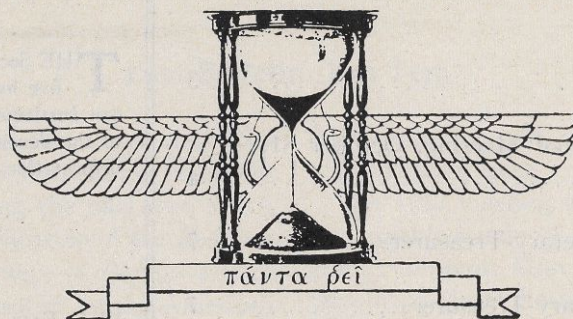


# RHEOLOGY BULLETIN



REVISED CONSTITUTION  
MEETING ABSTRACTS

PUBLICATION OF THE  
SOCIETY OF RHEOLOGY

VOLUME 18, NOS. 3 AND 4

DECEMBER, 1947



# RHEOLOGY BULLETIN

Vol. 18, Nos. 3 and 4

December, 1947

## TABLE OF CONTENTS

Last Bulletin (Pro Tem).....	3
Abstracts of Papers (Annual Meeting, October 31–November 1, 1947).....	4
Annual Report of the Secretary-Treasurer.....	7
Financial Report of Secretary-Treasurer.....	7
Minutes of Business Meeting, October 31, 1947.....	8
Constitution and By-Laws.....	9
International Rheological Congress in Holland, September, 1948.....	12
British Rheologists Club.....	14
British Rheological Nomenclature—A Letter to the Editor.....	14

### Associate Editors

A. Bondi	J. A. Pask
J. H. Elliott	W. W. Pendleton
R. G. Fordyce	B. R. Roberts
A. Gemant	R. Simha

Published for the

## Society of Rheology

by

The American Institute of Physics

57 East 55 Street

New York 22, New York

**T**HE Society of Rheology is one of the five founder societies of the American Institute of Physics and is dedicated to the development of the science of the deformation and flow of matter.

### OFFICERS

W. F. FAIR, JR., <i>President</i>
Mellon Institute of Industrial Research Pittsburgh 13, Pennsylvania
H. M. SPURLIN, <i>First Vice President</i>
Hercules Experiment Station Wilmington 99, Delaware
R. N. TRAXLER, <i>Second Vice President</i>
The Texas Company Port Neches, Texas
W. H. MARKWOOD, JR., <i>Editor</i>
Hercules Experiment Station Wilmington 99, Delaware
Earl K. Fischer, <i>Secretary-Treasurer</i>
Institute of Textile Technology Charlottesville, Virginia

Send manuscripts and editorial communications to:

W. H. Markwood, Jr.  
Hercules Experiment Station  
Wilmington 99, Delaware

Send orders for current and back issues,  
\$0.75 per copy to:

Society of Rheology  
57 East 55 Street  
New York 22, New York



# Rheology Bulletin

Publication of the Society of Rheology

---

Vol. 18, Nos. 3 and 4

December, 1947

---

## Last Bulletin (Pro Tem)

AS has been discussed at meetings of the Society, at Executive Committee meetings, and in the Bulletin during the past two years, the Society will cease publication of the *Rheology Bulletin* upon the appearance of *Physics Today*, a new news journal sponsored by the American Institute of Physics. This journal will appear early in 1948 and will carry timely news of general interest of developments in the realm of physics as well as news of the member societies of the Institute. Subscription to the journal is included in the dues of all members of these societies. The *Journal of Colloid Science* will continue to publish our technical papers.

We are fortunate to have these two journals of wide circulation carry on the functions begun by the *Rheology Journal* in October, 1929.

The editor wishes to thank those members whose help in supplying material has made the Bulletin a possibility. None of these associates has once failed to hit the deadline.

It is with chagrin that this last blurb must contain an apology. This issue is numbers three and four for 1947. Uncontrollable events in the arrangement of the program and decisions on the Constitution (the subjects scheduled for the

September number) made it impossible to have a pre-meeting issue.

The 1947 meeting was a good one, resting in the capable hands of Dr. Nason, technical program chairman; Miss Weltman, social program chairman; Mr. Willetts, viscometer exhibit chairman; and Mr. Lynch, who ably assisted both Miss Weltman and Mr. Willetts.

A new and effective feature of the meeting was the exhibition of the Green and Weltman concentric cylinder viscometer by the Precision Scientific Company, cylindrical viscometers by the Brookfield Engineering Company, a flow-meter-type viscometer by Fisher and Porter, the Macdonald plastometer by Gardner Laboratories, recording viscometers by Brabender, and an electronically timed falling ball viscometer by Tech. Laboratories. These useful instruments drew much attention and aided materially in the success of the meeting.

Dr. Ken Carpenter's movie-illustrated talk on a trip to the Far East was enjoyed by those attending the smoker on Friday evening.

The complete texts of all eleven papers presented at the meeting will appear in the number one issue of the *Journal of Colloid Science* for 1948.



## Abstracts of Papers Presented at Annual Meeting, Society of Rheology, Hotel Pennsylvania, New York, October 31–November 1, 1947

**Measurements of Stress Relaxation in High Polymer Materials.** W. S. MACDONALD AND ALEXIS USHAKOFF, *W. S. Macdonald Company, Cambridge, Massachusetts.*—A compact instrument has been developed for accurate measurement of stress relaxation. It consists of a jig having a leaf spring as a platform above which is a cam operated plunger which descends and compresses a sample placed on the leaf spring. Temperature compensated strain gages mounted on the underside of the spring transmit minute deflections to an electrical recorder. The jig is located in a temperature controlled oven above which is the recorder. Adequate space is allowed to temperature condition a number of samples. The cam is operated manually by a lever which is outside the oven and located on the front of the case which houses the entire unit. Samples can be loaded rapidly and the load adjusted through manipulation of the threaded plunger. The record of relaxation under the effectively constant deflection is continuous during the measuring time. A stylus records the stress relaxation on a circular chart. The curve drawn is a logarithmic spiral. When this curve is replotted on semi-log paper using time as abscissa and the ratio of load at time  $t$  to load at  $t_0$  as ordinate, a straight line results. The relaxation obeys the formula  $L/L_0 = 1 - K \log(t/t_0)$ , where  $t_0$  and  $t$  are the effective starting and subsequent times and  $L_0$  and  $L$  are the corresponding loads.  $K$  is a constant which is characteristic of the material tested and can be used as a criterion.

**Rheological Properties of Polystyrene.** ROLF BUCHDAHL, *Monsanto Chemical Company, Plastics Division, Springfield, Massachusetts.*—Previous measurements on polystyrene and highly concentrated polystyrene solutions are discussed briefly. The method used in this investigation—a rotational type of viscometer—is described and the experimental limitations of the present set-up are pointed out. Typical results obtained with this method are given, and it is shown that time dependent flow properties are of considerable importance in the rheological behavior of polystyrene. The data are discussed in relation to recent theories of viscous flow of high polymers, particularly with respect to the energy of activation of flow.

**Viscous Flow of Molten Polystyrene.** R. S. SPENCER AND R. E. DILLON, *The Dow Chemical Company, Midland, Michigan.*—It has been known for some time that molten polystyrene is a non-Newtonian liquid at high rates of shear. Eyring and co-workers have developed an equation for a type of non-Newtonian flow through capillary tubes which has been applied to rubbers and polyesters. The authors have found that the Eyring equation does not fit the data in the case of polystyrene, and a discussion of possible shearing stress-rate of shear relationships is presented. Molecular orientation during capillary flow was observed, and its dependence upon temperature and

pressure gradient is reported. The viscosity-temperature relationship is also discussed.

**The Cragoe  $L$  Function for Viscosity of Oils under Pressure at Certain Temperatures,** R. B. DOW, *Navy Department, Bureau of Ordnance, Washington, D.C.*—C. S. Cragoe<sup>1</sup> in 1933 suggested a simple function, the  $L$  function, for representing changes in the viscosity of lubricating oils with changes in temperature, pressure, and composition. The absolute viscosity,  $\eta$ , of an oil can be written in terms of

$$\eta = Ae^{B/L}$$

where  $A$  and  $B$  are constants for any oil, and  $L$  is the Cragoe viscosity function. The pressure coefficient of  $L$  is defined as

$$\beta = \frac{L_1 - L_p}{L_p(p-1)}$$

where  $L_1$  is the value at atmospheric pressure and  $L_p$  is the value at pressure  $p$ . On the basis of the rather meager data available at that time on the viscosity of oils under pressure, e.g., data of Hyde, Hersey and Shore, Kjesskalt, and Kleinschmidt, Cragoe concluded that  $\beta$  was approximately constant over a range of 1 to 1500 kg/cm<sup>2</sup> and varied only slightly with temperature between 20° and 80°C. In view of the obvious practical value of the  $L$  function, and the fact that rather detailed viscosity data<sup>2</sup> are now available at various pressures, it is considered desirable to reinvestigate the pressure behavior of the  $L$  function for several oils of widely different characteristics. A preliminary survey indicates that over an initial pressure range of 1 to 800 kg/cm<sup>2</sup>, Pennsylvania type oils exhibit a rapid decrease of  $\beta$  with increase of pressure, which may amount to 20 or 30 percent at 54.4°C. Beyond this range and extending to perhaps 1500 kb/cm<sup>2</sup>,  $\beta$  remains approximately constant. On the other hand,  $\beta$  for highly naphthenic oils remains practically constant over the same pressure ranges. The  $\beta$  relationships with temperature and other physical characteristics are discussed briefly for several American and foreign oils.

<sup>1</sup> "Changes in the viscosity of liquids with temperature, pressure and composition," Proc. World Pet. Congress II, 529 (London, 1933).

<sup>2</sup> For example, see R. B. Dow, "The rheology of lubricants," J. Coll. Sci. 2, 81 (1947).

**The Viscosity Basis of Plasticizer Action.** H. JONES AND E. CHADWICK, *Plastics Division, The Geigy Company, Ltd., Manchester, England.* A brief review of the origin and development of the "viscosity theory" of plasticizer action, now accepted as having a classical basis but primarily offering practical formulas with which to relate the behavior of plasticizers to the behavior of binary systems containing plasticizers. The fundamentals of the theory as currently elaborated comprise: 1. The miscibility of the components of binary systems on the basis of liquid-liquid mixing. 2. The rheological properties of the components.



3. The concentration factor. 4. The temperature dependence of (a) the miscibility and (b) the rheological properties of the components. Essentially the theory is, so far, best expressed in the form of the viscosity characteristics of the components; in idealized form thus,

$$\log \log B = x \log \log \text{Plast.} + (1-x) \log \log \text{Pol.}$$

where  $B$  = viscosity binary soln., Plast. = viscosity plasticizer component, Pol. = viscosity polymer component, and  $x$  = a function of the concentration of the plasticizer. The components vary considerably in their separate  $\nu$ - $T$  dependence. Plasticizers are normally the more sensitive components in these systems and will exert a marked influence on the temperature sensitivity of the rheological properties of the system. Further data in support of the theory are offered. Criticisms of the theory are discussed: 1. Solvent ability and the temperature coefficient of solvent ability (Doolittle). 2. The preferred use of oil extraction rates to measure, e.g., L.T. flex. (Alfrey). 3. The apparently anomalous behavior of the so-called resinous plasticizers (Alfrey). Experimental data are offered on: 1. Further data on plasticizer viscosity-temperature relationships. 2. Further relations of rheological properties of the binary system versus plasticizer viscosity, especially temperature dependence. The general trend of the results is to support the theory as giving best over-all picture of the rheological properties of the binary system. Exceptions are frequently noticed; these may well prove to be caused by incomplete liquid-liquid mixing. The proponents of the theory do not preclude the possibility of deviations being due to a special type of interaction of the plasticizer and polymer. Deviations may point to cases of unique interaction but such cases have not yet been observed in our experimental data. *Summary.*—A survey of the viscosity theory of plasticizer action is given and stress is placed on the viscosity (especially temperature dependence of viscosity) of the components and the ratio of their use. A prerequisite for the application of the theory is the mixing of the components at the temperature at which the study is made. Further relevant experimental data are offered and apparent variations from the rule are discussed and explanations suggested.

**Viscosity and Shear Elasticity Measurements of Liquids by Means of Shear Vibrating Crystals.** W. P. MASON, *Bell Telephone Laboratories, Murray Hill, New Jersey.*—By employing a technique discussed in a previous paper,<sup>1</sup> measurements of the shear viscosity and shear elasticity have been made for long chain molecule liquids of the polyisobutylene type. The viscosity measurements in the range around 15 kilocycles check the viscosities measured by falling ball measurements within the experimental error. As the temperature decreases or the frequency increases, the reaction of the liquid shows that a shear elasticity of the Maxwell type comes into play with a shear elastic constant of from  $5 \times 10^6$  to  $5 \times 10^7$  dynes/cm<sup>2</sup>. This elasticity increases with decreasing temperature and increases with chain length and represents an intermediate type to the "frozen" type of elasticity or the "kinetic theory type" in that it has the high compliance

of the "kinetic theory type" but the temperature variation of the "frozen" type of elasticity. It is suggested that this type of elasticity may be caused by a composite motion of the chains including hindered rotation within chains, as well as interaction of segments between chains. Since a viscous wave penetrates only a few hundredths of a centimeter this technique can be applied for thin films of a material. The torsional crystal cannot be constructed to work higher in frequency than several hundred kilocycles. By using thickness shear vibrating crystal covered by a thin film of the material to be measured, frequencies in the megacycle region can be measured and the properties of much lighter liquids determined. By driving highly etched quartz crystals nearly to their breaking point quite high rates of shearing stresses can be impressed upon the liquid and viscosities at high rates of shear determined.

<sup>1</sup>W. P. Mason, "Measurement of the viscosity and shear elasticity of liquids by means of torsionally vibrating crystals," *Trans. A.S.M.E.* (May, 1947).

**Theory of Plastic Flow Versus Theory of Plastic Deformation.** W. PRAGER, *Brown University, Providence, Rhode Island.*—The theories of plasticity which have been proposed for materials with strain-hardening can be divided into two groups: theories of plastic deformation and theories of plastic flow. The theories of the first group are based on the assumption that for continual loading the state of strain is uniquely determined by the state of stress. The theories of the second group, on the other hand, assume that only the infinitesimal increment of strain is uniquely determined by the existing stress and the increment of stress. Under the special conditions prevailing for the customary arrangements of testing materials under combined stresses the theories of both groups yield the same prediction, and the available empirical evidence of a more general character is too limited to allow a definite decision between the two kinds of theories. Under these circumstances, it seems worth pointing out that for the so-called neutral changes of stress (i.e., changes which constitute neither loading nor unloading) the theories of deformation lead to certain difficulties which do not arise with the theories of flow.

**A Penetroviscometer for Very Viscous Liquids.** J. J. BIKERMAN, *Merck and Company, Inc., Rahway, New Jersey.*—A new viscometer is described. Viscosity is calculated from the rate of descent of a heavy vertical rod in a coaxial tube filled with a liquid whose viscosity is greater than 1000 poises.

**Recent Developments in Industrial Viscometers.** HENRY GREEN, *Interchemical Corporation, New York, New York.*—A review of the development of viscometry in the light of the increasing understanding of the importance of knowledge of types of flow as influenced by shearing rates and stresses and by "structure" within fluid systems.

**New Aspects of Colloid Science to Rheology.** ERNST A. HAUSER, *Massachusetts Institute of Technology, Cambridge, Massachusetts.*—A brief historical survey of rheology as a



science is given from a colloid chemist's point of view. Based on recent contributions colloid science has made toward a better understanding of such properties of matter like elasticity, plasticity, and viscosity, its importance to rheology is pointed out. A few scientific and technological facts are discussed and offered as proof as to why rheology cannot survive as a science, unless it takes colloid science more seriously into consideration than it has done so far.

**Pseudoplastic Flow Properties of Lyophilic Colloids.**

EARL K. FISCHER AND CHARLES H. LINDSLEY, *Institute of Textile Technology, Charlottesville, Virginia*.—Colloidal solutions such as those prepared from starch, methyl cellulose, alginates, gelatin, water-soluble gums, etc.,

exhibit characteristic flow properties in which the apparent viscosity decreases with increased rate of shear. This type of flow is now quite generally designated as pseudoplastic to distinguish it from Newtonian, plastic, thixotropic, and dilatant flow. Because of the frequent occurrence of pseudoplasticity in materials used industrially, it is of considerable practical importance. Rheological data for methyl cellulose solutions and starch pastes were obtained on a rotational viscometer at different rates of shear and over a range of temperatures. These measurements will be discussed in connection with methods for analyzing the flow curves, a comparison of data obtained on the same solutions by means of capillary viscometers, and the theoretical basis for pseudoplasticity.



## Annual Report of the Secretary-Treasurer

October 31, 1947

During the current year the roster of the Society carries 234 domestic members and 32 foreign members, giving a total of 266. On November 1, 1946 there were 231 members and 43 Bulletin subscriptions. This year there have been no Bulletin subscriptions inasmuch as the Institute had been planning on the appearance of the new journal *Physics*; rather the Institute has been enrolling the subscribers as members. Consequently, it can only be said that the number of our members and Bulletin subscribers is about the same as last year. It is gratifying to report that the membership has not fallen off due to the increase of dues from \$2.00 to \$4.00 this year. Looking back over his six-year term of office, the writer notes that since 1941 the membership has increased by about 86 percent and the precarious position of the treasury—it was so low then, it was a question if the Bulletin could be continued—has improved to the extent that the balance on hand is about \$1200.

The Bingham fund has been the major activity of the Society this year. Under the enthusiastic leadership of the President, the Executive Committee has laid the foundation for sound financial support of the fund. Separate reports will explain the current status of the progress toward arriving at the type of medal to be awarded, and the amount of money donated to sustain the fund.

The Constitution of the Society has been rewritten by a Committee consisting of Messrs. Alfrey, Dow, and Markwood (*Chairman*) and the matter has been put before the Society for vote.

The Nominating Committee, consisting of Messrs. Nadai, Nason, Spencer, and Dow (*Chairman*) recommended the following candidates for office:

President	W. F. Fair, Jr.
First Vice President	H. M. Spurlin
Second Vice President	R. N. Traxler
Secretary-Treasurer	E. K. Fisher
Editor	W. H. Markwood, Jr.

### Financial Report of Secretary-Treasurer

January 1 to October 31, 1947

Cash on hand December 31, 1946.....	\$ 810.75	AIP 15% assessment.....	86.70
INCOME		Miscellaneous	
Membership dues.....	\$1064.81	Stationery.....	29.71
Back sale of Bulletin.....	50.12	Postage.....	2.82
	\$1114.93	Ballots.....	13.54
EXPENSE		46.07	
Academic Press (February issue).....	439.35		718.45
American Institute of Physics		Balance to date.....	\$ 396.48
First quarter.....	115.34	Total cash on hand October 31, 1947.....	\$1207.23
Second quarter.....	30.99		
	146.33		

R. B. Dow, *Secretary-Treasurer*



## Minutes of Business Meeting

Hotel Pennsylvania, October 31, 1947

The minutes of the 1946 Business Meeting were approved as printed in the November, 1946 issue of the Bulletin. The Secretary-Treasurer's Report was accepted as read.

Dr. Fair officially reported the establishment of the annual Bingham Award in Rheology. Dr. H. A. Barton, Director of the American Institute of Physics, will serve as chairman of the first award committee whose members will be announced later. The first award will be made in 1948. Mr. Charles Bradley Warren of Pittsburgh has been commissioned as sculptor of the medal. From Mr. Warren's plaster models, the Medallie Arts Company will prepare dies from which J. H. Matthews and Company will strike the medals in bronze.

The publication policy was reviewed briefly by W. H. Markwood, Jr. who stated that the new physics journal of the American Institute of Physics would definitely be published in 1948 and would replace the Bulletin to become the official publication of the Society; members will continue to get the special rheology issue of the Journal of Colloid Science. The cost of the latter, however, will be increased to \$1.75 in 1948, but the increase will be absorbed by the Society rather than increase the membership dues. H. A. Barton, Director of the American Institute of Physics, reviewed the plans of the Institute in regard to the national and international responsibilities and obligations which must be assumed. D. A. Katcher was introduced as the Editor of *Physics Today*, the new physics journal of the Institute. He stated that, while present plans were very flexible in regard to the new

journal, it was tentatively planned to publish popular summaries of current research, general announcements, news items, book reviews, etc. The objectives are twofold; first to reach the physicist, then the other scientists who have interests in physics. V. K. LaMer, Editor of the *Journal of Colloid Science*, stated that he hoped to have the special rheology issue published as the January, 1948 number. No new plans for this journal are contemplated at present.

The Society elected President Fair to be its representative on the Governing Board of the Institute for a two-year period beginning in January, 1948. The Executive Committee was authorized to choose the time and place for the next Annual Meeting.

R. N. Weltman reported for the Ballot Committee, comprised of G. R. Dunne, E. A. Hauser, and R. N. Weltman, which had counted the ballots for revision of the Constitution, and the election of new officers. The vote was unanimous for adoption of the new Constitution. The following candidates were declared elected:

President	W. F. Fair, Jr.
First Vice President	H. M. Spurlin
Second Vice President	R. N. Traxler
Secretary-Treasurer	E. K. Fischer
Editor	W. H. Markwood, Jr.

There being no other business the meeting was adjourned at 5:10 P.M. Seventy-nine members were registered at the two-day session.

Respectively submitted,  
R. B. Dow



# The Society of Rheology

## Constitution and By-laws

(Fully Amended as of October 31, 1947)

### CONSTITUTION

#### Article I—Name

The name of this organization shall be the Society of Rheology.

#### Article II—Purpose

The object of this Society shall be the advancement of Rheology and its applications. Rheology is here defined as the science of the deformation and flow of matter. The objects shall be promoted (a) by meetings, (b) by a publication policy designed to increase and disseminate knowledge of rheology, and (c) by other appropriate means.

#### Article III—Membership

Any person or institution interested in the purposes of the Society may apply for membership provided an application, made out in due form, is submitted to the Secretary who shall refer the applications to the Membership Committee as hereinafter provided for in Article III of the By-Laws.

#### Article IV—Officers

##### Section 1

The officers shall consist of a President, two Vice Presidents, Secretary-Treasurer, and Editor, elected by the membership.

##### Section 2

The officers shall be nominated by a nominating committee as hereinafter provided. They shall be elected by a majority vote determined by letter ballot of the membership. The term of office shall be two years.

#### Article V—Executive Committee

The officers and the immediate past president shall constitute the Executive Committee which shall transact the business of the Society not otherwise specifically provided for.

#### Article VI—Meetings

An annual meeting of the Society for the purpose of conducting technical sessions or symposia, and to transact business, shall be held each year. The Executive Committee shall announce the time and place at least six months prior to the meeting. Additional technical meetings may be held as shall be determined by majority vote of the Executive Committee.

#### Article VII—Reports

The Secretary-Treasurer of the Society shall report annually in writing to the membership at the Annual

Meeting in respect to the activities and the financial condition of the Society. Publication of the abstracts of these reports, setting forth the pertinent facts about the operation of the Society, shall satisfy the requirements of the membership.

The Executive Committee shall have the authority to make any other reports it considers advisable, or as may be requested by a legitimate agency or institution, or as may be required by civil law.

#### Article VIII—Amendments to Constitution

Amendments to this Constitution may be made by a majority vote of those voting in a letter ballot submitted to the membership after the members attending a regular meeting of the Society or the members of the Executive Committee have voted to submit such amendments to said letter ballot. The votes on the amendments shall be canvassed within ninety days after their origin. Said amendments shall become effective immediately upon certification of approval by the Secretary to the Executive Committee.

### BY-LAWS

#### Article I—Duties of Officers and Executive Committee

##### Section 1

The President of the Society shall exercise general care and supervision over the affairs of the Society subject to the direction and approval of the Executive Committee, and shall do and perform all acts usually incident to the office of President.

The President shall preside as Chairman at the meetings of the Executive Committee except that in the absence of the President a Chairman *pro tempore* shall be chosen by the Committee.

##### Section 2

The First and Second Vice Presidents shall take precedence in their respective order. If, for any reason, the office of President shall become vacant, the Vice Presidents shall succeed in office according to rank.

They shall, under the direction of the President, oversee the functioning of such committees as may be active in the Society.

##### Section 3

The Secretary-Treasurer shall keep the records of the Society, including minutes of all meetings, appointments, committees, and membership files.

He shall be responsible for the correspondence of the Society in regard to its ordinary and general matters of business.

He shall prepare an annual report of the activities of the Society in accordance with Article VII of the Constitution.



He shall be responsible for the printing, distribution, and collection of letter ballots which may be presented to the membership for vote. In particular, he shall be charged with the issuance and receipt of the ballots for the membership vote on officers as defined in Article IV of the By-Laws, and for the issuance, and tabulation of ballots on proposed amendments to the Constitution and By-Laws as specified in Article VIII of the Constitution, and in Article VIII of the By-Laws, respectively.

He shall receive all monies of the Society and deposit the same in a recognized bank in the name of the Society.

He shall be the disbursing officer of the Society and shall sign all checks and vouchers for expense incurred by the Society upon authorization of the Executive Committee.

He shall give bond for the faithful discharge of his duties, to the extent as may be required by the Executive Committee.

He shall prepare an annual report on the state of the finances of the Society in accordance with Article VII of the Constitution.

#### Section 4

The Editor shall be responsible to the Executive Committee for carrying out the publication policy of the Society.

He shall have the technical direction of the Society's publications, as defined in Article VI of the By-Laws.

#### Section 5

The Executive Committee shall be empowered to make working rules of order for the control and operation of the Society. All rules and regulations so made shall terminate with the expiration of tenure of office of the officers promulgating them, unless continued by incoming officers constituting the succeeding Executive Committee.

In the event that an officer of the Society dies or resigns before the completion of his term of office the Executive Committee shall appoint a successor to complete his unexpired term, subject to the provision stipulated in Section 2 of Article I of the By-Laws that the Vice Presidents succeed in respective order if the office of President becomes vacant.

The Executive Committee shall have authority to recommend the acceptance of gifts or memorials for the Society providing a majority vote of the Committee affirms the action. Such gifts shall be accepted by the Society upon a majority of the membership in attendance at a regular meeting of the Society unless opposed by a majority vote of the whole Society as represented by their personally appointed proxies at the next regular meeting after offer of said gift.

The Executive Committee shall authorize all expenditures and shall not create any indebtedness beyond the means of the Society, nor disburse funds for purposes non-essential to the business or purposes of the Society.

It shall determine the date and place of the annual meeting and any other meetings of the Society which shall be called in accordance with Article VI of the Constitution.

The Executive Committee shall hold regular meetings, preferably semi-annually, to consider the business of the Society, such meetings to be called by the Secretary in

accordance with previous action of the Committee on authorization of the President, or on written request of a majority of the Committee members.

Notices of meetings of the Executive Committee shall be given to each member at least ten days prior to the date of the meeting.

A majority vote of the Executive Committee shall govern, except where otherwise provided.

The Executive Committee shall have the power to overrule or modify the action of any officer of the Society.

## Article II—Dues and Privileges

### Section 1

Regular members of the Society shall pay annual dues of \$4.00, payable in advance, if resident of the United States or Canada, or \$4.40 if resident elsewhere. Each member shall be entitled to subscription to the official publications of the Society.

### Section 2

Sustaining members shall pay dues of \$25.00 annually as a minimum, payable in advance, and shall be entitled to subscriptions to the *Journal of Applied Physics* and the *Review of Scientific Instruments* in addition to the official publications of the Society.

A sustaining member may appoint a representative to act for it at meetings of the Society.

### Section 3

Regular membership and sustaining membership in the Society automatically carry, without payment of additional dues, membership in the American Institute of Physics. Such acceptance to membership in the Institute is provided for in its constitution.

### Section 4

Accepted applications for membership in the Society received prior to September 1 shall be considered as for the current year and back numbers of the current volume of the Journals will be furnished to said members. Applications accepted for membership after September 1 shall be applied to the following year and Journals will start with the first issue of the following year unless applicants specifically request the application to be applied to the current year.

Members delinquent in dues three months after the official date of renewal shall be declared suspended and their names removed from the official roster of the Society. Suspended members may be reinstated within a period of two years by payment of back dues; thereafter, applications for reinstatement shall be referred to the Membership Committee.

## Article III—Membership Committee

There shall be a standing membership committee of at least three members appointed by the President. The Chairman of the Membership Committee shall receive and pass upon all applications for membership with the advice of the Membership Committee, and shall notify the Secretary-Treasurer of the action taken upon the applications.



#### **Article IV—Nominating Committee**

There shall be a nominating committee consisting of at least ten members appointed by the President. The Nominating Committee shall nominate for all offices and shall publish all nominations at least six months prior to the next bi-annual election. Nominations will be included on the ballot upon petition by ten active members to the Nominating Committee provided such nominating petitions are received at least four months before the bi-annual election.

Printed ballots containing the names of all nominees shall be mailed in individual envelopes by the Secretary at least two months prior to the election to all members of the Society. These ballots shall be accompanied by a stamped return envelope addressed to the Secretary. Space shall be provided on the ballots for additional nominees. In order to be counted, ballots must be mailed to the Secretary so as to reach him not later than two weeks before the meeting which ends the biennial.

The Secretary shall deliver the ballots returned to him unopened to an Election Committee appointed by the President at the opening of the annual meeting. This Committee shall count the ballots and announce the results at a subsequent session during the annual meeting.

#### **Article V—Representatives**

##### *Section 1*

As a Member Society of the American Institute of Physics the Society shall be entitled to nominate candidates for directorship on the Governing Board of the Institute, to the number of and under the circumstances authorized by Article VIII of Amendment No. 1 of the Constitution of the American Institute of Physics, Inc.

On the basis of a membership census the Society shall elect one director to the Governing Board of the American Institute of Physics who shall be the President of the Society, or his officially appointed representative.

When the membership of the Society attains such a number as to entitle it to more members on the governing board of the American Institute of Physics they shall be, in order, the Secretary-Treasurer, the Editor, the First Vice President and the Second Vice President or proxies appointed by the President in their absences.

##### *Section 2*

The terms of office of directors representing the Society on the Governing Board of the American Institute of

Physics shall be set for two year periods, concurrent with their terms of office in the Society.

##### *Section 3*

The President shall appoint the Society's representative to the Council of the American Association for the Advancement of Science, on the basis of its membership as an Affiliated Society of Section B, Physics, of the A.A.A.S.

The President shall appoint an official representative of the Society to attend technical meetings, inaugurations, or dedications. Upon recommendation of the President, the Executive Committee shall determine the expense allowance of official representatives.

#### **Article VI—Publications**

##### *Section 1*

Technical papers presented to the Society for publication shall, after approval by the Editor, be submitted by the Editor to a journal recognized by the Society as an official organ of the Society for publication in such journal.

##### *Section 2*

The Society shall publish or choose a publication which shall officially contain news of the Society and other matters of rheological interest.

##### *Section 3*

The Editor shall have the authority to appoint assisting, contributing, and publishing editors to be responsible for the development of the different aspects of the publications of the Society.

#### **Article VII—Affiliated Sections**

The Executive Committee may grant the right to form local sections of this Society within designated boundaries. A refund may be made to the local sections as determined by the Executive Committee.

#### **Article VIII—Amendments**

The By-Laws may be amended by majority vote of the members returning a letter ballot after the members attending any regular meeting of the Society, or the Executive Committee, have voted to submit the proposed amendment to letter ballot. The votes on the amendments shall be canvassed within ninety days after their origin. Said amendments shall become effective immediately upon certification of approval by the Secretary-Treasurer to the Executive Committee.



## International Rheological Congress in Holland, September, 1948

Upon the initiative of the British Rheologists' Club an international congress on Rheology will be organized in Holland, by a group of Dutch Rheologists under the sponsorship of

"The Joint Committee on Rheology of the International Council of Scientific Unions," and  
"The Rheological Committee of the Royal Netherlands Academy of Sciences at Amsterdam."

The Congress will probably be held at Scheveningen in 1948 from Tuesday, September 21st until Friday, September 24th inclusive, to be followed by some excursions. Its program will consist of general and sectional lectures. The subjects will cover:

- (a) Theoretical and fundamental experimental problems;
- (b) Industrial applications;
- (c) Biological problems.

Plasticity of crystallized materials, soil mechanics and geophysical problems will be excluded, as in the course of 1948 other international congresses will pay attention to these subjects.

The provisional program is as follows:

### *Tuesday, September 21st:*

Morning: General lecture on Recent Developments in the Theory of Viscosity.

Afternoon: Communications from the Joint Committee. General lectures on:

- (a) Nomenclature;
- (b) Fundamental Experimental Methods.

### *Wednesday, September 22nd:*

Morning: Sectional Meetings

Afternoon: General lectures on:

- (a) Solutions of Macromolecular Substances;
- (b) Russian Work on Rheology.

### *Thursday, September 23rd:*

Morning: Sectional meetings, to be followed by a General lecture on Relations between Stress and Strain in Complicated Systems.

Afternoon: General lectures on:

- (a) Abnormal Substances and Abnormal Phenomena of Flow;
- (b) Psycho-physical Aspects of Rheology.

Informal dinner and evening entertainment.

### *Friday, September 24th:*

Morning: Sectional meetings, to be followed by a General lecture on Rheological Problems in Biology.

Afternoon: General lecture on Rheology in Industry, to be followed by communications from the Joint Committee.

### *Saturday and perhaps Monday, September 25th and 27th:*

Excursion if sufficient interest is shown.

An agreement has been foreseen with the Elsevier Publishing Company, Inc. at Amsterdam to publish the proceedings of the Congress in book form. Preprints of all papers will be forwarded to participants at least a month in advance of the Congress. Discussional remarks will be included in the final edition of the Proceedings.

Scientists intending to present papers should communicate with the first secretary, Dr. R. Houwink, Rubber-Stichting, Julianalaan 134, Delft, Holland. Manuscripts must be received before May 1, 1948. A maximum space of 3000 words, space for formulas and diagrams included, should not be exceeded, and the organizational committee must, in consequence of present strictures, reserve the right to cut down papers.

It is proposed that in the sectional meetings every speaker will give only a short account of his paper or mention the most important points, so that ample time will be available for discussion. The time to be allotted to each paper, inclusive of discussion, will be at most 30 minutes (but must perhaps be reduced when many papers are presented).

Because of a generous support from the side of the Dutch industry and from some Dutch Scientific Societies it will be possible to keep the congress fee for participants at approx. f. 10,- (£ 1,-), which it is hoped will also cover the cost of the preprints. It does not, however, include the price of the final edition of the proceedings, which can be fixed only when all papers have been received and to which subscription will be possible.

The organizational committee will help participants in obtaining hotel accommodation at



Scheveningen, and moreover will attempt to find accommodation in private quarters if so desired. Further particulars and information about prices will be given in due course.

*The Organizing Committee:*

J. M. Burgers, *Chairman*  
R. Houwink, *First Secretary*  
(For the Rheological Committee of the Netherl. Acad. of Sciences.)  
H. Kramers, for the Netherl. Physical Society  
A. J. Staverman, for the Netherl. Chem. Society  
R. N. J. Saal, for the Section Oil Technics of the Royal Institution of Engineers  
A. van Rossem, for the Society for Materials  
H. C. den Daas, assistant secretary.

*The Joint Committee in Rheology of the I.C.S.U.*

J. M. Burgers  
Mme A. Dobry-Duclaux  
P. Eggleton  
H. Eyring  
A. Frey-Wyssling

G. van Iterson, Jr.  
Th. van Karman, *Chairman*  
G. W. Scott Blair  
R. Signer  
G. I. Taylor

*The Rheological Committee of the Netherl. Acad. of Sciences:*

C. B. Biezeno  
H. G. Bungenberg de Jong  
J. M. Burgers  
W. G. Burgers  
J. J. Hermans  
R. Houwink  
G. van Iterson, Jr.  
R. Kronig  
H. R. Kruyt, *Chairman*  
F. A. Vening Meinesz  
J. Th. G. Overbeek  
C. J. van Nieuwenburg  
A. van Rossem.  
R. N. J. Saal.

R. HOUWINK  
Delft, October 8, 1947



## British Rheologists Club

Because of our widespread interest in the activities of British rheologists, the program of their September 1947 annual conference is reprinted here.

### Thursday, September 11

1:00 p.m. Lunch.

2:30 p.m. Annual Meeting.

3:00 p.m. "The Strength of the Earth." Professor Harold Jeffrey, F.R.S. University of Cambridge.

5:00 p.m. "The Mechanical Properties of Soils and their Relation to Engineering Practice." A. W. Skempton, M.Sc., A.M.I.C.E., F.G.S., University Reader in Soil Mechanics and Assistant Professor at Imperial College, London.

"The Effect of Shearing Stress on the Viscosity—Temperature Dependence of Lubricating and Hydraulic Oils." Dr. R. Schnurmann, Chief Physicist, Manchester Oil Refinery, Ltd.

7:00 p.m. Dinner.

8:00 p.m. Social Evening.

### Friday, September 12

10:00 a.m. "Preferred Orientation of Minerals and the Mechanism of Rock Flow." Professor F. C. Phillips, M.A., Ph.D., F.G.S., Herdman Professor of Geology, University of Liverpool.

"The Formation of Salt Domes and the Flowage of Rock Salt." Dr. G. M. Lees, Chief Geologist, Anglo-Iranian Oil Co.

2:00 p.m. Visits to places of rheological interest.

7:00 p.m. Dinner.

8:00 p.m. Informal Discussion, to be opened by Dr. K. Weissenberg and Mr. S. M. Freeman (Shirley Institute, Manchester), who will describe and demonstrate some rheological phenomena that have come to light since the last meeting.

### Saturday, September 13

9:30 a.m. "Industrial Viscometers." Discussion on Committee's Report, opened by Dr. E. W. J. Mardles.

12:00 noon. Lunch.

## British Rheological Nomenclature

### A Letter to the Editor

Dear Sir:

In connection with Section 3 and the Appendix of the British report on rheological nomenclature published in the June issue of the Rheology Bulletin, we should like to present the following comments.

1. *Traction and stress.* The adoption of a terminology which allows clear distinction between the force per unit area transmitted across a specified surface and the state of stress at a point is highly desirable. The terms "traction" and "stress" serve this purpose, but the fact that "traction" then covers tensile, compressive and shearing forces may create certain difficulties. An alternative procedure would be to reserve the term "stress" for the force per unit area transmitted across a specified surface and use the term "state of stress" or "stress tensor" when referring to the complete specification of the stresses transmitted across various surface elements through a specified point.

2. *Stress not a function of the material.* The statement in the first paragraph of Section 3 under the heading *Stress* might be misinterpreted. Even for an elastic body in equilibrium, the stresses at a generic point are not solely

determined by the forces applied to its surface, but may depend also on Poisson's ratio.

3. *Shear stress.* In the second paragraph of Section 3 under the heading *Stress*, the term shear stress is used in a rather restricted sense to denote a state of simple shear (stress). This may cause confusion in so far as the term *shear stress* is customarily used to denote what, according to the present proposal, would be called *tangential traction*.

4. *Moduli.* In the definitions of Young's modulus and bulk modulus, the denominators should read  $\delta l/l$  and  $\delta V/V$ , respectively.

5. *Appendix.* The strain components given in the Appendix are not tensor components. It seems highly desirable to define the shear components  $\epsilon_{xy}$ , etc., with the factor  $\frac{1}{2}$  so that the quantities  $\epsilon_{xx}, \dots, \epsilon_{xy}, \dots$  constitute the components of a tensor (strain tensor). If this seems desirable, the conventional strain components given in the Appendix might be denoted by  $\epsilon_{xx}, \dots, \gamma_{xy}, \dots$

Sincerely yours,

D. C. Drucker,      W. Prager,  
Associate Professor      Professor of  
of Engineering      Applied Mechanics  
Brown University, Providence, R. I.







