RHEOLOGY BULLETIN

Publication of the Society of Rheology

Volume 22, No. 2 Fall, 1953

THE BINGHAM MEDAL, 1953

Professor John D. Ferry of the University of Wisconsin, this year's recipient of the Bingham Medal, is one of the best known member of this Society for his contributions to our present knowledge of the rheology of polymeric systems, particularly in the field of periodic stresses.

Dr. Ferry published over ninety research papers covering such diverse subjects, in addition to rheology of polymers, as properties of proteins, studies of gelation and fibrin formation and action of antifouling paints, and has been recognized by the Eli Lilly Award in 1946. He has not only applied new concepts to an impressive volume of his own experimental work but provided others with a constant stream of new ideas.

THE ANNUAL FALL MEETING, 1953

After three years the Annual Fall Meeting of our Society returns to New York City with its high local concentration of members and interested non-members. A good attendance should be assured also by the unusually large turnout of papers. Apart from the number and quality, the Program Committee has succeeded in attracting speakers from all over the Nation covering a wide variety of topics.

As a consequence, the Meeting, originally scheduled for October 29 and 30, had to be extended to include the morning of Saturday, October 31st. On the first two days, the place of meeting will be the Panel Room, Hotel New Yorker, where also the registration takes place. On Saturday, the Meeting will move to the East Room.

The Annual Business Meeting of the Society will take place on Thursday at 4:30 P.M. in the Panel Room. Members are requested to attend. All participants are cordially invited to the Society's Annual Smoker in the Panel Room at 8 P.M., Thursday, when the Bingham Medal will be presented. Afterwards there will be demonstrations by the New York Telephone Co. under the title "Microwave Magic". Refreshments will be served.

According to indications from the speakers, the majority of the paper will be submitted for publication to the Society. It is anticipated that they will collectively appear in the late Spring in a Rheology Issue of the Journal of Applied Physics.

The individual sessions are scheduled to start at 10 A.M. and 1:30 P.M. on Thursday, at 9 A.M. and 1:30 P.M. on Friday, and also at 9 A.M. on Saturday. About 30 minutes will be available per paper including discussion. The talks will be arranged in the following order:

Thursday, A.M., Mock, Bestul, Carley, Mooney.

Thursday, P.M., Dexter, Krieger, Tordella, Hatfield, Gurnee, Sweeny.

Friday, A.M., Dienes, Nowick, Irwin, Freudenthal, Rivlin.

Friday, P. M., Poncelet, Shand, Lazan, Hammerle, Landel.

Saturday, Philippoff, De Witt, Padden, Catsiff, Tobolsky.

ABSTRACTS OF PAPERS TO BE PRESENTED AT THE FALL MEETING

A. B. BESTUL, NATIONAL BUREAU OF STANDARDS, WASHINGTON 25, D. C.

"COMPOSITION OF APPARENT SHEARING FORCES DURING SHEAR DEGRADATION OF POLYMERS"

Some polymeric systems are degraded when subject to vigorous shearing. In such cases the apparent shearing forces appear to be anomalous; their variation with rate of shear, concentration, etc., can be explained on the hypothesis that they include some contribution to the energy required by the degradation process. Some measurements of these forces in concentrated solutions of polyisobutenes under various conditions are reported and discussed.

JAMES F. CARLEY, DU PONT EXPERIMENTAL STATION, WILMINGTON, DELAWARE

"FLOW OF MELTS IN 'CROSSHEAD'-SLIT DIES; CRITERIA FOR DIE DESIGN"

"Crosshead"-slit dies are widely used for the extrusion of polymer sheeting, flat film, and blown film. In this paper we analyze the laminar flow of liquids in such dies. As an example, we derive an equation relating pressure to position along the slit for materials in which the shear rate is proportional to some power of the stress. This expression is then used to determine the die dimensions needed to make film whose caliper is uniform over its whole width. We examine several variations on the basic geometry and give some typical die dimensions.

E. CATSIFF AND A. V. TOBOLSKY, PRINCETON UNIVERSITY, PRINCETON, NEW JERSEY

"RELATION BETWEEN STRESS-RELAXATION STUDIES AND DYNAMIC PROPERTIES OF POLYISOBUTYLENE"

In order to extend experimental results on the stress relaxation and dynamic modulus of polyisobutylene over the entire time scale, use is made of the theorem that the effect

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The Polytechnic Institute
Brooklyn 1, N. Y.

of changing temperature is equivalent to a linear change of time scale. The data on the real dynamic modulus in the transition region can be represented by an error integral previously applied by the authors to other polymers.

E. CATSIFF AND A. V. TOBOLSKY, PRINCETON UNIVERSITY, PRINCETON, NEW JERSEY

"ELASTOVISCOUS PROPERTIES OF AMORPHOUS POLMERS IN THE TRANSITION REGION" II. "STRESS-RELAXATION OF BUTADIENE-STRYENE COPOLYMERS"

Experimental data have been obtained on the stress-relaxation modulus E(t) of several copolymers in their transition regions. The new data are expressed as master curves which can be fitted to the Gauss Error Integral form of reduced equation, as previously proposed. It appears possible to characterize the time-and temperature-dependence of E of amorphous polymers in general by means of the parameters of this equation: E^1 (glassy-state modulus), E^2 (rubbery-state modulus), T (distinctive temperature, related to second-order transition temperature), K (characteristic relation time at T), and h (parameter related to steepness of master curve). In the butadiene-styrene series, the effect of composition on these parameters has been determind.

F. D. DEXTER, BAKELITE COMPANY, BOUND BROOK, NEW JERSEY

"ROTATIONAL PLASTOMETRY APPLIED TO MOLTEN POLYETHYLENE"

A concentric cylinder rotational plastometer which automatically plots the shear strain vs. time curve at given shear stresses is described. It is shown that the flow of molten polyethylene can be expressed by a viscosity term, an elastic shear strain and a retardation time. The elastic shear strain increases with shearing stress while viscosity and retardation time drop. These changes may be expressed in terms of entropy effects.

G. J. DIENES, BROOKHAVEN NATIONAL LABORATORY, UPTON, NEW YORK

"MECHANICAL PROPERTIES AND LATTICE IMPERFECTIONS"

Imperfections in crystals are responsible for most structure sensitive properties as well as the mechanical characteristics of solids. Conversely, studies in mechanical properties permit conclusions about the nature of lattice imperfections. The effects of impurities of order, disorder changes, of the migration of imperfections are discussed and plastic properties described by the interaction of these factors.

A. M. FREUDENTHAL, COLUMBIA UNIVERSITY, NEW YORK CITY

"EFFECT OF RHEOLOGICAL BEHAVIOR ON THERMAL STRESSES"

The conventional elastic analysis of thermal stresses, coupled with the introduction of limiting creep rates and time — dependent fracture stresses as design criteria, results in procedures of design and analysis of considerable unreality for all parts of structures in the design of which thermal stresses are significant, such as heat — exchangers, nuclear reactors, etc.

The effect of rheological behavior with constant and temperature-dependent parameters on the level and distribution of thermal stresses is anaylzed under simplified conditions (uniaxial stress, spherical symetry) and compared with the elastic thermal stresses.

E. F. GURNEE AND T. ALFREY, JR., DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

"VIBRATIONAL PROPERTIES OF VISCOELASTIC REEDS"

The fundamental differential equation describing the free vibrations of a viscoelastic beam is developed and compared with the equation for the case of a purely elastic material.

This equation explicitly contains the intrinsic time dependent property of the material; the solutions of this equation are discusused by the "root-trajectory" method. The results are briefly extended to the case of forced vibrations. A few experimental results of free vibrational experiments are presented.

WILLIAM G. HAMMERLE, TEXTILE RESEARCH INSTITUTE AND PRINCETON UNIVERSITY, PRINCETON, NEW JERSEY

"MOLECULAR THEORY OF THE VISCOELASTICITY OF NONCROSSLINKED POLYMERS"

A theory of the viscoelastic behavior of noncrosslinked polymers above the brittle point has been developed which assumes viscous drags as the only internal forces. The diffusion equation for extensions at constant volume is solved and the predicted stress relaxation tested by means of published data. If corrected for chain entanglement the stress relaxation curve agrees with experimental data within 5% over seven decades of time.

For extensions at constant volume, the potential of a single molecule is proportional to the rate of strain, and is a quadratic function of Cortesian coordinates at the center of the chain.

MARSHALL R. HATFIELD AND GEORGE B. RATHMANN, MINNESOTA MINING & MANUFACTURING COMPANY, ST. PAUL, MINNESOTA

"CONSTANT STRESS ELONGATION OF SOFT POLYMERS: PLASTICIZER STUDIES"

Constant stress measurments on lightly cross-linked GR-S and polyisobutylene with and without plasticizer have been carried out and treated according to the principle of reduced variables. For GR-S plasticized and unplasticized samples

showed the equivalence of temperature and time, so that the concentration of plasticizer could also be reduced to yield a single curve. With polyisobutylene the plasticizer had a unique effect attributed to chain entanglement. Changes in activation energy with plasticizer are in all cases within experimental error.

B. J. LAZAN, E. PODNIEKS AND R. JOHNSON, UNIVERSITY OF MINNESOTA, MINNEAPOLIS, MINNESOTA

"DAMPING, ELASTICITY, AND FATIGUE PROPERTIES OF SOME NON-METALLIC MATERIALS"

Recently developed rotating beam equipment is described for determining the damping and elasticity properties of materials during a fatigue test. Data procured with this equipment on the effect of reversed stress magnitude, stress history, and frequency on the damping and elasticity properties of polystyrene, a glass-fabric laminate, and rubber are presented. These data and their units of expression are compared to those given in prior work. The significant differences between the general behavior of these non-metallic materials and metals are discussed. The engineering significance of damping and elasticity in design is briefly analyzed.

RICHARD A. MOCK AND CHARLES A. MARSHALL, DOW CHEMICAL COMPANY, MIDLAND, MICH.

"VINYLTOLUENE — STYRENE COPOLYMER SULFONIC ACID"
I. "VISCOUS PROPERTIES AND IONIC CHARACTER IN HYDROCHLORIC ACID SOLUTIONS"

The degree of dissociation of the copolymer polysulfonic acid in aqueous hydrochloric acid is apparently independent of the concentration of either solute. Most likely the polymer chain contracts so that always a maximum number if ionizing groups remains on the surface. The reduced viscosity depends on the ratio of the dissociated to the total number of counter ions. The limiting viscosities, and those at the maximum of a Fuoss plot, are proportional to the pH. At the maximum of the reduced viscosity the pH contains a well-defined contribution from the polymer.

It is permissible to postulate rather convincingly from our data that the reduced viscosity curve of the polysulfonic acid in water possesses a maximum accurately indicated by the intercept of a Fuoss plot (cf. equation (7) in the text). The intercept of a Fuoss plot for any polyelectrolyte can have the significance of a limiting viscosity number only when measurements are made in a non-ionizing solvent.

G. R. IRWIN, NAVAL RESEARCH LABORATORY, WASHINGTON, D. C.

"THE GROWTH AND INSTABILITY OF FRACTURE ORIGINS"

The Griffith crack theory stands in need of a study of the sequence of deformations accompanying crack growth prior to the attainments of a crack of critical size. Density measurements in copper and steel subjected to tension and compression suggest that flaws equivalent to tiny holes were present prior to the strain. It is further shown that the larger ones in a series of spreading cracks grow with disproportionately large speed. The general relations governing the onset of fast fracturing in relation to the released energy are given and the importance of the lack of similitude in the deformation of small, solid volume elements is pointed out.

IRVIN M. KRIEGER AND SAMUEL H. MARON, CASE INSTITUTE OF TECHNOLOGY, CLEVELAND, OHIO

"A STANDARDIZED TREATMENT OF VISCOMETRIC DATA FOR NON-NEWTONIAN FLUIDS"

Various methods available in literature for determining the flow curves of non-Newtonian fluids from viscometric data without the assumption of a flow equation may be unified to a general relationship by the use of the apparent fluidity. This relation has to contain a correction term, specific for the material and instrument, which becomes zero for Newtonian fluids. Methods for evaluating this correction term are developed.

ROBERT F. LANDEL AND JOHN D. FERRY, UNIVERSITY OF WISCONSIN, MADISON, WISCONSIN

"DYNAMIC MECHANICAL PROPERTIES OF CELLULOSE TRIBUTYRATE SOLUTIONS"

The viscoelastic properties of two fractions of cellulose tributyrate in trichloro propane have been studied by means of wave propagation, single transducer, and stress relaxation. The reduced dynamic rigidity and viscosity for each fraction form single curves and the distribution of relaxation times was constant over a wide time scale, differing in shape from those of synthetic polymers of comparable molecular weight, but resembling polyisobutylene of much higher molecular weight.

M. MOONEY AND W. E. WOLSTENHOLME, UNITED STATES RUBBER COMPANY, PASSAIC, NEW JERSEY

"THE RHEOLOGICAL UNIT IN RAW ELASTOMERS"

The existence of groups of molecules in uncrosslinked elastomers is postulated, which are held together by entanglement and move as elastic solid bodies. Considering such groups as rheological units, rubber-soluble dyes should be transferred across shear planes by the rotation of these units like ink by the rollers of a printing press. This phenomena has been observed with a Mooney viscosimeter, the rotor surface of which acts as a source of ink. From the velocity of the color front the mean size of the rheological units can be estimated and is found to lie in the range from 1-35 microns.

A. S. NOWICK, YALE UNIVERSITY

"INTERNAL FRICTION AND DYNAMIC MODULUS OF HEAVILY DEFORMED METALS"

The viscoelastic properties of a metal are greatly changed by deformation. There are various contributing factors, of which the internal friction is considerably increased. Three separate mechanisms have been found to contribute: (1) the viscosity of a network of slip bands produced by deformation increases strongly with temperature at constant frequency. This is due to coupling of various relaxation centers; (2) effects from dislocations which are capable of oscillation under alternating stresses, but which disappear at room

temperature during periods of about one day after the deformation; (3) a contribution not of viscoelastic origin which may be the major contribution to the internal friction, originating from a mechanism of static hysteresis and depending on amplitude rather than frequency. The dynamic modulus of deformed metals shows further contributions from a lowering of the unrelaxed modulus due to internal strain.

F. J. PADDEN AND T. W. DE WITT,
MELLON INSTITUTE, PITTSBURGH 13, PA.

"SOME RHEOLOGICAL PROPERTIES OF CONCENTRATED POLYISOBUTYLENE SOLUTIONS"

Three types of measurements have been made on concentrated polyisobutylene solutions. Dynamic measurements have been extended to low frequencies close to the region in which pure viscous flow predominates. A modified Stormer viscometer has been used to determine the apparent (non-Newtonian) viscosities of the same solutions. Pressures at the inner cylinder have also been measured in a concentric cylinder apparatus. It is noted that superposition procedures currently used for dynamic data are apparently applicable to the viscosity and pressure data with the rate of shear taking the place of frequency. Relations between these phenomena are discussed in the light of a theory proposed by one of the authors.

RONALD S. RIVLIN,
BROWN UNIVERSITY, PROVIDENCE, R. I.

"TEARING OF RUBBER WITH SOME IMPLICATIONS CONCERNING CUT-GROWTH"

Experimental evidence for use of an energy criterion in determining the static load at which a cut in a test-piece of pure gum vulcanize grows will be presented. It will be shown how a characteristic energy for the vulcanizate can be determined experimentally, such that from a knowledge of this and the elastic properties of the material the load at which a cut in a test-piece tears can be calculated. It will be shown that a study of the initial stages of the growth of a cut under static loading throws some light on observations concerning cut-growth under cyclic loading.

W. PHILIPPOFF, THE FRANKLIN INSTITUTE,
PHILADELPHIA 3, PA.

"FURTHER DYNAMIC INVESTIGATIONS ON POLYMERS"

The vibrational tester at the Franklin Institute provides the possibility of changing amplitude and shearing stresses to within ranges which can be obtained in rotational viscosimeters. Investigating the behavior of non-Newtonian materials at different frequencies, uncrosslinked polymers are found to exhibit Newtonian behavior up to the limit set by the temperature increase in the specimen. Static tests applying the same shearing stresses show a non-Newtonian behavior. Further experiments at small shearing stresses and low frequencies indicate that the non-Newtonian behavior is a combination of material properties and of the manner of stress application. The plots of viscosity vs. shear rate and viscosity vs. frequency differ only by a constant factor, while the initial viscosity is the same. It can be concluded that not the shear rate but the frequency itself is the governing factor. In all cases investigated, Ferry's method of reduced variables could be shown to hold over an extremely wide range of variables.

E. F. PONCELET, RESEARCH INSTITUTE,
STANFORD, CALIFORNIA

"THE MECHANISM OF FLOW IN CONDENSED PHASES"

The paper deals with flow as a mechanism of distortion and distention of microscopic domains. Distortion is a change in the configuration of a group of contagious particles, the probability of whose change in shear varies as a function reminiscsent of the hyperbolic sign law. Hence the viscosity is first fairly constant at low stresses but falls rapidly at higher ones. An expression is derived for the rate of distortion as a function of appropriate configurations and of hydrostatic compression.

If a configuration allows changes without rise in potential energy, the disordered state is maintained after each flip and the rate of flow stays uniform. If there is no cooperation and the flips create local strains, so that the concentration of flowable configuration decreases, the rate of flow will fall with the stress. Elastic after effects can be explained on the same basis.

E. B. SHAND, CORNING GLASS WORKS,
CORNING, NEW YORK

"THE STRESS FATIGUE OF GLASS"

The fatigue of glass differs materially from that commonly found in metals. The steady loading stress sustained indefinitely is about 40% of that required for fracture in five seconds. Fatigue is further not a function of load reversal but the integrated effect of stress and time. Tempering increases the short time strength and reduces the weakening by continued stress. Fatigue is also depending upon the presence of atmospheric moisture, in the absence of which little fatigue is found. The data confirm the hypothesis of delayed fracture from the slow propagation of cracks.

The study of fatigue at the molecular level is in its infancy but it has helped in developing the picture of crack propagation as influenced by local stress concentration and moisture.

KEITH H. SWEENY AND RICHARD D. GECKLER,
AEROJET-GENERAL CORP., AZUSA, CALIFORNIA

"THE RHEOLOGY OF SUSPENSIONS"
(Abstract not received in time.)

J. P. TORDELLA, DU PONT EXPERIMENTAL
STATION, WILMINGTON, DELAWARE

"UNUSUAL EXTRUSION PROCESS FOR 'TEFLON' POLYTETRAFLUOROETHYLENE RESIN"

Pure "Teflon" polytetrafluoroethylene resin may be extruded at high temperatures by a process which differs fundamentally from the standard method for extrusion of thermoplastics. The very high viscosity and the finite shear strength of the melted plastic prohibit rapid melt extrusion. However, at temperatures above the melting point more rapid flow occurs and smooth and regular, but weak and fibrous, monofil is extruded. Subsequent sintering yields strong, tough monofil. This separate sintering step may be eliminated by extruding at temperatures substantially above the melting point at atmospheric pressure but below the melting point at extrusion pressure. Sintering then occurs in the orifice, inasmuch as the melting point drops to its atmospheric pressure value at the outlet of the die. Further study is necessary to assess the commercial value of this extrusion process.

T. W. DE WITT,
MELLON INSTITUTE, PITTSBURGH 13, PA.

"A RHEOLOGICAL EQUATION OF STATE INCORPORATING NORMAL STRAIN, DYNAMIC AND NON-NEWTONIAN BEHAVIOR"

An equation of state is formulated from Maxwell's classical assumptions of superposition of the effects of strain and rate of strain. The time derivative of the stress is computed with respect to the axes in the fluid which are rotating at the rate measured by the vorticity. The transformation between rotating and fixed axes introduces cross terms between stress and vorticity. The resulting equation predicts non-Newtonian behavior and simultaneous normal stresses. For low rates of shear, or small cross terms, Newtonian flow or the usual Maxwell expression are obtained. A common origin is thus assigned to these phenomena. The method of reduced variables and distribution functions should be applicable to viscosity and pressure the same as to dynamic data.

WHERE IS RHEOLOGY TAUGHT?

Last Spring's inquiry led to a rather satisfactory response and to interesting, though not entirely unexpected, results. A preliminary report will be given below.

Of the approximately 400 inquiry cards sent out, about 60% were returned. The large majority of our membership acquired their rheological background the hard way, by self-study, usually in the course of their employment. Most of our rheologists are in doubt as to where to find facilities either for their own further study or for inquiring friends. Since a survey of existing teaching was one of the main subjects of our inquiry, a summary of replies follows. A more complete list, if possible supplemented by other sources of information, will be published later.

Brown University, Graduate Division of Applied Mathematics — *Plasticity, various rheological subjects.*

California Tech. — *Viscosity of Liquids and Solutions.*

Case Institute of Technology — *High Polymers, Paint Technology.*

Columbia University Dept. Civil Engin. and Appl. Mech. *Viscoelastic and Plastic Behavior, Deformation of gels, etc.*

Harvard University — *Testing, Lubrication, Viscoelastic Behavior.*

John Hopkins — *Solids.*

Kansas State College, Engineering and Architecture — *Applied Mechanics (Rheology course included).*

Lafayette — *Plasticity.*

Lehigh University — *Polymer chemistry survey course, Deformation of Gels, Pastes, etc.*

Massachusetts Institute of Technology — *Various rheological subjects, Colloids.*

National Bureau of Standards — *Various courses.*

Penn State — *Deformation of silicacious materials and soft solids, etc.*

Princeton University, Plastic Labs. — *Properties of Plastics.*

Purdue University — *Plasticity and Fluid Flow.*

Polytechnic Institute of Brooklyn — *Mechanical Behavior of Polymers.*

Stanford University — *Plasticity, Theory of Plasticity.*

Temple University — *Colloid Chemistry.*

University of Alabama — *Fluid Mechanics, Dynamics and Plasticity.*

University of Buffalo, Department of Physics — *Rheology (graduate level).*

University of California — *Fluid mechanics, lubrication, hydrodynamics.*

University of Delaware, Chem. Eng. Department — *Fluid dynamics.*

University of Illinois, Dept. of Aeronautical Eng. — *Inelasticity.*

University of Pittsburgh — *Plasticity, Lubrication.*

University of Rochester — *Rheology.*

University of Utah — *Rheology (seminars).*

University of Wisconsin — *Graduate course on polymers.*

MECHANICAL PROPERTIES OF WOOD AND PAPER

North-Holland Publishing Co., 1953
Distributed in U.S.A. by Interscience; 300 pages, 88 illustrations; Price $7.25.

Volume 3 of the Series of Monographs on the Rheological Behavior of Natural and Synthetic Products has appeared featuring the above subject under the Editorship of R. Meredith. It is a fascinating book which will occupy a central position in the vast field of so far poorly coordinated literature of two of our most important materials. To treat wood and paper in one volume, was a very advantageous arrangement, greatly facilitating the mutual coordination of our thinking on these two subjects.

The book tries to satisfy the Research Worker, as well as the Makers and Users. Hygroscopy and Swelling have been rightly made the central theme of the more theoretical section on Wood, but one would have liked to see an equally thorough discussion of the mechanical properties in terms of our by now rather extensive knowledge of wood structure. The chapters on Paper are outstanding in comprehensiveness and thoroughness and offer a unique picture of the intricate interplay between the nature of fibre and web properties. The only aspects that one might have wanted to see further discussed are the influence on strength of physical and chemical attack, and the possibilities of changing paper characteristics by sizing, wet strengthening, etc. This might, however, have changed the character and scope of the book too far.

THE SECOND INTERNATIONAL CONGRESS ON RHEOLOGY

The Second International Congress on Rheology, the Program of which was circulated to our members in our Bulletin Supplement in the Spring of 1953, was an even greater success than the first Congress held in Holland five years ago. There were about 250 visitors from twelve countries in attendance. A total of 56 papers were presented. The quality of most papers was high, and there was a great deal of stimulating discussion. Only 37 of the papers presented were available in preprint form before the meeting, but all of those presented, with the discussions, will be included in the final Proceedings of the Congress, and in this country will be available through the Academic Press.

Two general meetings were held on Tuesday and Thursday evenings during which discussions were held on the organization of an International Union of Rheology and on Nomenclature of Rheology. A number of factors bearing on the advisability and usefulness of an International Union, as well as questions of financing and affiliating with either the International Union of Chemistry, that of Physics, or that of Applied Mechanics were discussed. The general feeling was that the principal function of an International Union of Rheology should be to insure continuity of an organization which would organize periodic Congresses. The possibilities of such a body considering officially questions of nomenclature and of publishing an abstract journal were also mentioned. The attitude of our Society will be discussed at the next Executive Meeting, after which our membership will be consulted.

In the discussion on nomenclature, Dr. Leaderman presented results to date of the Nomenclature Committee of the Society of Rheology of the U.S.A. in its endeavors to agree on nomenclature and symbols for linear viscoelastic behavior.

THE BRITISH SOCIETY OF RHEOLOGY

Apart from being instrumental in the organization of the 2nd International Rheological Congress in Oxford, the British Society held two further meetings of interest. One took place at the University of Durham, on March 27 on the subject of Elasticity in Liquids. The following lectures were given:

Elastic Relaxation and Flow in Suspensions
R. Roscoe, Durham University.

The Rheological Behavior of Solid Particles in Liquid Media
S. Thornton, Durham University.

Experiments Relating to Shear and Compressional Viscosity
E. G. Richardson, Durham Univeristy.

Velocity Profiles in Viscoelastic Liquids
J. E. Caffyn and R. M. Underwood, Durham University.

Some Theories of the Weissenberg Effect
A. S. Lodge, Brit. Rayon Res. Assn.

The Annual Meeting on September 25th in London was followed by a Symposium on Mixing of Thick Liquids, Pastes and Slurries, including the following papers:

General Aspects of Mixtures and Mixing
P. V. Danckwerts, Dept. Chem. Engg. Cambridge Univ.

The Preparation of Pastes of Starch and Certain Gums for use in Sizing Textile Materials
E. H. Jones, The Brit. Cotton Ind. Res. Assn. Manchester.

The Mixing of Wheaten Flour Doughs
S. J. Cornford, Brit. Baking Ind. Res. Assn., Chorleywood.

Problems in the Mixing of Bituminous Materials
D. C. Broome, Limmer & Trinidad Lake Asphalt Co., Ltd.

Some Problems in Mixing Granular Materials used in Road Construction.
A. R. Lee, Road Res. Laboratory, Harmandworth, Middx.

The Mixing of Linseed Oil Putty
K. A. Lammiman, Res. Coun. Brit. Whiting Fedn. Bedford.

FOURTH PLASTICITY SYMPOSIUM

The Fourth Plasticity Symposium was held at Brown University on September 1-3, 1953 under the auspices of the Graduate Division of Applied Mathematics. More than 200 people from various parts of the United States and Europe attended the 3 day conference.

This year's meeting differed from previous Symposia in that the scope of material covered was considerably broadened to include not only papers on various phases of plasticity, both experimental and theoretical, but also papers on problems in viscoelasticity and general inelastic behavior of materials. This broader coverage of general non-elastic behavior is expected to be the theme of future Symposia.

One section of the Symposium was devoted to papers of particular interest to civil engineers, and was co-sponsored by the Engineering Mechanics Division of the American Society of Civil Engineers. The remaining sections were sponsored jointly with Brown University, by the Office of Naval Research.

No Proceedings of the Symposium will be published. However, a booklet of abstracts of all the papers presented was available at the meetings. Copies of this booklet may be purchased at $0.30 per copy from Graduate Division of Applied Mathematics, 182 George Street, Brown University, Providence 12, R. I.