

# RHEOLOGY BULLETIN

Publication of the Society of Rheology

Volume 26, No. 2

Spring, 1957

## 1957 ANNUAL MEETING

The Annual Fall Meeting of the Society of Rheology will be held in Princeton, N. J. on November 7, 8 and 9. The Textile Research Institute has offered the use of their new auditorium for the technical sessions. Adequate blocks of room reservations have been reserved at the Nassau Tavern and Princeton Inn.

The principal attraction of any scientific meeting is the program of papers presented. The selection of the papers is usually in the hands of a Program Committee. So it is with the Society of Rheology. This committee is most anxious to provide a well-rounded group of papers for the next meeting. All those interested in rheology are requested to participate in the work of this committee. Suggestions and contributions are invited. Presentation of papers is not restricted to members of the Society.

The deadlines for submission of papers are less difficult than those of many societies. Abstracts are required by September 1, 1957 and manuscripts by October 1. Suggestions and contributions should be forwarded to the chairman of the Program Committee, Dr. John P. Tordella, Research Division, Polychemicals Department, E. I. du Pont de Nemours & Company, Inc., Wilmington 99, Delaware.

## NOMINATIONS

In accordance with the new Constitution approved by the Society last year, the President appointed a nominating committee to prepare a list of candidates for the executive committee and officers. The following are the selections of candidates:

For President: J. H. Dillon  
Vice-President: J. H. Elliott  
Secretary-Treasurer: W. R. Willets  
Editor: R. D. Andrews

For the two members of the executive committee to be elected:

J. T. Bergen  
R. S. Marvin  
R. S. Rivlin  
J. P. Tordella

Ballots for this election will be mailed to the active membership around the first of July.

## NATIONAL BUREAU OF STANDARDS RHEOLOGY SECTION

A Rheology Section has been established at the National Bureau of Standards, to maintain and develop rheological standards as well as to develop new types of rheological measurements. The chief research interests of the new group will be in the field of phenomenological relationships between stress, strain, and time (rheological equation of state) in the non-linear region.

Work in rheology in other Sections of the Bureau will continue to grow, with emphasis on the rheology of various specific types of materials. The work of this Section is intended to supplement that of other groups and to concentrate on problems not previously given sufficient attention. Its establishment is a recognition of the growing importance of this field and of the need for continuing development of new measurement techniques and standards.

The Section is to be a fairly small one, with a total of about a dozen professional people, according to present plans. Obviously such a group must choose for investigation only a few of the many subjects which could properly fall into the field of rheology. The initial program is being developed to concern itself with the study of the response of solids and liquids to stress, and can be broken down into three main areas.

### I. VISCOSITY STANDARDS AND MEASUREMENT OF VISCOSITY OF LIQUIDS.

At the moment the only rheological standard provided by the Bureau, and the only ones which appear to be either needed or feasible, are material standards of viscosity. These are the familiar standard viscosity oils which are widely used for calibration of viscometers. The measurement of viscosity is based on its definition in terms of fundamental units, and as such a material viscosity standard would appear to be redundant. However, viscometers currently in common use are of such design that they can be used as absolute instruments only when measurements of relatively low accuracy are acceptable. This is due in part to the difficulty of measuring the critical dimensions with sufficient accuracy and in part to the deviations from the conditions of flow assumed in calculating the simple equations for any given viscometer. Hence it appears probable that there will be a continuing need for these material standards.

At present a series of commercial oils are used for

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 Bryce Maxwell, Editor  
 The Princeton University  
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these standards, no extra purification or treatment being attempted. The viscosity of each batch is measured at a number of temperatures, all values being obtained in instruments calibrated by direct or indirect reference to the viscosity of water at 20°C. The possible accumulation of errors when the reference is indirect and must be made through several intermediate steps, reduces the certainty with which values may be obtained for liquids whose viscosities differ greatly from that of water at 20°C. Efforts are being made to develop a viscometer with which the viscosities of the standard oils could be measured routinely, without reference to any material standard. Such an instrument should be particularly useful for the measurement of liquids of high viscosity, and might prove simple enough to be used in many laboratories to replace conventional instruments.

Most of the oils presently used for these standards are fairly stable, showing only a small viscosity change over a period of one or two years. For this reason, exact statements as to their stability are hard to document, and they have not up till now been certified as to stability. The data available are being analyzed with a view to preparing for release such conclusions on their stability as can be justified, although in any case it will still be advisable to obtain these oils for use as needed rather than as stockroom items.

There has been, over the past year or two, a considerable amount of discussion as to the desirability of obtaining accurate viscosity data for some pure hydrocarbons. If values were known for compounds which could be readily purified, the need for standard oils, each batch of which must be measured separately, might be diminished greatly and perhaps even eliminated. The work done on this problem so far indicates that the time and effort required to purify such materials is such that they would not be practical for use in most laboratories.

#### II. RHEOLOGICAL EQUATION OF STATE INCLUDING NON-LINEAR TERMS.

The principal research problem of this new group is in the general field of non-linear, time-dependent rheological phenomena. Basically, we need to know the minimum set of material constants or functions of time which will suffice to describe the rheological behavior of a material, and what if any relationships exist between such functions. There has been evidenced a growing interest in this field lately, but a great deal of experimental work still appears to be required before we are in a position to understand how to specify rheological

behavior most efficiently. Many laboratories are working on various aspects of this work and, we hope, to contribute to the solution of some of the problems in this field, in order that we may be in a position to fulfill the need for standards which may arise in the future.

#### III. RELATIONSHIP OF RHEOLOGICAL PROPERTIES TO STRUCTURE.

Although most of the work of this Section will be on the phenomenological study of mechanical properties, any research group in this field must consider the relation of such properties to structure in order to pursue its phenomenological studies efficiently. Moreover one cannot expect to conduct a basic research program on the phenomenological behavior of materials without considering how such properties reflect the basic structure of the material being investigated. It is anticipated that something like 20% of the effort of the group will be devoted to such work. Initially measurements of the dynamic bulk modulus, using the apparatus which personnel now in the Section developed in another section of the Bureau, are being carried out on the natural rubber-sulfur system, with the objective of investigating the behavior of the glass transition of this system as a function of static pressure, temperature, time, and composition. It is very likely that other transitions, not necessarily in polymeric systems, could be investigated using this technique.

## ANNUAL STATEMENT December 31, 1956

Cash in account, December 31, 1955	\$4,471.82
Receipts, January 1 through December 31, 1956:	
Dues collected:	
1956 .....	\$ 554.60
1957 .....	1,306.80
	1,861.40
Net income—sales of "Journal of Rheology"	12.61
Interest on "G" bonds.....	17.50
Registration fees at meeting.....	201.00
	\$6,564.33
Disbursements, January 1 through December 31, 1956:	
Contribution to A. I. P. ....	\$ 163.96
A. I. P. charge for dues collection	144.75
Journal of Applied Physics-	
Rheology issue.....	531.25
Bulletins:	
Printing .....	\$234.86
Mailing .....	59.18
	294.04
Publicity Committee.....	23.69
Membership list—preparation	
& mailing.....	166.51
Addressing & mailing announcements of ASTM Meeting....	15.70
Membership in foreign societies..	5.84

Secretary's office:			
Letterheads .....	\$ 25.75		
Membership cards.....	9.27		
Ballot envelopes.....	7.25		
Gratuities .....	20.00	62.27	
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Bronze Medal (Tobolsky) .....		6.33	
Meeting's expense (1956):			
Badges .....	\$ 28.21		
Pittsburgh Athletic Assn.	75.00		
Xerography .....	3.61	106.82	
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1955 Meeting's expense (projectionists) .....		115.00	
			<hr/>
			1,636.16
Balance in account, December 31, 1956.....			<u>\$4,928.17</u>
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Bingham Fund:			
U. S. Government Series "G" bonds.....	\$ 700.00		

## FOREIGN ACTIVITIES

The rheology societies of foreign countries continue to increase their activities. The program of mutual exchange of publications and information mailings between societies instituted last year has greatly increased speed of interchange of information and the scope of activities covered. The program of our last Annual Meeting has been listed in *Berichte der Deutschen Rheologischen Gesellschaft*. Abstracts of important papers published in this country and abroad are now abstracted in *Cahier Du Groupe Francais D'Etudes De Rheologie*.

The following notes on activities abroad may be of interest to our membership:

**Japan:** The Fifth Japanese Rheology Symposium was held in Kyoto, November 9-11, 1956 under the joint auspices of the Japanese Chemical Society, Physical Society, Highpolymer Society and Material-Test Association. There were twenty contributions including an invited lecture by Dr. H. Leaderman of the National Bureau of Standards now a visiting Professor in Japan under the Fulbright Act. English translations of the abstracts of papers presented in the Symposium are now being prepared and will be available for distribution at an early date.

**Czechoslovakia:** The International Symposium on Macromolecular Chemistry will be held in Prague, September 9-15, 1957 under the sponsorship of the International Union of Pure and Applied Chemistry. The provisional program indicates that about one-half the papers will be of direct interest to rheologists. Among the topics to be included will be: Statistics, thermodynamics and kinetics of physical processes and systems, Properties of macromolecules in solution, Properties of gels, melts and solids, Properties of suspensions and emulsions.

**Germany:** Although details are not yet available it has finally been established that the Third International Congress on Rheology will be held in Germany. This seems a happy solution to the many problems of transportation and currency exchange.

Friedr. Vieweg & Sohn have announced the reappearance of "Zeitschrift fur Instrumentenkunde". This review, which has served for sixty-five years in the exchange of knowledge between science and production resumed publication in January 1957.

**England:** The British Society of Rheology held a conference on the "Rheology of Elastomers" in May at the Rubber Producers Research Association, Welwyn Garden City.

In order to make available English translations of the results of research and development in the fields of science, medicine and technology in the U.S.S.R. and other Soviet orbit countries a non-profit foundation entitled the Pergamon Institute has been formed in London and New York. Among the objectives of the Foundation are the following:

To establish a translation panel of competent and highly qualified translators from Russian and other Slavonic languages into English, and to make available these services to scientists, learned societies, government agencies and industry throughout the world on a non-profit making basis.

To sponsor and foster research in the organization of scientific information, mechanical systems for storing and retrieving information and mechanical translation.

To publish a journal devoted to reporting translation work done anywhere in the world from Russian into English, and to encourage, coordinate and foster the teaching of Russian at higher seats of learning.

The Institute would be glad to receive support from any members of the Society in the work they are undertaking. They would appreciate advice and suggestions of members whose knowledge of Russian is sufficient to qualify them to become members of the Institute's panel of paid translators. They are also interested in receiving suggestions and recommendations of additional work which should be undertaken to assist the Society's members in keeping informed of what is being done in rheology in the countries concerned.

## BRITISH SOCIETY

The British Society of Rheology will hold a conference on "Rheology of Disperse Systems" at the University of Swansea on September 19 and 20. The tentative program contains:

- Mr. E. Bantoft—Some Measurements on Pigment-Plasticiser Dispersions.
- Mr. N. Casson—A Flow Equation for Pigment-Oil Suspensions of the Printing Ink Type.
- Mr. T. C. Daniells—Density Separation in Gaseous Fluidiser Beds.

Dr. G. F. Eveson—Viscosity of Stable Suspensions of Spheres.

Dr. A. Jobling and Mr. J. E. Roberts—Some Observations on Dilatancy and Thixotropy.

Mr. G. K. Jones—Strength of Porous Bodies Injected with Bentonite Suspensions.

Mr. R. S. Lenk—Rheology and other Factors Involved in Starch-Clay Coating Mixes.

Dr. T. V. Starkey—The Apparent Viscosity of Suspension Sols.

Mr. E. H. Steiner—Rheology of Molten Chocolate.

## A. I. P. NEWS

The American Institute of Physics moved its offices to the newly acquired property at 335 East 45th St. on June 8. Some of the renovations and improvements needed in the new headquarters are still being worked on but the major portion have been completed permitting the move at this time.

The Institute Development Fund Drive continues to be in need of the support of individual physicists and industrial concerns. We all have a stake in the work of the Institute and the objectives of this Drive. The Institute represents physicists, scientists and engineers as a whole. Although as professional men we may feel a greater degree of self sufficiency than most. The Institute is the political defender of scientists and the general public relations expert of its members. Our national defense is intimately associated with the work of the Institute and through it the great national resource of its members. This Fund Drive deserves our best support.

In order to help the Drive, the Acoustical Society of America and the American Physical Society have agreed to make supplementary contributions to the Fund of an amount equal to their regular annual support payment to the Institute. This regular annual support contribution to the Institute is a percentage of annual dues.

In the case of the Society of Rheology this is at the rate of 10 percent and currently amounts to about \$165. By unanimous vote of the Executive Committee it was agreed that we should make a similar special contribution to the Fund.

We note with regret the resignation of Dr. Henry A. Barton, one of the leaders of modern physics, as Director of the Institute and welcome to this post an old friend, Dr. Elmer Hutchisson. Dr. Barton has been Director of A. I. P. since its foundation in 1931 and will continue to be associated with the Institute on a part-time basis with the title of Associate Director. The change will take place July 1.

Dr. Hutchisson has been closely identified with the A. I. P. for over 20 years, was a member of its staff for a time, founded and edited the Journal of Applied Physics and has had a distinguished career as a scientist, educator and administrator. He comes to the Institute from the post of Dean of the Graduate School and Director of the Research Division of the Case Institute of Technology.

## BOOK REVIEW

A series of three volumes entitled "Rheology, Theory and Applications" edited by F. R. Eirich of the Polytechnic Institute of Brooklyn will be published by Academic Press. Volume one reached the market last fall. Volumes two and three are scheduled for spring and fall release this year.

The first volume indicates that this series will be a valued asset to any reference library. Twenty-two noted rheologists contributed to the volume. Each chapter contains an exposition of a subject on which the author is a recognized expert. By this means this volume and the two to follow will represent a composite collection of the current work on the flow and deformation of matter in nearly every line of scientific and technological activity.

The reader who is a specialist in a particular field will have the benefit of the work of other leaders in his field. The general worker in the field of rheology will benefit by this extensive combination of information on the many fields of the subject.

It is the hope of the publishers that new and fruitful generalization will be made easier because of these volumes, and older generalization re-interpreted and widened as a result of the organization and coverage. As a result progress toward unified rheology may be advanced.

The need for this unification becomes apparent to the reader as he scans the first volume. Some difference of opinion exists between the approach and the interpretation of rheological problems and behavior between the various authors. In such diverse material fields such as metals and polymers the same unified fundamental rheology can be applied. Similarly the dissemination of rheological knowledge from one materials field to another is assisted by this book.

## THE TRANSACTIONS

Final arrangements for publication of Volume I of the Transactions of the Society of Rheology have been completed. The members should receive their copies at approximately the same time as they receive this Bulletin.

This volume of 214 pages will contain twelve of the papers presented at the 1956 Annual Meeting, the Bingham Medal presentation speech and the nomenclature committee's final report. Through the cooperation of Interscience Publishers the Transactions will bring to rheologists a larger proportion of the material presented at the meeting than has been possible in the past. In addition to supplying copies for each member, Interscience Publishers will be prepared to sell additional copies on the open market to interested non-members. This wide dissemination of papers presented at our Annual Meetings will be beneficial to the science of rheology and to the Society.