

RHEOLOGY BULLETIN

Publication of the Society of Rheology

Volume 34, No. 2



MAY, 1965

36TH ANNUAL MEETING OF THE SOCIETY OF RHEOLOGY

Case Institute of Technology
Cleveland, Ohio

October 25-27, 1965

Abstracts: The maximum allowable length of abstracts has been extended to 500 words. Abstracts should be typewritten, double-spaced, and should include, just below the title, the name and address of the author; in case of multiple authorship, the name of the author who is to present the paper should be underlined. For a paper to be considered for presentation, two copies of the abstract, *postmarked no later than August 1, 1965*, should be mailed to I. L. Hopkins, Rm. ID205, Bell Telephone Labs, P.O. Box 261, Murray Hill, New Jersey, 07971.

Acceptance and presentation of Papers: The Program Committee will review all abstracts submitted before the August 1 deadline, and select those most appropriate for presentation at the meeting. Authors will be notified of the outcome on or before September 15, 1965.

Each speaker will have at least twenty minutes for his presentation (more if the size of the program permits). Discussion of papers will be scheduled separately.

Standard facilities available in each meeting room will consist of projectors for both 2" x 2" and 3¼" x 4¼" slides, plus a blackboard. Speakers are urged to rely on slides as much as possible. If other equipment is required, notification to this effect should be included in a covering letter accompanying the abstract at the time of its submission.

Publication: Authors are urged to consider publishing papers presented at the meeting in the Transactions of the Society of Rheology. Manuscripts will be eligible for inclusion in volume 10 if submitted to the editor, R. R. Myers, Chemistry Department, Kent State University, Kent, Ohio, on or before October 27, 1965. Acceptance for publication will be decided by the editor, in consultation with referees appointed by him for each manuscript. Brevity will be an important consideration. Presentation at a meeting is not a prerequisite for publication.

Program Committee: Stephen Prager, (Chairman), Department of Chemistry, University of Minnesota, Minneapolis, Minnesota 55455.

I. L. Hopkins (Secretary), Bell Telephone Laboratories, P.O. Box 261, Murray Hill, N.J. 07971

J. L. White, U. S. Rubber Company, Wayne, New Jersey 07470

L. E. Nielsen, Monsanto Company, 800 N. Lindbergh Boulevard, St. Louis, Mo. 63166

L. J. Zapas, National Bureau of Standards, Washington, D. C. 20234

D. H. Kaelble, Minnesota Mining and Manufacturing, 2301 Hudson Road, St. Paul, Minnesota 55119

Invited Speakers for Fall Meeting

J. T. Bergen (Armstrong Cork Co.)

Title to be announced

T. A. Litovitz (Catholic University)

"Viscoelastic Properties of Non-Polymeric Liquids"

D. C. Bogue (University of Tennessee)

"Constitutive Equations for Engineering Use"

Host Committee:

Local arrangements are being handled by I. M. Krieger, Dept. of Chemistry, Case Institute of Technology, Cleveland, Ohio 44106. See Executive Committee Minutes for details.

NOTICE OF WINTER MEETING

January 31 — February 2, 1966, U. S. Naval Post Graduate School, Monterey, California.

The Program Committee is:

Dale J. Meier, Chairman
Shell Development Company
Emeryville, Calif.

Thor L. Smith
Stanford Research Institute
Menlo Park, Calif.

Roger S. Porter
California Research Corporation
576 Standard Avenue
Richmond, Calif.

NOMINATION OF OFFICERS FOR 1966-67

The following nominees have been recommended by the Nominating Committee; in accordance with our constitution, ballot forms will be sent out later in the year:

President
Vice President

R. S. Marvin
H. Markovitz
T. L. Smith

Secretary
Treasurer

J. C. Miller
A. F. Lewis
S. Matsuoka

Editor
Members-at-large of
the Executive Committee

R. R. Myers
I. L. Hopkins
I. M. Krieger
R. F. Landel
S. Prager

RHEOLOGY BULLETIN

Raymond R. Myers, Editor
Department of Chemistry
Lehigh University
After August 1, 1965:
Kent State University
Department of Chemistry
Kent, Ohio, 44240

EXECUTIVE COMMITTEE

President—James T. Bergen, Armstrong Cork Company, Lancaster, Pa.

Vice-President—Robert S. Marvin, Rheology Section, National Bureau of Standards, Washington 25, D.C.

Secretary-Treasurer—John C. Miller, Union Carbide Plastics Company, Bound Brook, N. J.

Editor—Raymond R. Myers, Department of Chemistry, Lehigh University, Bethlehem, Pa.

Member—Thor L. Smith, Stanford Research Institute, Menlo Park, Calif.

Member—Herschel Markovitz, Mellon Institute, Pittsburgh, Pa.

BINGHAM AWARD COMMITTEE

R. Byron Bird, Chairman
Chemical Engineering Dept.
University of Wisconsin
Madison 6, Wisconsin

OCTOBER 27, 1964 ANNUAL BUSINESS MEETING OF THE SOCIETY OF RHEOLOGY MELLON INSTITUTE

President Bergen called the meeting to order at 4:15 p.m. Approximately 150 members were present. The minutes of the previous meeting were approved as published in the Bulletin. The Secretary-Treasurer gave his report on the finances and activities of the Society for 1964. A motion to accept the report was seconded and approved.

President Bergen made some remarks on physics education at the high school level. AIP has been studying the problem of declining enrollment in high school physics for about 6 months. The only significant action taken at this time was to strengthen the Regional Councilor program. It appears that more study will be necessary to arrive at additional courses of action. If anyone has any ideas on the problem, please contact A. B. Metzner at the University of Delaware.

A resolution was offered by T. Smith to send a letter of thanks to Mellon Institute from the Society for their hospitality.

R. R. Myers presented two changes in the Constitution and By-Laws which will create an office of Treasurer for the Society and change the cut-off date for

new members to June 30th. A motion to submit the changes to the membership by letter ballot was made, seconded and passed.

The Editor, R. R. Myers, announced that he expected 30-40 papers from the meeting to be submitted for the Transactions and that the date of submittal was the end of the current meeting.

Thor Smith reported that the Winter Meeting of the Society would be held at the Miramar Hotel in Santa Barbara.

A proposed scheme for controlling the number of papers at the Annual Meeting developed by the Executive Committee was explained by R. S. Marvin. The following suggestions were made:

1. Meeting will be no longer than 3 days.
2. No evening session.
3. Limited simultaneous sessions.
4. Twenty five minute papers.

The proposed scheme would be a 3 day meeting consisting of 7-10 sessions which would be divided among special topics and general sessions. All abstracts submitted for the meeting would be published in the Rheology Bulletin and any paper could be submitted to the Transactions for publication, where it would be screened by referees for suitability.

The proposal was then opened for discussion. The question of criteria for selection of papers was immediately brought up. A number of comments on techniques were made, such as requiring longer abstracts or the entire paper.

A show of hands on lengthening the meetings to four days showed a majority against this option. A vote on the proposition of one day of simultaneous sessions produced a majority against while a show of hands on simultaneous sessions for all days gave a yes vote.

R. S. Brodkey suggested that preprints for all papers be distributed but no papers presented at the meeting. The entire meeting would be limited to discussion.

A motion was made by J. H. Elliot to endorse the proposal presented by R. S. Marvin, but modified based on the discussion at this meeting. The motion was seconded. Considerable comment on the meaning of the motion ensued. The motion was described as agreeing in principle to the idea of limiting the number of papers by some technique. A vote on the motion showed a majority in favor of the policy.

John C. Miller
Secretary-Treasurer

EXECUTIVE COMMITTEE MEETING October 25, 1964

Executive Committee present: J. T. Bergen, R. S. Marvin, J. C. Miller, R. R. Myers, T. H. Smith, J. D. Ferry.

Others Present: R. F. Kratz, I. M. Krieger, A. F. Lewis.

1. Meeting was called to order by President Bergen at 2:10 p.m.
2. Minutes of the last Executive Committee meeting were approved as corrected based on comments by H. Markovitz.
3. President Bergen discussed the AIP concern and proposals for high school physics. The major problem seems to be the percentage decline of stu-

dents taking physics in high school. The Secretary-Treasurer brought up the point that AIP would like a uniform cut-off date of June 30 for all Societies. A motion to present this to the members at the business meeting was passed. A committee will be appointed by J. T. Bergen to discuss with AIP the costs of publishing the Transactions with the Institute.

4. Editor Myers expects 40 papers for the Transactions. The deadline is the last day of the meeting, October 28, 1964.
5. Thor Smith reporting for E. H. Lee, Editor of the Proceedings, said the last manuscript was sent to Interscience in April and that the papers to be published by number could be included at the end of Volume II. The problem of the Proceedings being delayed was discussed and it was felt that while it would be desirable to have Vol. I before Vol. IV, the only thing that could be done is to talk to R. Truelsen.
6. The Executive Committee decided to spend 15 minutes on policy for the format for future meetings before continuing to the other committee reports.
7. The discussion on future meeting format immediately brought up the problem of selection of papers for the meeting. The basic philosophy that every member has a right to give a paper was considered and not accepted. One method would be to have abstracts submitted, the program chairman select the program from the abstracts and the Editor select the papers for publication. I. Krieger suggested that a standard form for abstracts be worked out which would include author's address. The abstract would be 200 words and one paragraph with a limitation on the use of equations. An earlier deadline for abstracts was also suggested. The rest of the discussion will be continued later.
8. J. D. Ferry reported for the Bingham Committee that J. M. Burgers was the recipient of the Medal this year and that no nominees were selected for National Medal of Science.
9. The Membership Committee report was given by A. Lewis. A new brochure is necessary and after some comment, it was decided to rewrite the brochure. R. S. Marvin agreed to do this and circulate the new brochure to the Executive Committee. Lewis also suggested that a registration fee plus membership "bargain" be established at \$15.00 for the Annual Meeting.
10. The local arrangements for this Annual Meeting were reported complete and under control by R. F. Kratz.
11. The winter meetings on the West Coast have been successful and the one this year already has received 20 abstracts.
12. No new information on the Fifth International Congress has been received.
13. The meeting at Case Institute in Cleveland will be October 25-27. I. Krieger is the local arrangements chairman. It was suggested that the local

arrangements committee look into the possibility of a banquet.

14. The site for the 1966 meeting was discussed. Since no firm invitation from a university or research institute is available, hotels in Washington and Atlantic City were discussed. Atlantic City was tentatively chosen as the site.
15. A motion to extend the Winter Meeting to three days if necessary was seconded and passed.
16. The question of forming an office of Treasurer had been brought up a year ago by W. R. Willets. The Secretary-Treasurer believed this is probably a good idea and a committee of Miller, Myers and Willets will report on the necessary constitutional changes.
17. The discussion returned to the problem of limiting papers at the Annual Meeting. R. S. Marvin suggested choosing chairmen for restricted topics and allowing them full control over the papers. After considerable comment, the following ground rules were agreed upon. Restricted topics would be 75% of program, the other 25% would be general sessions. Seven to ten sessions would be held with double sessions on restricted topics. The Transactions would be thrown open to any paper submitted to the Editor and accepted or rejected only on the basis of referee's comments. Abstracts of 200 words would be printed in the Bulletin for any paper submitted by a member, but not more than 1 abstract per meeting.
18. The changes in the Constitution and By-Laws necessary to create the office of Treasurer were read by R. R. Myers. The changes will be presented to the members at the business meeting.
19. S. Prager will be program chairman for next year.
20. Next Executive Committee meeting is scheduled tentatively at AIP on February 5, 1965.
21. The meeting was adjourned at 7:00 p.m.

John C. Miller
Secretary-Treasurer

EXECUTIVE COMMITTEE MEETING

FEBRUARY 5, 1965

1. The meeting was called to order at 10:15 a.m. by President Bergen. The minutes of the previous meeting were approved as mailed to the Committee.
2. Executive Committee present: J. T. Bergen, R. S. Marvin, T. H. Smith, R. R. Myers, J. C. Miller, J. D. Ferry. Executive Committee absent: H. Markovitz. Others present: A. Lewis, I. Krieger, S. Prager.
3. The Secretary-Treasurer reported the cost of Volume VIII of the Transactions will be about \$1050, Part II of Proceedings \$1575 and \$1400 will be given to Brown University to support publication of the Proceedings of the Fourth Congress. A check for \$589 was received from R. F. Kratz as income from the Fall meeting in Pittsburgh.

4. Volume VIII of the Transactions will be published this month. R. S. Marvin talked with R. Truelsen at Interscience and got the following schedule for Proceedings of Congress: Part IV, Feb., Parts I and II March and Part III in April.
5. R. R. Myers reported that 34 papers were submitted for Part I, Volume 9, 24 were accepted and 16 had been sent to Interscience at the time of the meeting. A schedule for the Spring Bulletin was set up to receive copy by May 1st, to get the Bulletin out by June 1st. The program for the Fall meeting must be in Editor's hands by September 13th.
6. R. S. Marvin reporting on a meeting with Bergen, Smith and Prager, Feb. 4th, announced the Fall meeting would consist of 3 invited lectures and 12 sessions. Simultaneous sessions will be scheduled. No evening sessions will be scheduled and about 60 papers can be handled.

Abstract length will be increased to 500 words and the Editor will include in the Spring Bulletin a method of preparation of the abstract. S. Prager, chairman of the Program Committee suggested Fredrickson, Hopkins, Zapas, White for members of the Committee. An August 1st deadline was suggested for abstracts.

7. J. T. Bergen announced that a new brochure describing the Society had been written up by R. S. Marvin and was now available.
8. A. F. Lewis reported the membership to be 720 at this time and that 6 new members had been added at the West Coast Meeting.
9. The subject of Bulletin subscriptions was brought up in view of \$100 Sustaining fee to libraries. If we want publicity for meetings, the Bulletin is most likely to provide this publicity. The Secretary-Treasurer will talk with Interscience about their handling the subscriptions.
10. A canvass for sustaining members was felt by the Committee to be in order.
11. J. D. Ferry brought up the problem that libraries which were asked to pay \$100 membership should be informed they can buy the transactions from Interscience directly. The Secretary-Treasurer will send such a letter to the libraries.
12. I. Krieger described the arrangements made for the Cleveland meeting. The arrangements Committee will consist of Baer, Collins, Maron and Sieglaff. The Wade Park Hotel will be the meeting hotel, with a Howard Johnson motel for overflow.
13. Thor Smith suggested Monterey as the site for next West Coast meeting. A three day meeting was authorized.
14. The meeting place and time for the 1966 Fall meeting is the Traymore Hotel in Atlantic City, October 31 to November 2nd.
15. A motion to authorize J. T. Bergen as an official representative of the Society of Rheology to the

British Society of Rheology this year was seconded and passed unanimously.

17. The Secretary-Treasurer was authorized to pay \$10 dues to the AAAS for a council representative. A subscription to Science will be sent to the Secretary-Treasurer.
18. The next Executive Committee meeting will be in Cleveland, October 24th. The time will be announced later.
19. The meeting was adjourned at 3:30 p.m.

John C. Miller
Secretary-Treasurer

SOCIETY OF RHEOLOGY REPORT OF THE SECRETARY — TREASURER FOR 1964

1. *Financial*

The estimated expenses for 1964 are presented below. The sum appears large, but Vol. VII of Transactions listed as an expense for 1964 was distributed in 1963. The Financial Report for 1964 is also included in this Bulletin, but it is difficult to compare the report because it represents only the actual disbursements in 1964, and excludes the costs of Transactions VIII which are an expense to be charged against income in 1964. The large balances shown for 1964 are not reserves because of 1965 dues collected at the end of 1964.

Charges from the American Institute of Physics have increased somewhat as a result of our payments to maintain a Society membership file.

Our publication costs this year were more than expected because of an additional Bulletin and larger than expected cost in the Proceedings of Fourth International Congress on Rheology.

The Society has been fortunate in obtaining 10 Sustaining Members for 1965 at \$100.00. This represents considerable additional income for operations. The reserve is expected to be \$3500 at the end of 1965.

2. *Membership*

The membership of the Society has expanded to over 650 members under the direction of the membership chairman Armand Lewis. The rate of increase in membership has become more rapid and the Society will probably reach 750 in 1965.

3. *Publications*

Four issues of the Rheology Bulletin have been published and mailed to the membership. The second Volume of the Proceedings of the Fourth International Congress will be sent to all members who did not attend the Congress. Transactions, Vol. VIII, and the Proceedings will be mailed out in early 1965.

4. *Meetings for 1964*

Two meetings of the Society of Rheology were held this year, one at the Claremont University Center in California, February 3 and 4, and one at Mellon Institute in Pittsburgh, October 26-28. The meeting in

California was arranged by L. Dart of Claremont Men's College and in Pittsburgh by H. Markowitz and R. F. Kratz.

5. Executive Committee

Two meetings of the Executive Committee were held this year, on February 13 and October 25. Publication policy, the budget for 1964, number of contributed papers at meetings, and future meeting sites were discussed.

6. American Institute of Physics

All mailings, dues collection, accounting, etc., were made by the American Institute of Physics. With the introduction of a separate Society of Rheology membership list, our problems with lost members and non-receipt of publications by members have been substantially reduced. A new accounting system introduced this year has substantially lowered our costs of mailing and dues collection. This decrease was offset by the cost of the membership list.

Messrs. Bergen and Miller attended meetings of the Governing Board on February 15 and October 1, 1964. The Fall meeting followed the meeting of Corporate Associates and Society Officers held at the Biltmore Hotel in New York. A meeting of the Financial Committee of AIP and the Society Treasurers was held September 30 in New York to review accounting procedures and costs.

7. Acknowledgments

The Secretary-Treasurer is grateful for the cooperation of the Society Officers, committees, the American Institute of Physics staff and his Company management.

Respectfully submitted,
John C. Miller
 Secretary-Treasurer

ESTIMATED EXPENSE FOR 1964

Balance December 31, 1963		\$10,200	
Income From Dues to June 30		<u>2,000</u>	
			\$12,200
Expenses			
AIP Charges		\$ 1,400	
Membership Committee		155	
Printing Constitution and By-Laws		40	
Winter Bulletin	\$	271	
Spring Bulletin		105	
Summer Bulletin		88	
Fall Bulletin		400	
Editor's Expense		<u>300</u>	
	Total	\$ 1,164	\$ 1,164
Dues to U. S. Committee on TAM		100	
Transactions Vol. VII		1,900	
Transactions Vol. VIII		4,000	
Miscellaneous		<u>480</u>	
	Total	\$ 9,239	
Expected Balance December 31, 1964			\$ 2,961

BUDGET FOR 1965

Balance December 31, 1964		\$ 2,961
Income Dues		
650 Regular Members at \$10.00		6,500
10 Sustaining members at \$100.00		<u>1,000</u>
	Total	\$10,461
Disbursements		
Bulletins		\$1,000
AIP Charges		1,400
Transactions Vol. 9		4,000
U. S. Committee on TAM		100
Membership Committee		100
Miscellaneous		<u>300</u>
	Total	\$ 6,900
Estimated Balance December 31, 1965		\$ 3,561

CHANGES IN THE BY-LAWS

The following changes in the Constitution and By-Laws of the Society of Rheology have been approved by mail ballot of the membership.

1. Creation of the Office of Treasurer.
2. Representation of the Society on the Board of Directors shall be in the order President, Secretary, Vice President, Treasurer, and Editor.
3. Membership applications received after June 30 will be applied to the following year.

A new Constitution and By-Laws reflecting these changes will be available shortly. Members may obtain a copy by writing to the Secretary.

COMING EVENTS

The Department of Mechanical and Aerospace Engineering at Syracuse University announces a Rheology Conference comprising lectures at the main campus of Syracuse University by C. Truesdell of the Johns Hopkins University for a period of six weeks.

Invited papers from distinguished researchers in the field, at Pinebrook, the University's Adirondack Conference Center will also be a part of the program. The purpose of the conference is to promote the modern field of rheology and to present the recent developments in this general field of mechanics of deformable substances. If a member of your department is interested in submitting a paper, write to:

S. Eskinazi
 Syracuse University
 L. C. Smith College of Engineering
 Dept. of Mechanical and Aerospace Engineering
 Syracuse, New York 13210

The Fifth U. S. National Congress of Applied Mechanics will be held at the University of Minnesota, Minneapolis, Minn. in June 14-17, 1966. These meetings are held every fourth year and are planned to supplement the International Congresses of Applied Mechanics.

The Congress concerns itself with experimental and theoretical Applied Mechanics, including mechanics of rigid bodies and deformable solids, mechanics of fluids and gases, thermodynamics and heat transfer. Research workers are encouraged to submit 200-word abstracts covering current work. Based upon the abstract, each accepted paper will be allotted time for presentation and discussion at an appropriate session of the Congress.

Invited survey lectures and all accepted abstracts will be reproduced in a Proceedings to be available during registration at the Congress. Leading technical publications have agreed that this will not constitute official

IN MEMORIAM

Herbert Leaderman, who had retired in December after an extended illness, died Saturday morning, February 20.

Dr. Leaderman, known throughout the world for his pioneering work in Rheology and Polymer Physics, was one of the most active and valued members of the Society of Rheology. As chairman of a special Committee of the Society, he was largely responsible for developing the terminology for linear viscoelastic behavior, now in general use. His Doctoral thesis, published in 1943 as "Elastic and Creep Properties of Filamentous Materials," is still widely quoted as the basic work on which most studies of linear viscoelastic behavior are based. In recognition of his many services to both the field and the Society of Rheology, he was awarded the Bingham Medal in 1948.

Dr. Leaderman was employed at the National Bureau of Standards from 1948 until his retirement. While there, he extended his previous studies on creep and recovery of polymers and other viscoelastic materials, and carried out some of the earliest work on the effect of molecular weight distribution on viscoelastic properties of polymers. In 1956 he was awarded the Silver Medal of the Department of Commerce.

Before coming to NBS, Dr. Leaderman was a physicist for the Firestone Tire and Rubber Company. From 1938 to 1946 he worked at the Massachusetts Institute of Technology, serving as a member of the university's radiation laboratory staff after he received his degree of Doctor of Science.

Born in London, Dr. Leaderman received his B.S. from Cambridge University in 1934 and his M.S. (1938) and Sc. D. (1941) from the Massachusetts Institute of Technology. Recipient of two Fulbright fellowships, Dr. Leaderman was a Fellow of the American Physical Society and a past chairman of its High Polymers Division. He was also a member of the American Chemical Society and the Washington Academy of Sciences.

publication. It is hoped that the emphasis will be on current work and work in progress. In order to encourage new contributors in the field, the Editorial Committee will select a group of research papers from among the submitted abstracts for presentation and publication in full. Abstracts must be submitted by January 15, 1966, on special forms supplied by the Secretary of the Congress, Robert Plunkett, 107 Aero Building, University of Minnesota, Minneapolis, Minnesota 55455.

Mechanics of Viscoelastic Fluids—Invitation to Contribute to a Symposium on This Subject at the 58th Annual Meeting of the American Institute of Chemical Engineers, Philadelphia, Pennsylvania, December 5-9, 1965.

Invitation to Contribute to a Symposium on This Subject at the 58th Annual Meeting of the American Institute of Chemical Engineers, Philadelphia, Pennsylvania, December 5-9, 1965.

Papers are invited which may include a range of subject matters from discussions of rheological theories or experimental results which are of engineering interest to the analysis of applied problems in which the fluid mechanics of these materials plays a major role. A keynote speaker is planned and, if these plans materialize, it is hoped that a distinguished European guest will accept our invitation to play this role.

Abstracts will be due July 1 and completed papers by August 1, the latter to permit preprinting. Material may be sent to either:

A. B. Metzner	D. G. Thomas
Dept. of Chemical Eng.	Reactor Division
University of Delaware	Oak Ridge National Lab.
Newark, Delaware	Oak Ridge, Tennessee

EVENTS ABROAD

A three day Conference will be held at READING UNIVERSITY, ENGLAND in SEPTEMBER, 1965 on the topics:

RHEOLOGY IN AERO-SPACE RESEARCH
and
GENERAL RHEOLOGY

Further contributions are invited and those who wish to submit a paper should write to one of the Honorary Organizers.

D. W. Hadley	K. Walters,
J. J. Thomson, Phys. Lab.	Dept. of Applied Maths.,
Whiteknights Park,	University Col. of Wales,
READING, BERKS.	Aberystwyth, GLAM.

The Conference will be held in three of the days from 21-24 September but the exact timing has not yet been fixed.

Accommodation will be available in a hall of residence. Further details will be circulated later.

The British Society of Rheology held their spring meeting in Nottingham on Wednesday and Thursday, April 7 and 8, 1965. The subject for the conference was "The Flow of Powders and Granular Materials."

The Borough Polytechnic Symposia on Polymers and Plastics was presented on May 6 and 7 by the Department of Chemistry and Chemical Technology in London. The theme of the symposium was "Deformation and Flow of Plastics."