RHEOLOGY BULLETIN

Publication of the Society of Rheology

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THE BINGHAM MEDAL

By unanimous decision of the Award Committee, this year's Bingham Medal will go to Dr. A. Nadai. The recipient's merits as a pioneer of rheology are such as to make sure of the widest possible approval. The Award will be accompanied by a citation and by a brief enumeration of the Medalist's accomplishments. Most rheologists will remember that Dr. Nadai was one of the original group gathering around Dr. Bingham in 1929 when the foundation of the Rheological Society was planned.

THE ANNUAL MEETING, 1952

As usual, the Annual Meeting of the Society of Rheology will be held towards the end of the last week in October, i.e. on October 30 and 31. After the very successful meeting in Chicago last year, it was decided to return to a meeting place on the East Coast. The decision fell on Philadelphia, particularly in view of the very attractive invitation by Dr. Henry B. Allen, Executive Vice-President and by Dr. Nicol Smith, Executive Director, who offered the facilities of the Franklin Institute for the Meeting. We may, therefore, look forward to a most congenial atmosphere.

Thanks to the efforts of the Program Committee, the program is again a highly attractive one. Details will be given below Where possible, related papers will be grouped together and the discussion opened by an appointed discussion leader. Apart from the general papers, there will be three special lectures of review character, designed not only to report on important developments but to stimulate discussion from the floor. In view of the very full program, there will probably be insufficient time for the discussion, without formal papers, on fundamental rheological concepts which had also been planned. An equivalent airing of views may, though, be anticipated during the period introduced by Dr. Leaderman's discussion.

As arranged at present, the meeting will take place in the Lecture Hall of the Franklin Institute, 20th Street and Benjamin Franklin Parkway. Registration will begin on Thursday at 9 A.M. and the meeting will open at 9:30 A.M. There will be a morning and afternoon session each on Thursday and Friday. A general business meeting will be called at 4 P.M. on Thursday, followed by a cocktail hour at 6 P.M. and a banquet at 7 P.M., after which the Bingham Medal will be presented. Dr. Thelen, who is in charge of the meeting has further kindly opened the facilities of the Institute for those who wish to take their luncheon there. Please return the enclosed postcards as soon as convenient.

LECTURE PROGRAM, OCTOBER 30-31

SPECIAL LECTURES:

T. ALFREY AND R. ANDREWS, DOW CHEMICAL COMPANY, MIDLAND, MICH.

"REVIEW OF DYNAMIC METHODS".

This paper reviews the present status of dynamic mechanical measurements on plastics, elastomers, and fibers. Such measurements reveal the viscoelastic properties of a material in the acoustical and ultrasonic ranges of time-scale, and hence supplement creep and stress relaxation methods which are used to determine the long-time behavior. It is now possible to compare results obtained on the same material by different methods, in different frequency ranges, and at different temperatures. Various approximation methods for correlating dynamic data, and for computing distributions of elastic relaxation times will also be discussed.

H. LEADERMAN, NATIONAL BUREAU OF STANDARDS, WASHINGTON, D.C.

"PROPOSED NOMENCLATURE AND SYMBOLISM FOR LINEAR VISCOELASTIC BEHAVIOR OF HIGH POLYMERS."

There is at present a lack of uniformity in the use of terms and symbols describing the observable and derived quantities associated with the linear viscoelastic behavior of high polymers. A logical system of nomenclature which is likely to be adopted must be modified to take account of convenience and of current usage.

R. S. RIVLIN, NAVAL RESEARCH LABORATORY, WASHINGTON, D.C.

"FINITE ELASTIC DEFORMATIONS."

A brief account will be given on the basis of the theory by which load-deformation relations for bodies of elastic materials may be calculated when the strains are not infinitesimally small. Some of the principal results will be given and it will be shown how these may be related to the measured load-deformation relations for vulcanized rubber.

GENERAL LECTURES:

J. T. BERGEN, ARMSTRONG CORK COMPANY, LANCASTER, PA.

"ANOMALOUS VISCOUS FLOW AT VERY LOW RATE OF SHEAR AND SMALL SHEARING STRESS."

The paper describes a viscometer of the Pochettino or telescoping-cylinder type, adapted for use with an analytical balance to allow very small forces to be applied to the sample. Examples of low-shear rate flow curves for various anomalous systems are given. Flow properties of paints in region of a few dynes/cm^2 are found to be indicative of their "levelling" and "sagging" characteristics.

RHEOLOGY BULLETIN
F. R. EIRICH, EDITOR
Brooklyn 2, N. Y.
The Polytechnic Institute

A. B. BESTUL, NATIONAL BUREAU OF STANDARDS, WASHINGTON, D.C.

"TEMPERATURE COEFFICIENTS OF NON-NEWTONIAN VISCOSITY AT CONSTANT RATE OF SHEAR AND AT CONSTANT SHEARING STRESS."

In the type of non-Newtonian viscous behavior exhibited by high polymers and their solutions, rate of shear varies more rapidly than linearly with shearing stress. In the ranges of rate of shear and of shearing stress observable with available techniques, logarithmic plots of rate of shear versus shearing stress for a given system at different temperatures tend to lie approximately parallel to each other. It follows from these facts that the temperature coefficient of viscosity at fixed shearing stress is larger than that at fixed rate of shear. It was further found with a number of polymers and their solutions, that for fixed shearing stress the temperature coefficient tends to be the same as in the limit of zero shear, whereas it decreases with increasing rate of shear.

K. J. CLEEREMAN,
DOW CHEMICAL CO., MIDLAND, MICH.

"PHYSICAL PROPERTIES OF ORIENTED POLYSTYRENE MONOFILAMENT."

This paper discusses the fabricating variables that must be considered in the production of polystyrene monofilament. The effect of these fabricating variables on physical properties is also discussed. On the basis of this discussion a suggested method of fabricating highly oriented polystyrene monofilament is given.

G. E. DECKER, NATIONAL BUREAU OF STANDARDS, WASHINGTON, D.C.

"EFFECT OF SURFACES OF ROTOR AND DIES ON MOONEY VISCOSITY."

It was found that most commercial rubbers adhere to the metal surfaces sufficiently well so that serration in the dies and rotors are not required to prevent slippage. In studies of synthetic rubbers of relatively high molecular weight, slippage of the rubber on the metal surfaces causes erratic and low apparent viscosities, and is a function of the type of metal in contact with the specimen. Decreasing the speed of the rotor eliminates these anomalous results.

G. J. DIENES, BROOKHAVEN NATIONAL LABORATORY, UPTON, N. Y.

"EFFECT OF NUCLEAR RADIATIONS ON THE MECHANICAL PROPERTIES OF SOLIDS."

The effect of nuclear radiation on mechanical properties is discussed and it is shown that the observed changes can be quite satisfactorily interpreted on the basis of the production of interstitial atoms and vacant lattice sites by fast particle irradiation. In molecular solids nuclear radiations bring about changes in the substance which are best described as chemical ones, and drastic changes in the mechanical properties of high polymers are observed.

W. M. FELTON, FRANKLIN INSTITUTE, PHILA., PA.

"SONIC MEASUREMENTS ON GRINDING WHEELS."

This paper describes a non-destructive method for testing whether the manufactured grade of a grinding wheel corresponds to the designed grade. This method includes a sonic testing device for measuring natural frequency and a mathematical expression for a grade index that is proportional to the velocity of sound.

L. D. GRANDINE AND J. D. FERRY, UNIVERSITY OF WISCONSIN, MADISON, WIS.

"DYNAMIC MECHANICAL PROPERTIES OF THE SYSTEM POLYSTYRENE-DECALIN."

The dynamic rigidities and viscosities of solutions of polystyrene in decalin and of the undiluted polystyrene have been measured over wide ranges of concentration, temperature, and of frequency. The data, when reduced to a reference state of unit density and viscosity, give single composite curves. The distribution function of relaxation times in solution shows the three characteristic regions previously identified for polyisobutylene. The undiluted polymer gives single composite curves and the relaxation distribution function is somewhat sharper than those for other polymers in the transition from soft to glassy consistency; it is considerably sharper than the distribution function from data on solutions.

H. J. KARAM, DOW CHEM. CO., MIDLAND, MICH.

"REFRACTION STUDY OF ORIENTED POLYSTYRENE MONOFILAMENT."

Retraction of oriented polystyrene monofilament was studied. A method to obtain a retraction curve for oriented fibers is described. The portion of the retardation time spectrum oriented was calculated from the data. The effect of fabrication variables (% hot stretch and stretching bath temperature) on the spectrum are described.

M. MOONEY, U. S. RUBBER CO., PASSAIC, N. J.

"A TEST OF THE THEORY OF SECONDARY VISCOELASTIC STRESS."

Experimental data on secondary stresses in a viscoelastic liquid have been analyzed in terms of the superelasticity theory of secondary stresses as developed by Mooney. Slightly modified, the theory agreed within experimental error with observed normal stresses at various radii on a stationary circular plate mounted parallel to a rotating plate.

J. T. G. OVERBEEK, VAN'T HOFF LABORATORY, UNIVERSITY OF UTRECHT, NETHERLANDS (MIT)

"ACCURACY OF SMALL OSTWALD-VISCOMETERS."

Systematic and random errors in the determination of viscosity with a small type of Ostwald viscometer have been investigated. The more important systematic errors are (a) the end correction, (b) the surface tension correction and (c) the drainage correction. The random errors can be separated into one part due to the filling and positioning of the viscometer and one part due to the actual measurement of the flow time.

W. PHILIPPOFF, FRANKLIN INSTITUTE, PHILA., PA.

"INVESTIGATIONS ON ELASTOMERS IN A WIDE RANGE OF FREQUENCIES."

A vibration tester has been developed for the investigation of asphalts that allows the investigation of plastics in a range of frequencies from around 10 cycles per sec. to 2½ days per cycle, i.e. a more than 10^6 fold range. Data on the frequency dependence of modulus, loss, and viscosity are presented. The results can be described in terms of the "box distribution" as advanced by several authors.

J. E. PRICE, SIMONDS ABRASIVE CO., PHILA., PA.

"SONIC GRADE COMPARATORS FOR TESTING GRINDING WHEELS."

A discussion of operational problems and design changes necessary to achieve proper utilization of a sonic comparator developed by FI for use in determination of grinding wheel grade variations. Possible use of sonic data for determination of cracked wheels is discussed.

W. ROTH, ULTRA-VISCOSON CORPORATION, EAST HARTFORD, CONN.

"A CONTINUOUS ULTRASONIC VISCOSIMETER."

Ultrasonic techniques were employed in order to design a viscosimeter that would measure and record viscosity directly, continuously, and automatically. A small magnetostrictive strip is excited at an ultrasonic frequency in such a manner that the strip shears the liquid in which it is immersed. The ultrasonic waves in the strip are damped in accordance with the viscosity of the liquid. The probe is connected by a cable to an electronic computer which solves the equation relating viscosity to the damping of the probe. The instrument, called the Ultra-Viscoson, has a total range of 0-50,000 centipoises x grams/c.c., and requires only several ml. of liquid for proper operation. Its theory will be presented.

P. E. ROUSE, FRANKLIN INSTITUTE, PHILA. 3, PA.

"VISCOELASTIC PROPERTIES OF DILUTE POLYMER SOLUTIONS."

The viscosity and shear modulus of dilute solutions of polymers have been measured over the frequency range from 200 cps to 60 kc. as a function of molecular weight, concentration, type of solvent and viscosity of solvent. The data show satisfactory agreement with the results of a new theory in which the elasticity of a solution is related to the increase in free energy produced by the disturbance of the distribution of configurations of the polymer molecules away from its equilibrium form.

L. J. SHARMAN, HAMILTON COLLEGE, McMASTER UNIVERSITY, HAMILTON, ONTARIO.

"EFFECTS OF RATE OF SHEAR ON INHERENT AND INTRINSIC VISCOSITIES OF POLYSTYRENE FRACTIONS."

Fractions of polystyrene from 0.3 x 10^6 to 10 x 10^6 molecular weight were measured at rates of shear in the range of 100 - 20,000 sec^{-1}. The viscosities are sensitive to shear at high molecular weights; at a given temperature the effects are greater the higher the molecular weight and the better the solvent. Intrinsic viscosities should be determined in a poor solvent at a low temperature.

PHYSICS TODAY

The welcome news has just been received that as from January, 1953 the American Institute of Physics will make its Journal "Physics Today" available free of charge to all members of the Societies comprising the AIP.

"Physics Today" has proven its value as the general information Journal of physicists and has established its place among the AIP Journals. The Society of Rheology is glad to see one of its good deeds rewarded. By having assisted by means of a group subscription in seeing "Physics Today" through the critical days of its infancy, we are now able to pass on to our members the accrued interest of receiving this valuable journal free. Members interested in the story of the general progress of AIP are reminded of the Directors Report for 1951, published in "Physics Today", May, 1952.

J. C. R.

The Joint Commission of Rheology (JCR) of the International Council of Scientific Unions (ICSU) reported lately on its activities over the last three years.

A brief account was given as to why the creation of an International Union of Rheology (IUR) was abandoned and the proposed substitute of an International Association of Rheological Societies (IARS) was held temporarily in abeyance. The possibility that IARS might be established as an adhering body of the International Union of Theoretical and Applied Mechanics (IUTAM) has also not been further pursued. Since the British Society of Rheology (BSR) has been going ahead in the meantime with the organization of the Second International Congress on Rheology, to be held in Oxford in July, 1953, it was thought best to postpone any decisions until this Congress provides an opportunity for exchange of opinions between all the parties concerned. The BSR has, in the meantime, requested the JCR to accept the sponsorship of the Congress and it is anticipated that all members of JCR will support the Congress.

The need for an international organization in rheology has become more urgent, since the ICSU has adopted new rules according to which it is stipulated that joint commissions should act for limited periods only, and that for more permanent work they should be replaced by Commissions of the parent Unions. As long as no rheological Union exists, it would in future become difficult to have a forum for international discussion without depending on the cooperation of such related unions as the IUTAM or the Union of Pure and Applied Physics. In view of this situation, the JCR will call a meeting during the 1953 International Congress on Rheology in order to discuss what should be done, and to turn over its task to whatever new organization may be created.

SECOND INTERNATIONAL CONGRESS ON RHEOLOGY

The British Society of Rheology, supported by the Joint Commission on Rheology of the International Council of Scientific Unions, invites all rheologists to attend the 2nd International Congress on Rheology to be held at St. Hilda's College, Oxford, England, from the evening of Sunday, July 26th, until the afternoon of Friday, July 31st, 1953, and to contribute a paper. It will be recalled that the 1st Congress was held in Holland in 1948. Sir Geoffrey Taylor is President and Dr. G. W. Scott-Blair, The University, Reading, England, is the Hon. Organizing Secretary.

The Congress will cover the whole field of the study of the deformation and flow of matter, except such specialized subjects as have come to be regarded as branches of applied mechanics, e.g., the classical theory of elasticity, aerodynamics, etc.

Papers, which must not exceed 2,000 words in length including space for figures will be accepted subject to referee's approval and should reach the Organizing Secretary by December 1st, 1952. However, the Secretary should be informed of the intention of sending a paper as early as possible prior to this date. The Proceedings will be published in book form and, since it is intended to circulate proofs at the Congress itself, contributions cannot be guaranteed inclusion in the Proceedings if received late. Contributions cannot be accepted for publication unless one of the authors is present to read the paper personally. For further details, please, communicate with Dr. Scott-Blair.

A CONFERENCE ON PLASTICITY

The British Society of Rheology continues its remarkable activities by holding a "Conference on Plasticity" at the occasion of its Annual General Meeting at the University of Southhampton, Sept. 25-27, 1952. The program contains lectures on: Plastic Flow in Metals, Laws of Plasticity, Instruments for Measuring Plasticity in the Rubber Industry, Compression and Bearing Capacity of Cohesive Layers, Interpretations and Use of Thermoplastic Flow Data, Capillary Stresses and Strains in Wet Fibres, and Plasticity and Elasticity of Gels. Abstracts of these papers may be available later.

2nd MEETING OF RHEOLOGISTS IN BERLIN

The German Rheological Society, the founding of which last year was reported on in our previous Issue, convenes a 2nd Rheological Meeting in Berlin, September 24-27, 1952. The place of the meeting is again the Materials Testing Institute, and the Secretary is Dr. H. Umstaetter, Berlin-Dahlem, Unter den Eichen 86-87. Fifteen lecturers from Germany and abroad have been committed. We hope to report on the program in our next Issue.

XIIIth INTERNATIONAL CONGRESS OF PURE AND APPLIED CHEMISTRY, 1953

In view of the huge congregations at recent Congresses, rendering efficient organization almost impossible, it was decided not to call for general sessions every four years as in the past, but to stagger the meetings and to give the sections free hand to call meetings at two-yearly intervals. The first such Congress will take place in Sweden, and will comprise Physical and Colloid Chemistry, a Symposium on Wood and Wood Constituents, and a Symposium on Macromolecules. The former two groups of meetings will be held at Stockholm, July 29 to August 4, 1953, and the latter at Uppsala on August 5-7, 1953.

Some special lectures will be arranged. Short papers are cordially invited. All inquiries or applications should be directed to: XIIIth International Congress of Pure and Applied Chemistry, Stockholm 70, Sweden.

DEFORMATION AND FLOW

The North-Holland Publishing Company is preparing a series of Monographs on the Rheological Behavior of Natural and Synthetic Products under the above title. The Editorial Board consists of J. M. Burgers, J. J. Hermans and G. W. Scott-Blair.

Volume I, Deformation and Flow in Biological Systems, edited by Frey-Wissling, has already appeared; it forms a corollary to the Colloquium on Bio-Rheology held in Lund, Sweden, in 1950, and contains a Report on the Proceedings. There are further Essays by prominent Biologists, Physiologists, Zoologists, Botanists, etc. The topics covered are: Protoplasm, Muscle, Plant Cell Wall, Movement of Water, Latex Flow, Blood and Lymph, Cerebro-spinal and Intraocular Fluid, and Diffusion Phenomena.

Further volumes in preparation are "Molecular Theory of Fluids" by H. S. Green, "Flow Properties of Disperse Systems" by J. J. Hermans, and "Mechanical Properties of Wood, Paper and Textiles" by R. Meredith.

In view of the lack of comprehensive Texts, Reviews or collective writings covering the wide field of applied rheology, this series of Monographs promises to make a most valuable contribution to the growth of our science.

THE ABSOLUTE VISCOSITY OF WATER

Our members' attention is directed to a recent publication, Research Paper 2279, of the National Bureau of Standards, on the "Absolute Viscosity of Water at 20°C."

Since water is the almost universal standard for absolute viscosities, there has been an increasing demand for a more accurate determination, which has been published now. The newly found value is 0.010019 poise as compared with the previously accepted figure of 0.01005. The value to be used by the Bureau in future is 0.01002.