneniya)

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1958, Vol. 28, Nr 7, pp. 1452-1458 (USSR)

ABSTRACT: The range of working frequencies in plants using the "method of force and velocity" is limited at the high-frequency side by a number of phenomena. These lead to the fact that the measured effective part of impedance adopts an absurd negative value. The authors investigated the rules governing such an effect of negative friction as well as the causes for its development, viz. the causes connected with the electric phenomena in the electrodynamic transformer and with the mechanical properties. The following is shown: In order to prevent the "catching up" of the phase ($\varphi_k \neq 0$) of the great demands have to be made on the construction of the

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SOV/57-28-7-16/35

On the Effect of "Negative Friction" in Plants Using the "Method of Force and Velocity" and the Means for Its Elimination

moving system and of the apparatus itself: With small mass the coil support must be very rigid, the material of the support must be non-conductive, and no parts must exist in the body of the transformer that give way. φ_k denotes the additional phase shift dependent on the frequency. Based on the experimental investigation of the phase frequency dependence the following is found: 1) The difference between the experimental data and the predictions of theory, i.e. the deviation from formula (1) must mainly be attributed to the anomalous phase frequency dependence. 2) The anomaly of the phase frequency dependence consists of the superposition of the additional $\varphi_k = f(\omega)$ on the basic phase frequency dependence. ω denotes the angular frequency.
3) The linear dependence of φ_k on the frequency makes it possible to take φ_k into account in a simple way and to compensate for it; this again makes it possible to extend the working range of the apparatus using the method of force and velocity.
The formula (1) reads: $\delta_M = KE$.

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SOV/57-23-7-16/35

On the Effect of "Negative Friction" in Plants Using the "Method of Force and Velocity" and the Means for Its Elimination

The direct measurement is based on the electric equivalent of the mechanical impedance E which by the formula (1) is connected with the mechanical impedance of the investigated system Z_M.

K denotes the factor of the electromechanical coupling depending on the construction of the apparatus, which is experimentally determined. There are 2 figures, 1 table, and 9 references, 6 of which are Soviet.

ASSOCIATION: Leningradskiy politekhnicheskiy institut imeni M. I. Kalinina (Leningrad Polytechnical Institute imeni M. I. Kalinin)

SUBMITTED: July 11, 1957

1. Electrical networks--Analysis 2. Industrial plants--Equipment

Card 3/3

[illegible]: Vol[illegible]nov, M. P., Kuvshinskiy, Ye. V. [illegible] 28 [illegible]

[illegible]: Investigation of Natural Rubber Vulcanizates by the Method [illegible] (Issledovaniye vulkanizatov naturalnogo [illegible])

[illegible]: [illegible], 1958, /Vol 28, Nr [illegible], pp. [illegible] (USSR)

[illegible]: [illegible] 2 vulcanising agents for natural rubber were investigated [illegible] by [illegible]

[illegible] were and [illegible] on samples which had not been previously stretched. The composit[illegible] [illegible] 1 - [illegible] at -1[illegible], +[illegible] and +8[illegible]° of [illegible] natural rubber NR by the [illegible]

[illegible] -28- [illegible]

Invest[illegible] of [illegible] Rubber Elongated by the Method of [illegible] tration

[illegible] crystallization. The formation of the crystalline phase leads to a loss of [illegible] in [illegible]. [illegible] references, [illegible] which are Soviet.

ASSOCIATION: [illegible] Institut [illegible] [illegible] Chair of the Physics of Dielectrics

Card 2/2

AUTHORS: Melekhina, Ye. V., Kuvshinskiy, Ye. V. 76-32-5-8/47

TITLE: Kinetics of the High Pressure Polymerization of Methylmethacrylate(Kinetika polimerizatsii metilmetakrilata pri vysokikh davleniyakh)

PERIODICAL: Zhurnal fizicheskoy khimii, 1958, Vol. 32, Nr 5, pp. 1016--1022 (USSR)

ABSTRACT: The present work is a completion of the paper L.F. Vereshchagin, V.A. Derevitskaya and Z.A. Rogovin (Ref 1) with the main attention in the kinetics being paid to the injected polymerization. Benzoylperoxide was used to 0,2 percent by weight and the experiments were carried out at pressures of 1 kg/cm^2 at 5o-7o^{o}C and of 1ooo-45oo kg/cm^2 at 25-5o^{o}C. The kinetics were determined according to the dilatometric method by which means polymerization depths of to about 3o% could be determined with an accuracy of 0,1% while with pressures of above 1ooo kg/cm^2 the dilatometric method according to Ye.V. Kuvshinskiy and A.S. Semenova (Ref 3) was applied. For filling the ampoules with the monomer a special vacuum plant was constructed the scheme of which as well as the working technique are given. From a graphically shown curve can be seen that the

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course of polymerization can be divided into four sections; the experiments on the influence of the injection concentration on the polymerization kinetics on the other hand show that the moment of reaching the same polamerization depth is inversely propotional and the reaction velocity is directly proportional to $\sqrt{c}$. The temperature dependence of the reaction velocity is shown by a number of isobars while from a diagram it can be seen that with the increase of pressure the activation heat decreases and that on the other hand the rise of pressure effects an increase of the polymerization velocity. The increase of the polymerization degree was first observed by Norrish and Brookman (Ref 6), while the increase of the polymerization velocity and the increase of the molecular weight, not observed in the case of styrene, is explained by the occurrence of the jelly effect. Finally the authors point out that in using high pressures new elementary reactions of polymerization were observed. There are 9 figures, 1 table, and 10 references, 7 of which are Soviet.

Kinetics of the High Pressure Polymerization of Methylmethacrylate

76-32-5-8/47

ASSOCIATION: Politekhnicheskiy institut im. M.I. Kalinina, Leningrad (Leningrad Polytechnical Institute imeni M.I. Kalinin)

SUBMITTED: November 9, 1956

1. Acrylic resins--Polymerization 2. Polymerization--Analysis 3. Mathematics--Applications

Card 3/3

VOTINOV, M.P.; SUBBOTIN, S.A.; SAMOLETOVA, V.V.; KOPYTOVSKAYA, S.P.; KUVSHINSKIY, Ye.V.

Investigating the crystallizability of "SKI" vulcanized rubber by the method of adiabiatic stretching. Vysokom.soed. 1 no.7:1016-1020 Jl '59. (MIRA 12:11)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut sinteticheskogo kauchuka.

(Rubber, Synthetic)

SOV/181-1-9-20/31

15(8)

AUTHORS: Bessonov, M. I., Kuvshinskiy, Ye. V.

TITLE: Cracks in Transparent Plastics, Their Growth and Structure

PERIODICAL: Fizika tverdogo tela, 1959, Vol 1, Nr 9, pp 1441 - 1447 (USSR)

ABSTRACT: In the present paper the authors describe an interference
method for the investigation of cracks in the interior of a
transparent material. They investigated the growth of cracks
in samples of rectangular and round cross section from poly-
styrene and polymethyl methacrylate (PMMA) with 2% plastifier -
dibutylphthalate. The cracks were produced by the action of
some kg/mm². Figure 1 shows a typical picture of microcracks
formed in the PMMA in penetrating light. Figure 2 is a
schematic representation of the possible observation direct-
ions. Next, the authors discuss the investigation results
shown in numerous figures (photos are enlarged 22, 40, 60,
or 120x). Figure 3a shows PMMA ($\sigma = 5$ kg/mm², $t^0 = 20^0$C) a side
view in penetrating light; the cracks penetrate 0.2 to 0.3 mm
into the depth of the material. Figure 2b shows the inter-
ference picture of such cracks: strip sets of the shape of cut
parabolas superposing one another (Fig 2b'). Figure 4 shows

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Cracks in Transparent Plastics, Their Growth and Structure SOV/181-1-9-20/31

the reconstruction of form and dimensions of such a crack (the interference picture was taken under green light with 0.53μ) carried out by means of the data obtained from the interference pictures. The angle from the crack walls enclosed in the central part, was found to be $\sim 25'$, the distance between them at the surface $\simeq 4\mu$. A small number of internal cracks was found in the sample interior (Fig 5). Figure 6 is a schematic representation of an instrument for the observation of the crack growth. Figure 7 shows a series of six pictures describing the crack growth in the various stages (PMMA, 4 kg/mm^2, 20°C). Figures 8, 9, and 10 show pictures of individual cracks, figure 9 is the only picture showing cracks in polystyrene, figure 10 shows a single large crack in oriented PMMA. All details concerning the taking of such pictures are dealt with closely. There are 10 figures and 12 references, 9 of which are Soviet.

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy AN SSSR Leningrad (Institute of High-molecular Compounds of the AS USSR, Leningrad)

SUBMITTED: May 5, 1958

Card 2/2

BESSONOV, M.I.; KUVSHINSKIY, Ye.V.

Certain characteristics of the destruction of annealed polystyrene. Vysokom.soed. 1 no.10:1561-1565 O '59.
(MIRA 13:3)

1. Institut vysokomolekulyarnykh soyedineniy AN SSSR.
(Styrene)

28(5) SOV/32-25-9-35/53

AUTHORS: Bessonov, M. I., Kuvshinskiy, Ye. V.

TITLE: Determination of Creeping in Solid Polymers

PERIODICAL: Zavodskaya laboratoriya, 1959, Vol 25, Nr 9, pp 1117-1120 (USSR)

ABSTRACT: Since hitherto there had not been a generally used method and standard device to test the creeping (C) in polymers, the present paper describes a proper method used in the Institute mentioned in the Association. The tests are carried out at constant temperature and constant tensile stress of the sample. To record the course of accumulation of deformations the (C)-curves are plotted automatically, this being especially necessary when the speed of (C) is great, as under high tensions. Microsamples (Fig 1) were tested, which had been heated to 10 to 15° over the softening temperature (ST) beforehand and then slowly cooled down to room temperature. The (ET) of the sample is determined according to the method of the Institut fizicheskikh problem AN SSSR (Institute for Physical Problems of the AS USSR) (Ref 1). The graph of a horizontal thermal chamber (Fig 2), in which stretching is

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Determination of Creeping in Solid Polymers SOV/32-25-9-35/53

carried out under observation of the sample deformation through a measuring microscope and recording the deformation by an electric rheochord transmitter, as well as showing the loading mechanism, is presented. The latter can work in two ways - with a disc and counter weight, as well as with a figured eccenter. Calculation methods for the two types of loading are mentioned. Visual deformation measurements are usually made without correction for "boundary effect". The above mentioned transmitter was linked to a bridge circuit (Fig 4), this again linked to a recording potentiometer of type EPP-09 (scale 30 mv). The absolute maximum measuring error of deformation was ± 0.005 mm. The temperature stabilization in the abovementioned chamber was achieved by means of a direct current - bridge circuit of type UMV and a governing millivoltmeter of type MRShchPr and was ± 0.5° within the temperature range +20 to +200°. There are 4 figures and 8 references, 3 of which are Soviet.

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SOV/32-25-9-35/53

Determination of Creeping in Solid Polymers

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy Akademii nauk SSSR (Institute for High Molecular Compounds of the Academy of Sciences, USSR)

Card 3/3

28(5) SOV/32-25-9-37/53

AUTHORS: Sidorovich, A. V., Kuvshinskiy, Ye. V.

TITLE: Device for the Determination of the Heat Dilatation of Films and Threads

PERIODICAL: Zavodskaya laboratoriya, 1959, Vol 25, Nr 9, pp 1124-1126 (USSR)

ABSTRACT: In investigations concerning the hardening of polymers (P) it is most appropriate to test the linear dilatation of thin (P)-films. Through high-vacuum treatment at increased temperatures low molecular matter and particularly moisture can be practically entirely removed from such samples. An orientation of the macro-molecules in the film, which arises during the production of the film and becomes visible on heating in form of shrinkage and deformation, can be removed through prior heating of the sample in high vacuum to 40-50° over the glazing temperature. An apparatus was constructed which allows quantitative linear dilatometric analysis in the vacuum (10^{-2} - 10^{-5} mm Hg) under dynamically strictly controlled time and temperature conditions (20-250°). The samples can be cooled or heated with homogeneous speed in a range of 0.5°/h to 2°/h, or can be kept at constant temperature with

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SOV/32-25-3-37/53

Device for the Determination of the Heat Dilatation of Films and Threads

an accuracy of ± 0.2° for several days. At the same time as the dilatometric measurements the sample can be weighed. The apparatus (Fig 1) essentially consists of two glass cylinders. In the upper cylinder there is a quartz spiral balance to which the sample is fastened with a quartz thread, so that it hangs in the lower cylinder. To the lower end of the sample another quartz thread is glued (with the adhesive BF-2), so that its lower free end hangs into a tapering part of the lower cylinder, which is fused together. The lower end of the quartz spiral, as well as the free end of the quartz thread hanging from the sample are examined with one cathetometer MIR-1 (with ocular micrometer AM9-2) each. The lower cylinder is situated in an electrical oven. The two glass cylinders can be evacuated. An installation is used for thermal control (Fig 2), containing among other things an automatic transformer LATR-2, millivoltmeter MRShchPr-54, two resistors of the sliding contact rheostat RSP, as well as a sound frequency generator 3G-10. Measurement of the heat elongation of thin quartz threads showed that with frequent heating and cooling very little elongation resulted. Tests concerning the hardening- and softening process of atactic polystyrene through radical

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SOV/32-25-9-37/53

Device for the Determination of the Heat Dilatation of Films and Threads

polymerization showed (Fig 3) that only in the range over 110° the state of polystyrene is clearly determined by temperature. With lower temperatures the length of the sample is dependent on prior thermal treatment. There are 3 figures.

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy Akademii nauk SSSR (Institute for High Molecular Compounds of the Academy of Sciences, USSR)

Card 3/3

5.3830, 5.4100

75336
SOV/57-29-10-13/18

AUTHORS: Sidorovich, A. V., and Kuvshinskiy, Ye. V.

TITLE: Anisotropy of Thermal Expansion of Polytetrafluoroethylene Unidirectionally Rolled

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1959, Vol 29, Nr 10, pp 1271-1272 (USSR)

ABSTRACT: Polytetrafluoroethylene $(-CF_2-CF_2-)_n$ rolled into thin films in either longitudinal or transverse direction, is subjected to heating and cooling, and its anisotropy studied through measurements of its thermal coefficient of linear expansion and observation of phase transition. Sample films were heated from 20° C to 120° C, cooled to -22.5° C, and then heated again to 20° C. The temperature changes were made at the rate of 1.5° C/min. It has been observed that the heating and cooling curves show a high degree of hysteresis. The thermal coefficient of linear expansion in the longitudinal direction of rolling is only about half that obtained

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Anisotropy of Thermal Expansion of Polytetrafluoroethylene Unidirectionally Rolled

[illegible]
SOV/57-29-10-13/18

in films rolled in the transverse direction. Thermal anisotropy is observed at temperatures of [illegible] to 25° C only in films rolled in the transverse direction, whether these are heated or cooled. The observed thermal anisotropy of polytetrafluoroethylene films undirectionally rolled is considered to be very pronounced. There is 1 figure; and 5 references, 3 U.S., 2 U.K.: Rigby, H. A., Bunn, C. W., Nature, N° 4170, 583, 1949; Furukowa, G. T., McCoskey, R. E., King, G. I., J. Res. Nat. Bur. St., 49, Nr 4, R. P. 2364, 1952; Quinn, F. A., Roberts, D. E., Work, R. N., J. Appl. Phys., 22, 1085, 1951; Kirby, R. K., J. Res. Nat. Bur. St. 57, 2, R. P. 2696, 1956; Bunn, C. W., Howells, E. R., Nature, Nr 4429, 549, 1954.

ASSOCIATION: Institute of High-Molecular Compounds, Academy of Sciences, SSSR (Institut vysokomolekulyarnykh soyedineniy, AN, SSSR)

SUBMITTED: April 18, 1959

Card [illegible]

S/181/60/002/01/22/035
B008/B014

AUTHORS: Lebedev, G. A., Kuvshinskiy, Ye. V.

TITLE: Rules Governing the Deformation of Amorphous Polymethylmethacrylate and Polyvinylacetate by Cold Extraction

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 1, pp. 96-105

TEXT: The article under review shows that it is possible to elongate polymers below the temperature of vitrification continuously (without constrictions) and to study the stress-strain curves quantitatively. Samples with a cross section of up to 1 mm^2 were subjected to tensile tests in the temperature range +20 ÷ +160°C. The authors studied polyvinylacetate (PVA) and polymethylmethacrylate (PMMA). The changes in the length and cross section of the samples were examined visually and photographically. Analyses of numerous experiments have shown that stress-strain curves usually show peaks in their initial sections if the sample does not tear up to an elongation of $\sim$ 10 per cent. Contractions were not observed in every case (Fig. 1). It may be assumed that the density of

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Rules Governing the Deformation of Amorphous
Polymethylmethacrylate and Polyvinylacetate
by Cold Extraction

S/181/60/002/01/22/035
B008/B014

the material changes only slightly during the tensile test. Table 1 shows
that the change of (lb^2) does not exceed 2.5 ÷ 1.4% at a degree of elonga-
tion of $1 \leqslant \lambda \leqslant 2.25$. In addition to the stress-strain curves of PVA foil,
Fig. 2 shows drawings of samples elongated to different extents. It was
established that the existence of a peak need not be caused by contrac-
tion. The development of a contraction is always accompanied by a
"plateau" on the stress-strain curve (Section AB in Fig. 1). Relaxation
occurs in addition to elastic deformation (Fig. 3). It was proved that
the increase of stress is actually due to elastic deformation. A theory
of the process of elongation is established on the basis of a gereraliza-
tion of the relations of Maxwell's theory concerning viscous-elastic
media. Theoretical stress-strain curves characterized by a steep rise and
a flat drop are represented in Fig. 4. The descending branch of the
curve (Fig. 4b) represents the dynamic equilibrium between the increase
in stress and its relaxation. A differential method was developed for
analyzing the intermittent stress-strain curve (Figs. 5 and 6). It is
suited for an exact and reliable determination of the differential

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VC

Rules Governing the Deformation of Amorphous
Polymethylmethacrylate and Polyvinylacetate
by Cold Extraction

S/181/60/002/01/22/035
B008/B014

modulus of normal elasticity E and of the rate of relaxation $\frac{\partial\sigma}{\partial t}$ at various stages of deformation. There are 6 figures, 2 tables, and 3 Soviet references.

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy AN SSSR, Leningrad (Institute of High-molecular Compounds, AS USSR, Leningrad)

SUBMITTED: April 14, 1959

VC

Card 3/3

BESSONOV, M.I.; KUVSHINSKIY, Ye.V.

Relation between the static breakdown and deformation of solid amorphous polymers. Vysokom. soed. 2 no. 3:397-403 Mr '60. (MIRA 13:11)

1. Institut vysokomolekulyarnykh soyedineniy AN SSSR.
(Polymers) (Strains and stresses)

17.4312
15.8500 also 2209

83824
S/190/60/002/005/014/015
B004/B067

AUTHORS: Sidorovich, A. V., Kuvshinskiy, Ye. V.

TITLE: Thermomechanical Study of Amorphous and Crystalline Polymers

PERIODICAL: Vysokomolekulyarnyye soyedineniya, 1960, Vol. 2, No. 5, pp. 778-784

TEXT: The authors of the present paper intended to find out whether new plastics can be classified among the known plastics by investigating them thermomechanically. They used an apparatus described in Refs. 4, 5. 50 mm long, 2 - 4 mm wide, and 0.05 - 0.5 mm thick polymer strips were studied by uniaxial, uniform stretching under a load of 20 - 100 kg/cm², with linear temperature rise in the range from -150 to 250°C and a velocity of 0.4 to 100°C/h. From among the amorphous polymers, polystyrene, polyethyleneterephthalate, and the styrene rubber copolymer of the type CKC-80 (SKS-80) were studied (Figs. 1, 2). From among crystalline polymers, isotactic polypropylene, polyethylene, polytetrafluoroethylene and polyethyleneterephthalate (which was caused by heating to pass over into the crystalline state) were investigated (Figs. 5 - 7). Deformation

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83824

Thermomechanical Study of Amorphous and Crystalline Polymers

S/190/60/002/005/014/015
B004/B067

in amorphous polymers depends to a higher degree on stretching than in crystalline polymers. As is shown in Fig. 1, stretched polystyrene 15 resumes its original length as soon as the stretching ceases. The influence exercised by stretching and the rate of heating on the softening temperature is low. In the case of crystalline polymers, however, the thermomechanical curve is more complicated and cannot be characterized by the softening temperature alone. Three sections may be distinguished, namely the region below vitrification, the region of cold flow, and the region of melting. For these polymers the following can be determined by thermomechanical investigation: softening temperature of the amorphous part, melting temperature of the crystalline part, and the temperature of cold flow. On the basis of thermomechanical curves, the thermostabilities 15 of polymers of the same type may be compared (Fig. 8). These curves vary more strongly under the influence of experimental conditions than in the case of amorphous polymers. There are 8 figures and 8 references: 5 Soviet, 2 British, and 1 French.

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy AN SSSR (Institute of High-molecular Compounds of the AS USSR)

SUBMITTED: February 4, 1960

Card 2/2

Kuvshinskiy, Ye. V

S/181/60/002/007/005/042
B006/B070

AUTHORS: Aero, E. L., Kuvshinskiy, Ye. V.

TITLE: The Fundamental Equations of the Theory of Elasticity of Media With Rotational Interaction of Particles 26

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 7, pp. 1399-1409

TEXT: The classical theory, which is based on the assumption of central forces acting between the molecules, is not able to describe many phenomena, for example, the propagation of short waves of sound. In order to be able to explain certain anomalies in the dynamic elasticity of plastics, the authors have developed a phenomenological theory of elasticity of complicated media, taking into account the rotational interaction of particles. In this theory, the particles are regarded not as points, but as extended objects whose distance from each other is equal to their diameter. The action of the particles on one another is described by a system of forces and moments. According to the schematic diagram of Fig. 1, equations for the equilibrium of forces are

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The Fundamental Equations of the Theory of
Elasticity of Media With Rotational Inter-
action of Particles

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BC06/B070

set up, and the interaction of particles in contact with one another is investigated. The motion of a part of the medium enclosed by a surface is investigated, the equation of motion is set up, and expressions for the asymmetric stress tensor σ_{ik}, (Fig. 2), and the micromoment tensor μ_{ik} are discussed. Later, the deformation energy W of an element of the medium is investigated by taking into account the volume- and surface forces and moments. Equations (13) - (16) give integral equations for W. The deformation energy per unit volume is finally given by $dL = \sigma^s_{ik} de_{ik} + \text{dev}\ \mu_{ik} dr_{ik}$. Since, dr_{ik} is a deviator ($dr_{ll}=0$) $\mu_{ik} dr_{ik} \equiv \text{dev}\ \mu_{ik} dr_{ik}$, σ^s_{ik} is the symmetric part of the tensor σ_{ik}, e_{ik} is the "pure" deformation tensor of the classical theory. The properties of the tensor r_{ik} are investigated, and it is designated as the "tensor of small torsion and bending". The authors then investigate the elastic potential and Hooke's law for an isotropic substance of a constant mass,

VC

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in which the interaction of particles leads to distribution of forces and moments on the surface. For the potential, formula (33) is found, e_{ik} and r_{ik} being given by (33a) and (33b). A generalization of the equation of motion is then given, the relation between the components of the deformation tensor are studied, and it is shown that the same relations hold between the components of e_{ik} and r_{ik} tensors (identity theorem of Saint Venant). There are 2 figures and 7 references: 3 Soviet, 2 French, and 1 Indian.

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ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy AN SSSR Leningrad (Institute of High-molecular Compounds of the AS USSR, Leningrad)

SUBMITTED: December 3, 1959

S/190/60/002/010/008/026
B004/B054

AUTHORS: Vershinina, M. P., Kuvshinskiy, Ye. V.

TITLE: Study of the Mechanical Destruction of Polymethyl Methacrylate and Polystyrene on the Basis of Changing Molecular Weight

PERIODICAL: Vysokomolekulyarnyye soyedineniya, 1960, Vol. 2, No. 10, pp. 1486-1493

TEXT: The reduction of the molecular weight of polymers in mechanical crushing observed by various investigators induced the authors to carry out the following experiments: Chips were cut off on a turning lathe from rods of polymethyl methacrylate with a molecular weight determined viscosimetrically in benzene between $0.58\cdot10^6$ and $8.4\cdot10^6$, of polystyrene with a molecular weight between $0.14\cdot10^6$ and $1.4\cdot10^6$. The thickness of chips was varied between 3 and 75 μ, the turning speed between 1.5 and 70 cm/sec. The intrinsic viscosity $[\eta]_{\text{cut}}$ of the chips was determined as a function of the initial intrinsic viscosity $[\eta]_{\text{init}}$ (Fig. 1). The higher the initial molecular weight of the polymer, and the thinner the

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V

chips, the more $[\eta]_{\text{cutt}}$ decreased. This effect is discussed as a consequence of the destruction on the surfaces newly formed during cutting (Fig. 2); a "destruction depth" $g = (\Delta[\eta]/[\eta])\cdot h$, where h is the thickness of the chips. Fig. 3 shows the function $g = g(h)$ which is not linear. Further, the authors experimentally determined $g/h = \Delta[\eta]/[\eta]$ as a function of the cutting speed v (Fig. 4), and the function $g = f(\sqrt{h/v})$ (Fig. 5). The latter yielded a family of curves with linear initial sections having the same tangent. The authors therefore assume diffusion processes. They tried to find a universal curve $g/h = f(\sqrt{1/vh})$. The destruction depth should be determined by the diffusion coefficient D. Fig. 6 shows that no universal curve but another family of curves was obtained. The value of D was found to be 10^{-4} cm^2/sec which does not agree either with the order of magnitude of the gas diffusion (10^{-6} cm^2/sec) or with that of the temperature coefficient of heat conductivity (10^{-3} cm^2/sec). Thus, the destruction processes do not only depend on the rupture of chemical bonds on the cut surface, but they enter deeper layers of the material, develop with time, and are limited by factors which are not yet known. There are 6 figures and 10 references: 16 Soviet and 4 US.

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Study of the Mechanical Destruction of Polymethyl Methacrylate and Polystyrene on the Basis of Changing Molecular Weight

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B004/B054

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy AN SSSR (Institute of High-molecular Compounds of the AS USSR)

SUBMITTED: April 21, 1960

Card 3/3

S/122/60/000/007/005/011
A161/A029

AUTHORS: Bessonov, M.I., Engineer; Zakharov, S.K., Engineer; Kuvshinskiy, Ye.V., Doctor of Physics and Mathematics

15

TITLE: Experience in Determining the Mechanical Properties of Plastics in Microspecimens

✓

PERIODICAL: Vestnik mashinostroyeniya, 1960, No. 7, pp. 41 - 45

TEXT: A new mechanical test system for plastics, requiring specimens of only 30 to 50 g (100 times less than in the existing test methods), has been developed by Institut vysokomolekulyarnykh soyedineniy AN SSSR (High-Molecular Compounds Institute of the AS USSR) in cooperation with industrial institutes. The test system includes tests for softening temperature, specific impact resistance and tension, and, for specific cases, for creep and long-time strength (Ref. 2). The specimens are disks of 10 mm in diameter and 4 or 2 mm thick, 10x10x4 and 15x 10x4 mm plates, and two-lateral blades of 15 to 35 mm long, up to 4 mm wide and with 8 mm transition radii. The softening point is determined in an ИФП (IFP) apparatus (Fig. 1) developed by A.P. Aleksandrov and Yu.S. Lazurkin and built in the workshops of Institut fizicheskikh problem AN SSSR (Institute of Physical

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A161/A029

Experience in Determining the Mechanical Properties of Plastics in Microspecimens

Problems of the AS USSR). The apparatus consists of a copper tray with eight cavities for specimens, a heater placed between the tray and the asbestos cover, a resistance thermometer of 0.1 mm nickel wire wound on mica, an asbestos-lined hood and a support with dial indicator. The thermostatic system is illustrated by a diagram (Fig. 1b). The test consists in determining the penetration depth of a needle (Fig. 2). The curve shape, as in this graph, shows the difference between a "linear" plastic, like organic glass, and "three-dimensional", like ebonite and escapon. The softening point is easily found for the "linear" plastics, only approximately for "loosely joined" (escapon) and not at all for "firmly joined". The "IFP" test takes 4 - 8 h. Impact resistance is tested with a "Dinstat" pendulum frame described in a French source (Ref. 4) on a plate specimen; the tension test machine is shown in a diagram (Fig. 4) and is used for finding the normal modulus of elasticity, relative elongation in rupture, etc. As is known, the mechanical characteristics of plastics very considerably depend on the speed with which the load is applied, and on temperature, but there is yet no industrial machinery for determining such characteristics on "microspecimens" and the described special machine (Fig. 4) had to be built. Detailed design descrip-

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A161/A029

Experience in Determining the Mechanical Properties of Plastics in Microspecimens

tion is given. Figure 4b shows pickups of the machine connected into a bridge fed from a "ЗГ-10" (ZG-10) sound generator by 6 volt current with a 5,000 cycles frequency. The bridge unbalance is proportional to the applied load and is amplified. The applied force ranges are 0 - 5 kg, 15 - 30 kg and 60 - 200 kg, the accuracy is within 1% of the limit load; the thermostatic and cryostatic system makes possible tests in a temperature range between -120 and +250°C. The elongation diagram is recorded on tape. As can be seen in two graphs (Fig. 6) where the results of tests with normal and "micro"-specimens on organic glass and ebonite are compared, the "microspecimens" show practically the same results. It is mentioned that the new test system is analogous to the tests described in Reference 1. The tests are in use since 1954. There are 6 figures and 5 references: 2 Soviet, 2 English and 1 French.

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Card 3/3

15 (3), 28 (5)

S/032/60/026/01/003/052
B010/B123

AUTHORS: Kuvshinskiy, Ye. V., Bessonov, M. I., Zakharov, S. K., Sidorovich, A. V.

TITLE: Answers to the Inquiry About the Test Methods of the Physical and Mechanical Properties of Plastics

I

PERIODICAL: Zavodskaya laboratoriya, 1960, Vol 26, Nr 1, pp 7 - 8 (USSR)

ABSTRACT: The test method and the dynstat type apparatus (Ref 1) may be recommended for the evaluation of the brittleness of plastics. In the institute of the authors successful tests on [illegible] samples were carried out (Ref 2), which can be further recommended. For determining the connection of the structure of plastics and their physical and mechanical properties, [illegible] facts have to be considered. If the influence of the structure upon a certain property is to be evaluated, the characteristics of only this property may be determined. If, however, differences of two (or more) plastics are to be investigated, the thermomechanical properties must be investigated within a wide temperature range and with varying stress. Tensile strength during expansion (and bending) is only to be

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Answers to the Inquiry About the Test Methods of the Physical and Mechanical Properties of Plastics. I

S/032/60/0[illegible]/01/005/0[illegible]
B010/B[illegible]

determined at a single standard deformation rate (but not load rate) which can be easily reproduced. At the same time the durability and creep is to be determined at [illegible]. For determining the heat resistance of plastics the upper limit of temperature of usability of finished products should be fixed and not of the plastic itself, as it depends on the purpose of usability of the finished product. Therefore, the determination technique cannot be universal. The existing apparatus for determining the heat resistance of plastics (Martens, Vick) are technically imperfect and must be substituted by new and modern constructions. The indirect evaluation method of the density determination can be regarded as simple and universal method of determining the degree of crystallization. There are 6 references, 5 of which are Soviet.

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy AN SSSR (Institute of High Molecular Compounds of the AS USSR)

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28 (4)
AUTHORS: **Sidorovich, A. V., Kuvshinskiy, Ye. V.** S/032/60/026/01/033/052
B010/B006

TITLE: Apparatus for Thermomechanical Investigation of Polymers 1 by the Method of Monoaxial Elongation

PERIODICAL: Zavodskaya laboratoriya, 1960, Vol 26, Nr 1, pp 100 - 102 (USSR)

ABSTRACT: An apparatus (Fig 1) was designed for testing thin uniformly heated plastic samples under uniform stress (at monoaxial elongation). A temperature range of -150 to +270° at heating- and cooling rates of 2 to 60°C/hr, loads of 20 g to 3 kg, and sample elongations of 0-50 mm can be applied in the test. Sample strips having a test length of 50 mm, a width of 2-5 mm and a thickness of 0.05 - 0.5 mm are tested. The apparatus contains a device for uniform sample elongation by means of an electric deformation primary element, a thermostating unit, to control heating and cooling rates, and a unit for recording sample deformation and temperature. At the one end, the sample is clamped to a fixed holder, and at the other to a holder attached to a wire rope. The horizontal wire is guided over a pulley, the pan with the weights being attached to the depending end. The pulley has a scale, and is axially firmly attached to a disk. The latter is

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Apparatus for Thermomechanical Investigation of Polymers by the Method of Monoaxial Elongation

S/032/60/026/01/033/052
B010/B006

adjusted as rheochord primary element of sample deformation. The sample itself is placed in a horizontal cylindrical chamber which can be heated by a heating element or cooled by liquid nitrogen. The heating element is fed by an autotransformer of the type LATR-1 and the nitrogen is circulated by a UMT pump. Commutation of the current in the heating element and switching-on of the pump are effected by means of an electronic EPV-01 potentiometer. Furthermore, an RSP rheostat, SD-2 electric motor, KVT-6 potentiometer, VS-12 rectifier, PP potentiometer, and an M-494 microammeter are used. The circuit scheme applied to record sample deformation and temperature is illustrated (Fig 2). Thermomechanical curves for crystalline polyethylene terephthalate obtained by means of the apparatus described above by applying various loads and a temperature increase of 0.9°C/min are given (Fig 3). There are 3 figures.

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy Akademii nauk SSSR (Institute of High-molecular Compounds of the Academy of Sciences, USSR)

Card 2/2

S/032/60/026/012/018/036
B020/B056

AUTHORS: Bessonov, M. I., Vashchenko, V. S., and Kuvshinskiy, Ye. V.

TITLE: Determination of the Surface Cracking Resistance of Transparent Plastic Materials on Wedge-shaped Samples

PERIODICAL: Zavodskaya laboratoriya, 1960, Vol. 26, No. 12, pp. 1390-1391

TEXT: The surface cracking resistance may be characterized by means of the tensile stress, at which the first visible cracks occur within a given time interval after application of load, or by determining the surface under stress in the case of a pure bending test, at which the first cracks occur. A further possibility is offered by the occurrence of cracks on the surface of plastic materials sometimes after having been wetted with organic liquids. For being able to judge the surface cracking resistance, these methods are, however, unsuited. V. R. Regel' (Ref. 7) suggests the curve $\tau_0 = f(\sigma)$, i.e., the determination of the time interval τ_0 from the instant of stress being applied to the sample up to the occurrence of the first cracks as a function of the tensile stress σ for the purpose of characterizing the surface

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Determination of the Surface Cracking Resistance of Transparent Plastic Materials on Wedge-shaped Samples

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B020/B056

cracking resistance of plastic materials. In the present paper, it is also suggested to characterize surface cracking resistance by means of the relation $\tau_0 = f(\sigma)$, where the sample has the shape of a truncated wedge. The cracks at first occur in the narrow sections of the sample, and only later on the broader sections. A cracking front forms, which gradually shifts from the narrower to the broader sections of the sample. The width of the sample at the place of the "front" is periodically measured, the time since the beginning of the stress is noted, and from the thickness of the sample and the tensile force, the tensile stress corresponding to τ_0 is calculated. The wedge-shaped samples (Fig. 1) were sawed with a circular saw. The angle of the wedge was about 5°, the maximum width of the sample was 8-9 mm, and its minimum width 3 to 3.5 mm. The thickness of the samples was 1-4 mm, and their full length 55-60 mm. Before the experiments were made, the samples were heated to a temperature, which was higher by $10 - 20^{\circ}$ than the fusion point of the given material. In the case of the shape of the samples selected, the stress dropped from the minimum to the maximum section to about the half of its former amount. The results obtained

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Determination of the Surface Cracking
Resistance of Transparent Plastic Materials
on Wedge-shaped Samples

S/032/[illegible]/026/012/018/036
B020/B0[illegible]

by wedge-shaped and ordinary samples were in good agreement (Fig. 2). For the purpose of calculating the relation $\tau_0 = f(\sigma)$, in the first case two, and in the second case 11 samples were used. The total time needed for the investigation, using a test cell, was in the first case about 8, and in the second case about 18 hours. There are 2 figures and 8 references: 4 Soviet, 3 US, and 1 German.

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy Akademii nauk SSSR (Institute of Highmolecular Compounds of the Academy of Sciences USSR)

Card 3/3

BESSONOV, M.I., inzh.; ZAKHAROV, S.K., inzh.; KUVSHINSKIY, Ye.V., doktor fiz.-matem.nauk

Using microspecimens for studying the mechanical properites of plastics. Vest.mash. 40 no.7:41-45 Jl '60. (MIRA 13:7)
(Plastics--Testing)

S/181/61/003/001/038/042
B102/B204

AUTHORS: Antuf'yev, V. V., Votinov, M. P., Kuvshinskiy, Ye. V., and Savin, A. G.

TITLE: Investigation of the ageing processes of titanium-containing ceramics by means of electron paramagnetic resonance

PERIODICAL: Fizika tverdogo tela, v. 3, no. 1, 1961, 286-288

TEXT: It was the purpose of the present paper to study the electrical ageing of titanium-containing ceramics by means of electron paramagnetic resonance (epr). The investigations were carried out with capacitor ceramics (87% TiO_2, 5% ZrO_2, 2% $BaCO_3$, 6% Al_2O_3, and 6% SiO_2 paste, burned in the usual manner); the specimens had the shape of tubes (28 mm long, wall thickness 1 mm) and were partly electrically aged (180°C, 700 v constant voltage). The aged specimens were denoted by K_a, and those let in their original shape, by K_o. For the investigations, an epr radiospectrometer with h-f modulation (1 Mc/sec) of the magnetic field was used; the epr signal was recorded by a recorder in the form of the first

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derivative of the absorption curve. In the case of a fixed frequency of the shf generator of 9300 Mc/sec, the field could be varied between 1000 and 4000 gauss. At 300°K, no difference could be found between the epr spectra of K_o and K_a; in both cases only 1 weak broad line (with $g \simeq 4.14$) was found. Therefore, all further experiments were carried out at 77°K. At this temperature, K_o showed a complex spectrum between 1000 and 4000 gauss; the spectrum of K_a was similar, but the lines with $g \simeq 1.97$ and 1.93 were 1.5 times more intense. This part of the spectrum was more accurately investigated. During ageing, the concentration of paramagnetic defects increased, and the electrical conductivity was 100-1000 times increased. An attempt is now made to find out why, in spite of this considerable increase of conductivity, the intensity of epr signals increased only 1.5 times. The opinion is widespread that ageing of titanium ceramics is related to a reduction of titanium; thus, K_o ceramics, which had been chemically reduced in different ways, were investigated. The degree of reduction was determined from the time for which the specimens had been heated in CO at 900°C. After having been heated for 10 minutes in CO (K_o-10), K_o had an epr spectrum which was

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Investigation of the ageing processes... B102/B204

exactly the same as that of the original K_0. With further reduction, intensity and width of the line with $g \simeq 1.93$ increased, the line with $g \simeq 1.97$ remained unchanged in contrast to the effect produced by electric ageing. After 60 minutes of reduction (K_0-60) the line with $g \simeq 1.93$ was so broad that it overlapped that with $g \simeq 1.97$. The concentration of paramagnetic defects in K_0-60 was higher by 3 orders of magnitude than in K_0. Thus, in the case of chemical reduction, only the concentration of 1 type of paramagnetic defects is increased, in electric ageing, however, the concentration of 2. In the pure components of the ceramics, no epr signal was found, not even (TiO_2) in the case of irradiation with $7 \cdot 10^6$r γ-radiation from Co^{60}. The authors thank V. Ya. Kunin for his collaboration, and I. D. Fridberg and K. Ye. Lisker for placing the material at their disposal. There are 1 figure and 3 Soviet-bloc references.

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S/181/61/003/001/038/042
B102/B204

Investigation of the ageing processes...

ASSOCIATION: Politekhnicheskiy institut im. M. I. Kalinina (Polytechnic Institute imeni M. I. Kalinin); Institut vysokomolekulyarnykh soyedineniy AN SSSR Leningrad (Institute of High-molecular Compounds, AS USSR, Leningrad)

SUBMITTED: July 21, 1960

Card 4/4

SIDOROVICH, A.V.; KUVSHINSKIY, Ye.V.

Characteristics of the thermal expansion of polyethylene terephthalate. Vysokom. soed.3 no.2:161-163 F '61. (MIRA 14:5)

1. Institut vysokomolekulyarnykh soyedineniy AN SSSR.
(Terephthalic acid)

89588

S/190/61/003/002/006/012
B101/B215

15.8500

AUTHORS: Layus, L. A., Kuvshinskiy, Ye. V.

TITLE: Effect of the molecular weight on the strength of oriented amorphous polymers

PERIODICAL: Vysokomolekulyarnyye soyedineniya, v. 3, no. 2, 1961, 215 - 222

TEXT: It was the purpose of the present work to study the effect of the molecular weight of oriented polymers on their strength in that range of molecular weights in which the strength of isotropic polymers is no longer affected. Stressstrain curves of oriented polymers also had to be plotted. Polyvinyl acetate (PVA), polymethyl methacrylate (PMMA), and polystyrene (PS) were used for the experiments. From the solutions of these polymers films were deposited on glass plates and then dried in the vacuum for 3 - 4 days; the temperature was gradually increased up to 90°C for PVA and 150°C for PS and PMMA. The molecular weights were viscosimetrically determined. The softening temperature was determined by plotting the

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B101/B215

Effect of the molecular weight ....

thermomechanical curves. Strips of 4 mm width and 10 mm length of 100 - 150μ films were subjected to preparatory drawing at increased temperatures. The ratio λ between elongated specimen and initial length was between 2 and a maximum of 200 - 300 for PVA, and 15 - 16 for PMMA. After drawing the strips had a thickness of 10 - 15 and 50 - 60μ, which was optically determined with an ИЗВ-1 (IZV-1) apparatus; their width amounted to 0.6 - 2.5 mm. The stress-strain diagram was taken of a 10 mm strip of specimens thus treated. A table gives the data of the specimens studied, and the experimental conditions. Fig. 2 shows the stress-strain diagram of PVA which consists of three sections: a steep first section (I), a flat central section (II) in which maxima may occur for PVA and PS, and a steep terminal section (III) leading to the break. The shape of the curve depends on the elongation λ. PMMA and PS showed the same behavior. The upper part of Fig. 5a shows the breaking stress σ_b (σ_p in the Fig.), and the lower part shows the breaking elongation ε_b (ε_p in the Fig.) as functions of preparatory drawing λ. Fig. 6 gives the tensile strength of isotropic and oriented polymers as a function of the molecular weight.

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B101/B215

Effect of the molecular weight ...

Hence, a dependence of tensile strength on the molecular weight which does
not exist in isotropic polymers was found in polymers oriented by drawing,
E. I. Barg (Dokl. AN SSSR, 84, 257, 1952, Ref. 5), A. V. Stepanov (Zh. eks.
i teor. fiziki, 19, 973, 1949, Ref. 14), and P. P. Kobeko (Amorfnyye
veshchestva, Izd. AN SSSR, 1952 str. 234 (Amorphous Substances, Publishing
House of the AS USSR, 1952, p. 234) Ref. 15) are mentioned.
There are 6 figures, 1 table, and 15 references: 10 Soviet-bloc and 5 non-
Soviet-bloc. The 4 references to English language publications read as
follows: W. H. Carothers, F. J. Natta, J. Amer. Chem. Soc., 55, 4714,
1933; A. M. Sookne, M. Harris, Industr. and Engng. Chem. 37, 4"8, 1945;
Sh. Tachikava, Rayon a. Synthetic Textiles, 32, no. 3, 31, 43, 1951; 32,
no. 7, 32, 42, 1951; P. Y. Flory, J. Polymer Sci., 11, 37, 1953

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy AN SSSR
(Institute of High Molecular Compounds of AS USSR)

SUBMITTED: June 16, 1960

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S/190/61/003/002/C06/012
B101/B215

Effect of the molecular weight ...

Table: Properties of the initial polymers, conditions of their preparatory drawing, and experimental conditions. Legend: 1) Molecular weight, $M_v \cdot 10^6$; 2) softening temperature; 3) temperature of preparatory drawing; 4) rate of preparatory drawing, %/sec; 5) rate of stretching of oriented specimens, %/sec; a) PVA; b) PS; c) PMMA

Характеристика исходных полимеров, условия их предварительной вытяжки и режим испытаний

Мол. вес $M_v \cdot 10^6$ ①	Температура размягчения T_p, °C ②	Температура предварительной вытяжки $T_в$, °C ③	Скорость предварительной вытяжки $v_в$, %/сек. ④	Скорость растяжения ориентированных образцов v_p, %/сек. ⑤
Ⓐ Поливинилацетат				
0,15	45,0	70	2,55	0,55
0,25	40,7	70	2,55	0,55
0,45	40,5	70	2,55	0,55
Ⓑ Полистирол				
0,10	100	120	2,55	0,14
0,58	101	120	2,55	0,14
0,88	92	110	2,55	0,14
1,00	102	120	2,55	0,14
Ⓒ Полиметилметакрилат				
0,65	124	170	10,00	0,14
0,65	124	170	2,55	0,14
1,30	122	170	10,00	0,14
1,30	122	170	2,55	0,14
2,70	114	170	10,00	0,14
2,70	114	170	2,55	0,14

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89588
S/190/61/003/002/006/012
B101/B215

Effect of the molecular weight ...

Fig. 2. Stress-strain curves of oriented PVA.
Legend: a) Solid curve: $M_v = 0.450 \cdot 10^6$; dashed curve: $M_v = 0.25 \cdot 10^6$; б: $M_v = 0.15 \cdot 10^6$.
The numbers in the curves give the degree of preparatory drawing.

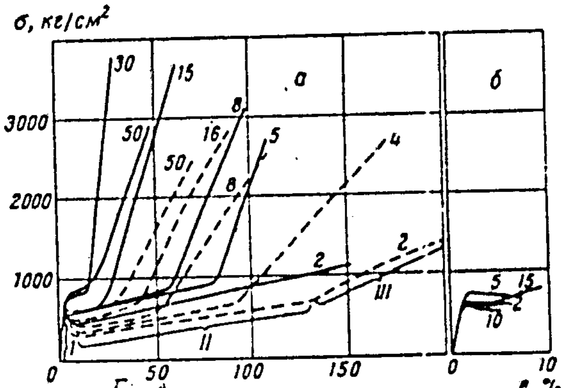

Fig.2

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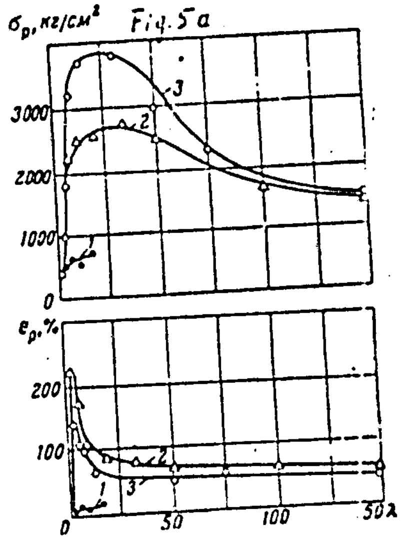
89588

S/190/61/003/002/006/012
B101/B215

Effect of the molecular weight ...

Fig. 5a. σ_b and ε_b as functions of preparatory drawing λ for PVA.

Legend. 1) $M_v = 0.15 \cdot 10^6$;
2) $M_v = 0.25 \cdot 10^6$;
3) $M_v = 0.45 \cdot 10^6$



Card 6/7

09568
S/190/61/003/002/C06/012
B101/B215

Effect of the molecular weight ...

Fig. 6. Tensile strengths of polymers as functions of their molecular weights.
Legend: 1) and 2) PVA; 3) and 4) PS; 5) and 6) PMMA;
a) oriented; δ) isotropic.

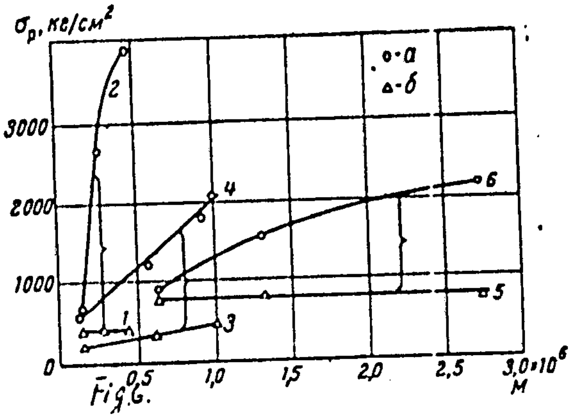


Fig.6.

Card 7/7

BESSONOV, M.I.; KUVSHINSKIY, Ye.V.

Kinetics of the growth of "silver" cracks in transparent solid polymers.
Fiz.tver.tela 3 no.5:1314-1323 My '61. (MIRA 14:6)

1. Institut vysokomolekulyarnykh soyedineniy AN SSSR, Leningrad.
(Polymers)

20142

S/181/61/003/002/040/050
B102/B201

15.8500 2209

AUTHORS: Bessonov, M. I. and Kuvshinskiy, Ye. V.

TITLE: Characteristic features in the development of destructive cracks in solid polymers

PERIODICAL: Fizika tverdogo tela, v. 3, no. 2, 1961, 607-610

TEXT: A study has been made of the microscopic growth and the structure of destructive cracks in an organic glass (polymethyl methacrylate + 6% dibutyl phthalate). The authors worked by the method of controlled destruction, where a single destructive crack forms by a slow and flat development; the experiment is graphically represented in Fig. 1. The specimen dimensions were 50 x 20 x 4 mm^3. A microscope with large focal length was used for the observations made at room temperature in the direction denoted by 1. Two groups of interference fringes were observed near the tip of the crack, during observations in the reflected light: a group of very distinct narrow fringes on the tip of the crack, and a group of broad blurred fringes behind these (this is not observable in the transmitted light). If the crack grows, the narrow fringes move ahead with it, without changing their shape.

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20142

S/181/61/003/002/040/050
B102/B201

Characteristic features in ...

The broad fringes change their shape and shift, the slit surface displays a reddish coloring (in the reflected light) which, however, disappears on heating. Results are compared with those of a previous paper (Ref. 7: FTT, 1, 1441, 1959) in which the authors studied the structure and the growth of cracks formed in "silver" by the impression of transparent solid polymer into the latter. There are 3 figures and 9 references: 5 Soviet-bloc and 3 non-Soviet-bloc.

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy AN SSSR Leningrad (Institute of High-molecular Compounds AS USSR, Leningrad)

SUBMITTED: July 2, 1960

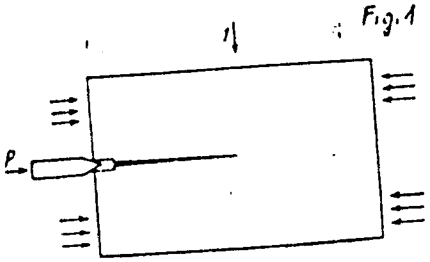

Fig. 1

Card 2/2

S/181/61/003/009/016/039
B102/B104

AUTHORS: Lebedev, G. A. and Kuvshinskiy, Ye. V.

TITLE: Structural characteristics of the "silver" cracks in polymethyl methacrylate films

PERIODICAL: Fizika tverdogo tela, v. 3, no. 9, 1961, 2672 - 2679

TEXT: The structure of the so-called "silver" cracks which form in the deformation of polymethyl methacrylate and polyvinyl acetate at temperatures below the vitrification point was studied with the aid of the microscope МКУ-1(MKU-1). It was shown that these strongly light-scattering cracks are filled with polymer substances whose nature was changed. For the production of these cracks various films were elongated at temperatures of up to 80°C. Subsequently, microphotographs were taken in transmitted, reflected, and obliquely reflected light. The authors also made interference pictures with an МИИ-1(MII-1) interference microscope. It was found that 20-30-μ deep and about 10-μ wide cuneiform cracks had formed which were almost completely filled with porous polymer whose optical properties considerably differed from the original properties. The polymer in the cracks showed very fine

Card 1/2

S/181/61/003/009/018/039
B102/B104

Structural characteristics of ...

transverse cracks connecting the edges of the main crack. Special experiments with treatment at different temperatures (up to 120°C) showed that obviously due to the heat the "silver" filling the cracks shrinks (compression). The cracks did not disappear upon heat treatment without deformation of the films. This could be easily achieved by compression at room temperature although the cracks remained visible under the microscope. There are 6 figures and 6 references: 4 Soviet and 2 non-Soviet. The latter read as follows: B. Maxvell, L. Rahm. Ind. Eng. Chem., <u>41</u> 1948, 1949. C. Hsiao, J. Sauer. J. Appl. Phys. <u>21</u>, 1071, 1950.

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy AN SSSR Leningrad (Institute of High-molecular Compounds AS USSR Leningrad)

SUBMITTED: April 10, 1961

Card 2/2

29740
S/190/6[illegible]/003/0[illegible]/0[illegible]
B110/B10[illegible]

15 8510

AUTHORS Sidorovich, A. V., Kuvshinskiy, Ye. V.

TITLE: Thermomechanical proper[illegible] of linear amorphous [illegible] polymethyl methacrylate, [illegible] lystyrene

PERIODICAL: Vysokomolekulyarnyye soyedineniya v. 3, no. [illegible], [illegible] 1704

TEXT: The authors investigated amorphous polymers under low stresses (≥ 0.0[illegible] kg/cm^2). They tested atactic polymethyl methacrylate [illegible] ($[\eta] = $ [illegible] 4 in [illegible]) films ($[\eta] = $ [illegible].6 in benzene), and polystyrene (II) ($[\eta] = $ [illegible]) of different molecular weights, as well as I obtained by fractional precipitation obtained by evaporation of solutions of bulk polymers [illegible]. Freely suspended films were dried at $\leq 10^{-[illegible]}$ mm Hg. The temperature was raised every 2 - 3 hr by 15 - 20°C and kept constant at 40 - 60°C above the vitrification temperature for 50 - 60 hr. Since the films were [illegible] soluble after the thermomechanical tests, no structuration took place. Films 30 mm long, 2 - 4 mm wide, and 0.0[illegible] - 0.2 mm thick were examined at $\theta = 20 - 200^\circ$C ($d\theta/dt = 60^\circ$C/hr) by means of a constant stress. At

Card 1/4

29740
S/190/6[illegible]/003/0[illegible]/0[illegible]
B110/B10[illegible]

Thermomechanical properties ...

0 [illegible] 0 kg/cm^2, a glass thread with hooks for weights was attached to the film by means of БФ-2 (BF-2) glue. At $\Delta l/l_0 \leq 30\%$, the test of I in a wide temperature range is only possible under low stresses. At 0 [illegible] 0 [illegible] the curves $d\theta/dt = 60^\circ$C/hr consist of a sloping and a steep [illegible]. The softening temperature [illegible] curve is sloping at $\sigma_0 \leq$ [illegible] kg/cm^2, an S-shaped section is formed at with increasing stress. At $\sigma_0 \leq$ [illegible] kg/cm^2 the following sections exist: (1) a low temperature section with slight deformation; (2) a section with steep deformation increase due to transition to the highly elastic state; (3) a comparatively sloping (plateau) section; and (4) a steep high temperature section. There are similar conditions for II, but II is more deformable. At $\leq$ [illegible]0°C (I) and $\leq 105^\circ$C (II) and $\sigma_0 \geq 20$ kg/cm^2 the stress dependence is not linear with deformation. At higher temperatures and $\sigma \leq 6$ kg/cm^2 (I) and $\sigma_0 \leq$ [illegible] kg/cm^2 (II), it is linear. The deformability $D = (1/\sigma)(\Delta l - \Delta l_0)/l_0$ was determined from the thermomechanical curves and referred to σ. The nonlinearity [illegible] the stress dependence of deformation [illegible] that the [illegible]

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29740
S/190/61/003/011/011/016
B110/B101

Thermomechanical properties...

do not coincide at low temperatures as they do at high temperatures. Samples obtained in narrow fractions were tested to investigate the molecular-weight (MW) and polydispersion dependences of thermomechanical properties. The MW were determined by means of light scattering at the laboratory of V. N. Tsvetkov in the IVS AN SSSR. For Mw = [illegible]; [illegible]$\cdot 10^5$; $5.0 \cdot 10^4$; and 0.5 and 2 kg/cm^2, the following was found: (1) the sections corresponding to the start of softening coincide for all fractions ($\theta_v \sim 125^\circ$C); (2) only at Mw = 1.94$\cdot 10^6$, there is a plateau between 130 and 170°C; (3) there is no essential difference between nonfractionated polymers and their fractions. The results obtained corresponded to those obtained by V. A. Kargin, T. I. Sogoleva (Zh. fiz. khimii, 23, 530, 1949). Since after the test cycle: loading - heating - cooling - unloading - heating the initial length was restored, only highly elastic and thermal-expansion deformations exist. Investigations of polystyrene ($[\eta]$ = 4.1 in benzene) with 0.5 and 25 kg/cm^2 at 2 and 60°C/hr heating rate also indicate the absence of flow. The steep rise of the thermomechanical curves is effected by accumulation of highly elastic deformations under ordinary test conditions. The results obtained [illegible]

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22740
S/190/61/003/011/0[illegible]/016
B110/B10[illegible]

Thermomechanical properties..

the convenience of a particular definition of the viscous flow state of linear polymers is questionable. G. L Slonimskiy (Dokl AN SSSR, 62, 238, 1948) and P P Kobeko, Ye V Kuvshinskiy, G K Gurevich (Izv AN SSSR ser. fiz., 2, 329, 1937) are mentioned. There are [illegible] figures and 10 Soviet references

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy AN SSSR (Institute of High-molecular Compounds AS USSR)

SUBMITTED: December 27, 1960

Card 4/4

S/181/61/003/011/035/056
B108/B138

AUTHORS: Sidorovich, Ye. A., Kuvshinskiy, Ye. V.

TITLE: Shock compression of rubbers

PERIODICAL: Fizika tverdogo tela, v. 3, no. 11, 1961, 3487-3494

TEXT: Some time ago, the authors developed a KC (KS) pendulum type elastometer (ZhTF, 26, 4, 877, 1956). With this device strain data can be obtained from cylindrical rubber specimens and compared with theoretical results. The shock-stress signals as picked up by a piezo-quartz dynamometer (L. A. Layus. VINTI, Peredov. nauchno-tekhn. i proizv. opyt, t. 32, 1958) are fed into an ЭНО-1 (ENO-1) oscilloscope. The force during the impact time is

$$F_K = \frac{V_0 M}{\sin^2 \varphi} \omega_K e^{-\delta_K t} \sin(\omega_K t - 2\varphi), \tag{1}$$

$$F_M = \frac{V_0 M}{\sin^2 \psi} \omega_M e^{-\delta_M t} \sin(\omega_M t - \pi). \tag{2}$$

respectively for a Kelvin-Voigt and for a Maxwellian model (subscripts K

Card 1/3

S/181/61/003/011/035/056
B108/B138

Shock compression of rubbers

and M, respectively). V_0 denotes the pendulum velocity at the beginning of the impact, M the pendulum mass, the ω's are the natural frequencies of the pendula. The experiments showed that the Maxwellian rather than the Kelvin model is applicable to shock deformation of rubbers. The force during the impact is a monotonic function of time and with no sudden rise at the beginning of impact. Resilience was found to be independent of the size of the specimen. According to the Maxwellian theory its logarithm is directly proportional to the impact time. The experiments showed, however, that resilience either does not change at all or rises slightly with decreasing impact time. This study led to the conclusion that in general the Maxwellian model is applicable although it cannot be used for an accurate prediction of frequency course. The Kelvin model holds true only for substances with a high resilience, i.e., having low mechanical losses. There are 4 figures, 1 table, and 4 references: 3 Soviet and 1 non-Soviet. The three references to English-language publications read as follows: L. Mullins, I. R. I. Trans., 22, 235, 1947; Rubb. Chem. Technol., 20, 998, 1947; Ye. V. Kubshinskiy, Ye. A. Sidorovich. Rubb. Chem. Technol., 32, 3, 662, 1959.

Card 2/3

S/181/61/003/011/035/056
B108/B138

Shock compression of rubbers

ASSOCIATION: Vsesoyuznyy nauchno-issledovatel'skiy institut sinteticheskogo kauchuka im. S. V. Lebedeva Leningrad (All-Union Scientific Research Institute of Synthetic Rubber imeni S. V. Lebedev, Leningrad)

SUBMITTED: June 23, 1961

Card 3/3

29619
S/120/61/000/004/031/034
E194/E355

15.9300

AUTHORS: Volodin, V.P., Kabin, S.P. and Kuvshinskiy, Ye.V.

TITLE: Measurement of the dynamic mechanical properties of rubber in the frequency range from 0.01 to 4 000 c.p.s.

PERIODICAL: Pribory i tekhnika eksperimenta, no. 4, 1961, p. 179

TEXT: A previous work (Ref. 1 - this journal, 1957, No. 5, 86) described equipment for determining the dynamic mechanical properties of rubber in the frequency range of 100 to 4 000 c.p.s. It was shown that, in principle, the apparatus could be used for lower frequencies and this has now been done. Measurements of the shear modulus and tangent of mechanical loss angle can now also be made in the frequency range of 0.01 to 100 c.p.s. The output of an ultralow-frequency generator is amplified and applied through a resistance to the coil of a vibrator. A peak voltmeter is used to measure the voltage drop across the resistance which is proportional to the stress applied to the specimen. It also measures the

Card 1/2

29649
S/120/61/000/004/031/C34
E194/E355

Measurement of ....

alternating component of the output voltage from a capacitative pick-up which is proportional to the displacement of the specimen. A phasemeter is used to measure the phase-angle between the voltage corresponding to stress and that corresponding to strain. Measurements can be made in the temperature range -30 to +60 °C. Test results are quoted for shear modulus and tangent of mechanical loss angle as functions of frequency at a temperature of 15 °C for СКБ (SKB) base rubber. Thus, at a frequency of 0.01 c.p.s. the shear modulus is 2.6×10^6 dynes/cm^2 and $\tan \delta = 0.17$. At a frequency of 100 c.p.s. the corresponding figures are 5.4×10^6 dynes/cm^2 and $\tan \delta = 0.3$ c.p.s.
There are 2 figures and 1 Soviet-bloc reference.

ASSOCIATION: Leningradskiy politekhnicheskiy institut (Leningrad Polytechnical Institute)

SUBMITTED: November 17, 1960

Card 2/2

22334

S/191/61/000/005/002/003
B124/B218

15.8500 2409, 1372

AUTHORS: Bessonov, M. I., Kuvshinskiy, Ye. V.

TITLE: The relationship between destruction, deformation, and cracking of solid amorphous polymers

PERIODICAL: Plasticheskiye massy, no. 5, 1961, 57-63

TEXT: The principal results of studies performed in recent years on the relation between the destruction of solid amorphous polymers and their creep and cracking are presented. The relationship between temporary dependences of the strength of solid amorphous polymers and their creep is first dealt with (Fig. 1). The common exponential relation between life and stress of the type $\tau = Ae^{-\alpha\sigma}$ holds only for acetyl cellulose in the whole range of temperatures and stresses concerned. In every test, the creep curve was determined until the specimen cracked. Fig. 2 shows the creep curve of acetyl cellulose (AC) in the coordinates ε and log τ. At any stress, creep curves of AC must be S-shaped. In general, the creep curve of the polymer in the coordinates ε log τ must be S-shaped. This is an indication of the complicated time dependence of the rate of creep

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22334

S/191/61/000/005/002/003
B124/B218

The relationship between destruction...

deformation accumulation. Experimentally, the dependence of log τ on log (1/v) for ebonite at 20, 40, and 60°C, for AC at 60°C, for a copolymer of methylmethacrylate and methacrylic acid (CMMA) at 20°C, and for polystyrene (PS) at 20°C yielded a straight line. The relation between τ and v can be expressed by the empirical equation $1/\tau = v^m/c$ (m and c are constants depending on temperature and the type of polymer). This relation indicates that destruction and deformation are entirely different. interdependent processes. Destruction and deformation rates change unproportionally with varying stress. This is illustrated by Fig. 4. Heating tests indicate that destruction is a local process covering small areas of the material. Therefore, it is not directly related to the deformation accumulation in the entire specimen. The destruction was examined by a microscopic study of the cracking of solid, amorphous, transparent polymers (organic glasses). When transparent polymers crack, their cracks glitter intensely in the reflected light. The authors developed the so-called "face" process for observing such cracks (M. I. Bessonov, Ye. V. Kuvshinskiy, FTT, 1, 1441 (1959)). The dumpbell-shaped specimen is put on the microscope stage and subjected to constant tensile stress (Fig. 5). The faces of the specimen are polished. Observations are made in reflected light, using

Card 2/3

22334

[illegible]

The relationship between destruction... B124/B218

a microscope of large focal distance, and a reflector. After the [illegible] of the cross-sectional edges, a glittering ring appears, which [illegible] broadens gradually. A series of interference figures is observed. [illegible] a given tensile stress, cracks grow at a constant rate, while the [illegible] of ordinary cracks is accelerated. Unlike what is the case with ordinary cracks, the modulus of elasticity of a specimen with "silver" cracks does not depend on their enlargement, and the rate of growth of "silver" cracks depends, not on the amount of stress at the end of the crack, but on the mean stress acting upon the specimen. Fig. 7 shows examples. The formation of "silver" cracks may be considered to be a primary stage of polymer destruction. Fig. 11 shows the enlargement of cracks in polymers. There are 11 figures and 6 references: 5 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: I. Benbon, F. Roesler, Proc. Phys. Soc., 70, 201 (1957).

Card 3/3

VOLODIN, V.P.; KABIN, S.P.; KUVSHINSKIY, Ye.V.

Measuring dynamic and mechanical properties of rubber in the frequency range from 0.01 to 4,000 hertz. Prib. i tekh. eksp. 6 no.4:179 Jl-Ag '61. (MIRA 14:9)

1. Leningradskiy politekhnicheskiy institut.
(Rubber--Testing)

S/181/62/004/012/007/052
B104/B102

AUTHORS: Kuvshinskiy, Ye. V., and Sidorovich, A. V.

TITLE: Ways to develop a quantitative theory of vitrification

PERIODICAL: Fizika tverdogo tela, v. 4, no. 12, 1962, 3403-3408

TEXT: This is a critical survey on studies since 1936 on the relaxation theory of the vitrification of amorphous bodies. It is shown that the relaxation theory, although well known, gives only qualitative results, and that systematic investigations of vitrification are lacking. To develop the theory further, the following studies are proposed: (1) experimental investigation of rules governing property charges of a substance during heat treatment, compression and elongation; (2) confirmation that when a function of state is established this enables the behavior of a substance under any course of treatment to be predicted; (3) explanation of a kinetic equation on the basis of the general conceptions of molecular relaxation. The equation of state

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S/181/62/004/012/007/052
B104/B102

Ways to develop a quantitative ...

$$\left(\frac{dU}{dt}\right)=\sum_i\left(\frac{\partial U}{\partial\alpha_i}\right)_{\theta,\,p,\,\alpha_{j\neq i}}A_i+\left(\frac{\partial U}{\partial\theta}\right)_{p,\,\alpha_i}\left(\frac{d\theta}{dt}\right)+\left(\frac{\partial U}{\partial p}\right)_{\theta,\,\alpha_i}\frac{dp}{dt}=$$
$$=f_1+f_2q+f_3r \qquad (4)$$

$$\left(\frac{\partial f_2}{\partial p}\right)_{\theta,\,t}=\left(\frac{\partial f_3}{\partial\theta}\right)_{p,\,t}=\left(\frac{\partial^2U}{\partial p\partial\theta}\right)_{\alpha_i}.$$

is derived for the function of state

$$U=U\left(\alpha_i;\ \frac{d\alpha_i}{dt};\ \theta;\ p;\ q,\ r\right)=U(\alpha_i;\ \theta;\ p). \qquad (2)$$

where

$$\left(\frac{d\alpha_i}{dt}\right)=A_i(\alpha_j;\ \alpha_{j_0};\ \theta;\ p)=A_i(\alpha_j;\ \theta;\ p). \qquad (3)$$

α_i = inner parameter of the substance, θ = temperature, p = pressure, q = dθ/dt, r = dp/dt. From (4) it follows that the proposed experiments must be of very varied nature, but the experimental conditions can be exactly determined if temperature and pressure vary according to a previously fixed law.

Card 2/3

S/181/62/004/012/007/052
B104/B102

Ways to develop a quantitative ...

ASSOCIATION: Institut vysokomolekulyarnykh soyedineniy AN SSSR, Leningrad (Institute of High-molecular Compounds AS USSR, Leningrad)

SUBMITTED: July 2, 1962

Card 3/3

BESSONOV, M. I.; KUVSHINSKIY, Ye. V.

Using the PMT-3 apparatus for determining the microhardness of polymers. Zav. lab. 28 no.4:504-505 '62. (MIRA 15:5)

1. Institut vysokomolekulyarnykh soyedineniy AN SSSR.

(Polymers--Testing)
(Hardness)

KUVSHINSKIY, YE. V.

AID Nr. 972-31 21 May

MECHANISM OF RUBBER WEAR (USSR)

Rudakov, A. P., and Ye. V. Kuvshinskiy. Vysokomolekulyarnyye soyedineniya, v. 5, no. 3, Mar 1963, 417-423. S/190/63/005/003/020/024

The wear of rubber has been studied at the Institute of Macromolecular Compounds, Academy of Sciences USSR, with special equipment permitting 1) visual observation and cinemicrophotography of the phenomena occurring as a smooth steel indenter slides back and forth on a rubber surface and 2) study of the effects of the number of indenter passes, contact pressure, and gaseous medium. The experiments were conducted at room temperature with filled butadiene (СКБ, СКД), butadiene-styrene (СКС-30-А), carboxylated (СКС-30-1), isoprene (natural, СКИ), and butyl rubbers and with unfilled СКИ and nairit. Rubber wear was shown to be the result of degradation. The rubber surface becomes tacky, and the wear mechanism is a continuous rolling up and removal of this tacky surface layer. In some cases the presence of oxygen affects the nature of the wear: the wear of isoprene rubbers in air was shown to differ from that in He. In air, it is accompanied

Card 1/2

AID Nr. 972-31 21 May

MECHANISM OF RUBBER WEAR [Cont'd] S/190/63/005/003/020/024

by the separation of an oily liquid indicating the development of oxidation, which is also observed in the case of СКС-30-А. The wear processes of СКД and СКС-30-1 in air and in He are identical. It is also shown that the degradation of rubber is not associated with the evolution of the heat of friction. Changing the temperature of the experiment affects the development of the process considerably. For example, at temperatures above the softening point of polymethyl methacrylate, its wear is similar to that of rubber, but at lower temperatures the wear is different: particles are chipped off of the unchanged material. The results of the study lead to the general conclusions that the wear of rubber is closely linked to the development of mechanochemical degradation. [BAO]

Card 2/2

ACCESSION NO: AP3006764 S/0190/63/005/009/1393/1397

AUTHORS: Fomenko, B. A.; Volodin, V. P.; Sidorovich, A. F.; Kuvshinskiy, Ye. V.

TITLE: Thermomechanical investigations of polyisobutylene by means of dilation and penetration

SOURCE: Vy*sokomolekulyarny*ye soyedineniya, v. 5, no. 9, 1963, 1393-1397

TOPIC TAGS: polymer, thermal oxidation, single axis elongation, polyisobutylene, amorphous polymer, thermomechanics

ABSTRACT: The low-molecular-weight polymer was prepared by means of thermal oxidation decomposition of the high-molecular-weight product, heating the latter in air at 160-170C for 50 hours. The characteristic molecular weights M_{w_1} and M_{w_2} were 0.55×10^6 and 1.86×10^6 respectively. The method of investigation consisted of single-axis elongation of a film strip under a constant force, and penetration by a 3-mm cylindrical indentor under a gradual temperature rise. The results show behavior of polyisobutylene analogous to other linear polymers. As in other amorphous polymer deformations, a sharp branch in the thermomechanical curve of polyisobutylene shows a superelastic behavior. Orig. art. has: 4 figures.

Card 1/2

ACCESSION NO: AP3006764

ASSOCIATION: Institut vy*sokomolekulyarny*kh soyedineniy AN SSSR (Institute of High-Molecular-Weight Compounds AN SSSR)

SUBMITTED: [illegible] DATE ACQ: 30Sep63 ENCL: 00

SUB CODE: CH NO REF SOV: 008 OTHER: 000

Card 2/2

KUVSHINSKIY, Ye.V.; AERO, E.L.

Continuity theory of asymmetric elasticity, allowing for "internal" rotation. Fiz. tver tela 5 no.9:2591-2598 S '63. (MIRA 16:10)

1. Institut vysokomolekulyarnykh soyedineniy AN SSSR, Leningrad.

LAYUS, L.A.; KUVSHINSKIY, Ye.V.

Structure and mechanical properties of "oriented" amorphous linear polymers. Fiz. tver. tela 5 no.11:3113-3119 N '63. (MIRA 16:12)

1. Institut vysokomolekulyarnykh soyedineniy AN SSSR, Leningrad.

L 35043-65 EWT(m)/EPF(c)/EWP(J) Pc-4/Pr-4 RM/GL S/0000/64/000/000/0046/0055
ACCESSION NR: AT5004096

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AUTHOR: Rudakov, A. P.; Kuvshinskiy, Ye. V.

15

TITLE: Wear of rubber on a smooth indentor

SOURCE: Nauchno-tekhnicheskoye soveshchaniye po friktsionnomu iznosu rezin. Moscow, 1961. Friktsionnyy iznos rezin (Frictional wear of rubber); sbornik statey. Moscow, Izd-vo Khimiya, 1964, 46-55

TOPIC TAGS: rubber, rubber property, rubber research, wear resistance, friction, mechanical working

ABSTRACT: The wear of rubber depends on its properties and on the conditions under which it is being used. Wear is not always the result of scratches and cuts, but also results from sliding along a smooth surface. The hypothesis that durability is determined by the elastic strength characteristics of rubber contradicts the findings of many experiments. Nevertheless, there are theories which identify wear of rubber with mechanical destruction. Here, on the contrary, it is believed that processes associated with fatigue play a decisive role. Consequently phenomena which occur during rubbing of a rubber surface with a smooth indentor were investigated. A special device was constructed for this purpose (see Fig. 1 of the En-

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closure). When the indentor is dragged along the surface of a rubber speciman, the latter remains unchanged for a certain period of time, after which thin cylindrical pellets are formed. These pellets are located generally perpendicular to the motion of the indentor. Due to the destruction of the rubber its upper layer becomes sticky and weak. The experiments were carried out with SKI, SKD, SKB, and SKS-30A rubber and with natural rubber. It was found that surface oxidation processes take place during the wear of SKI based rubber and natural rubber. The destruction of rubber during indentor treatment cannot be attributed to the heat liberated due to friction. Orig. art. has: 6 figures and 6 equations.

ASSOCIATION: none

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ENCLOSURE: 01

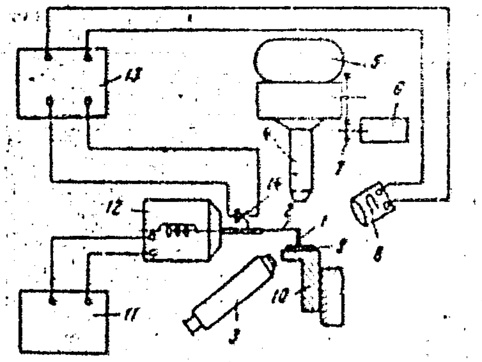

Fig. 1

Test Equipment

1 - indentor; 2 - dynamometer spring; 3 - MIR-1 microscope; 4 - M-9 microscope; 5 - motion picture camera; 6 - synchronous motor; 7 - reduction gearbox; 8 - illuminator with flashlight; 9 - rubber specimen; 10 - jack stand; 11 - ZG-10 generator; 12 - GMK-1 mechanical vibration generator; 13 - flashlight power supply; 14 - synchronizing switch

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ACCESSION NR: AP4009147 S/0190/64/006/001/0052/0057

AUTHORS: Layus, L. A.; Kuvshinskiy, Ye. V.

TITLE: Isometric heating as a method of studying oriented amorphous solid polymers

SOURCE: Vy*sokomolekulyarny*ye soyedineniya, v. 6, no. 1, 1964, 52-57

TOPIC TAGS: polymer, solid polymer, amorphous polymer, orientation, oriented polymer, stretch, isometric heating, deformation, stress, stretch velocity, macromolecule orientation, degree of orientation, isometric heating diagram

ABSTRACT: The proposed method of isometric heating is similar to the thermomechanical method. In the first the stress is measured under constant deformation and gradual increase in temperature, while in the second method the deformation under constant stress is being recorded. The material for the present investigation consisted of polyvinylacetate (PVA) (Mol. wt. 790 000) and polymethylmethacrylate (PMM) (Mol. wt. 710 000) film bands 100 microns thick, 2 mm wide, and 20 mm long. These bands were held immobile in a vertical position by two clamps, the upper being connected with a dynamometer. The setup was placed in a chamber equipped with a heating system to provide a gradual temperature rise at a desired

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