

RHEOLOGY BULLETIN

Publication of The Society of Rheology, Inc.

Volume 42, No. 1



May, 1973

THE SOCIETY OF RHEOLOGY

44th ANNUAL MEETING

OCTOBER 28-31, 1973

Sheraton-Mount Royal Hotel
Montreal, Quebec, Canada

Program Committee

B. D. Coleman, Mellon Institute, Carnegie-Mellon University, Pittsburgh, Pa. 15213.

J. M. Dealy, Department of Chemical Engineering, McGill University, P. O. Box 6070, Montreal 101, Quebec, Canada.

R. F. Landel, Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, Cal. 91103.

L. J. Zapas (Committee Chairman), Polymers Division, National Bureau of Standards, Washington, D.C. 20234.

The meeting will be the first held outside of the United States, and will take place in Montreal's Sheraton-Mt. Royal Hotel (Peel Street).

Host Organization: Macromolecular Science Division, Chemical Institute of Canada

Honorary Host: S. G. Mason, McGill University

Organizing Committee: H. P. Schreiber, Chairman, c/o Department of Chemistry, McGill University, P. O. Box 6070, Montreal 101, Quebec
D. R. Axelrad, P. Carreau, A. Eisenberg & M. R. Kamal

Reception

There will be a reception for those attending the meeting at the McGill Faculty Club, 3450 McTavish Street on Sunday evening, October 28. The Bingham Award Banquet will be held at the Hotel on Tuesday evening, October 30, and on Wednesday evening arrangements will be made for those attending the Meeting to dine out in small groups at one of the charming restaurants of the old quarter of Montreal.

Customs

Citizens or permanent residents of the U. S. do not need passports or visas to enter Canada, but immigration officials occasionally request some evidence of U. S. citizenship so it is suggested you carry something like a birth, baptismal or voter's certificate. Visitors to Canada from countries other than the U. S. must have valid passports. U. S. residents may take up to \$100 worth of merchandise back home if they have been in Canada over 48 hours. Airlines serving Montreal include AER

Lingus, Aeroflot, Air Canada, Air France, Alitalia, Allegheny, B.O.A.C., CP, Delta, Eastern, E.P.A., KLM, Lufthansa, Nordair and Quebecair.

Call for Papers

Submit two copies of an abstract of 200 words or less to any member of the Program Committee before July 31, 1973. Equations are to be used sparingly. The Program Committee will review the abstracts for originality, relevance and technical character as a basis for acceptance.

The papers to be presented will be scheduled for 20 minutes followed by 10 minutes for discussion. Projection facilities and blackboards will be available.

Symposium

One session will be devoted to a symposium on "Unsolved Problems of Rheology Facing Industry". Two copies of 250 word abstracts should be submitted before June 30, 1973. The problems should be very well defined and will be sent to referees for evaluation as a basis for acceptance. The time for presentation may be from 1 to 15 minutes followed by 10 minutes for discussion and questioning. The abstracts should be sent to R. F. Landel, Symposium Chairman, Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, Cal. 91103. The whole symposium will be transcribed with the intent of publishing it in the Transactions of the Society of Rheology.

Invited Speakers

B. D. Coleman is organizing a symposium on stability problems. Additional invited speakers will include: Richard Stein: "Mechanical Properties of Crystalline Polymers". D. R. Axelrad: "Micromechanics in Rheology".

1973 BINGHAM MEDALIST

Robert Simha, Department of Chemistry, Case Western Reserve University, has been selected as the recipient of the 1973 Bingham award.

PROBLEMS IN INDUSTRIAL RHEOLOGY

The Society's latest attack on this recurrent theme was made at the Monday evening session at the Cincinnati meeting. Subsequently, President Eirich appointed an ad hoc committee chaired by Nobu Nakajima of B. F. Goodrich Chemical Company, Avon Lake, Ohio 44012 to accumulate examples of practical problems. The committee polled the executive committee and others for example of unsolved or incompletely understood problems for submission to the program committee for the Montreal meeting. It also prepared the following format for the problem description and invites others to supply examples using this format as a guide:

RHEOLOGY BULLETIN

Raymond R. Myers, Editor
Department of Chemistry
Kent State University
Kent, Ohio 44242

FORMAT FOR RHEOLOGY PROBLEM STATEMENTS

The following outline is meant to provide only a general guide for insuring that problem statements are concise and coherent, yet contain all relevant information. Specific problems of an unusual nature may require that the author deviate from the format in order to make his presentation complete. In any event, the statements should be no more than 2000 words in length.

Introduction

The general nature of the problem should be discussed. Rheological aspects relevant to the problem should be clearly identified. The author should include pertinent literature references to help define the historical significance of the problem. The practical or industrial value should also be discussed. This discussion should clarify the scope of problem and the urgency of its solution.

Objective

An adequate solution to the problem must be clearly defined in terms of an objective(s). The generality of the information needed should correspond to the generality of the problem. This section should be brief, preferably a list of particular objectives with priorities identified.

Problem Description

This section should constitute the major portion of the problem statement. Any specific, preferably quantitative, information describing the problem itself, the equipment or apparatus used, the conditions under which it is observed, and the material(s) involved should be included. *Data* characterizing the problem, whether transient or steady-state, must be given. If the equipment is familiar to rheologists it can be specified by name and referenced, however, if it is unusual it should be described in detail. The conditions should be specified as completely as possible: deformation mode (shear, extensional, complex), deformation rates, temperature, and pressure. If, for example, the deformation is complex and conventional parameters such as shear rate or strain rate are not applicable, then such variables as flow rate, channel geometry, stretching velocity, etc. must be specified. Temperature or pressure gradients, if measurable, should also be reported. The material should be characterized as completely as possible. These characterizations might include relevant rheological measurements as well as chemical or structural analyses.

Summary

The problem should be restated concisely, possibly referencing those conditions or materials described in the section above which require most urgent attention. If

the material is available for others, either directly from the author or from a commercial source, the procurement procedure should be described.

References

The listing of literature citations should conform to the rules established by the *Transactions of the Society of Rheology*.

Assistant Editor J. L. White has summarized the Cincinnati meeting Monday evening session as follows:

"Industry was the original source of rheology, as it supplied the unusual materials (paints, spinning dopes, rubber compounds) which were the subjects of its beginning. Despite the recent emphasis on academic oriented rheology, the basic source of problems are still industrial. For example the whole matter of uniaxial and biaxial stretching of viscoelastic fluids derived from the work of industrial scientists (Ziabicki, Ballman, Cogswell, Meissner, Denson). There remain enormous numbers of polymer processing problems, which are relatively untouched by rheologists. Considerable help could be given to American industry if academic rheologists become concerned with these areas. These problems relate to injection and blow molding, and sheet forming in the plastics industry; the fiber spinning-drawing-texturing of the fiber-textile industry; and mixing, milling and extrusion in the rubber industry. Probably, only academic rheologists can carry out the long analyses and experiments to resolve these areas. These industrial problem areas are extremely challenging. Many of them involve not only fluid mechanics rheology, but the interaction of fluid mechanics with crystallization so one must combine the disciplines of Oldroyd, Avrami and Stein for proper interpretation. Other problems involve the behavior of multiphase systems ranging from rubber-black compounds to disperse two phase molten plastic systems. These could be the future generations of problems to the academic rheologist. A better job by both the industrial scientist and of the academician is needed to make them known and get the job done. Equally as important is the need to develop a rational funding situation. Considerable changes are needed in the attitudes if not the structure of government funding of academic research."

RHEOLOGY SOCIETY SHORT COURSE

Montreal, October 27, 28 (Sat., Sun.) 1973

INSTRUMENTATION AND MEASUREMENT OF RHEOLOGICAL PROPERTIES

— A Short Work Shop Course —
to be conducted by:

Professor William W. Graessley
Department of Chemical Engineering
Northwestern University

Course Description

This is intended to be a lecture and workshop course in which the students would participate in a variety of rheological measurements on a common sample with commercially available apparatus. These measurements may include capillary and cone and plate flows, viscoelastic and normal thrust measurements. Lectures will emphasize basic theory, analysis of the data, required corrections and limitations and the relation among the measurements.

Registration

The registration fee for the course is \$75 prior to September 15, 1973. Student rates will be one half of above.

Further information may be obtained from M. H. Birnboim, Department of Chemistry, Rensselaer Polytechnic Institute, Troy, New York 12180, E. A. Collins, Development Center, B. F. Goodrich Chemical Co., Avon Lake, Ohio 44012 or J. L. White, Department of Chemical & Metallurgical Engineering, University of Tennessee, Knoxville, Tennessee 37916.

OTHER ASSOCIATIONS

IUTAM and IUPAC

The eleven national societies which comprise the membership of the International Committee on Rheology have voted to seek affiliation with both the International Union on Theoretical and Applied Mechanics and the International Union of Pure and Applied Chemistry, and to amend the By-Laws of ICR to admit a voting delegate from IUTAM (IUPAC requires only a non-voting delegate). Formal applications for affiliation have now been submitted to both unions and should be acted on within the next few months. In addition to helping avoid conflicts in meeting dates, these affiliations should serve to give ICR an opportunity to express the opinions of its members on nomenclature and other questions to the appropriate committees of these much larger international organizations in a timely fashion. These affiliations are requested under special provisions in the statutes of both unions which involve no financial commitment on the part of ICR.

Italian Society

The 2nd meeting of the Italian Society of Rheology was held in Siena on May 10-12, 1973. Contact G. Pezzin, Via delle Palme 1, 35100 Padova.

The British Society of Rheology

The 1973 Autumn Conference of the Society will be held at the University of East Anglia, Norwich, from September 18-21. The theme of the conference will be "Modern Developments in Rheology". Deadline for titles and abstracts was April 30, 1973. Contact K. M. Beazley, 44 Brockstone Road, Boscoppa, St. Austell, Cornwall, U.K.

APPLIED MECHANICS CONGRESS

The Seventh U. S. National Congress of Applied Mechanics will be held at the University of Colorado in Boulder, Colorado during June 3 - June 7, 1974. Send manuscripts before Jan. 1, 1974 to S. K. Datta, Chairman, Editorial Committee, Seventh U. S. National Congress of Applied Mechanics, Department of Mechanical Engineering, University of Colorado, Boulder, Colorado 80302.

RHEOLOGY SURVEY

The response to the Rheology Survey conducted late in 1971 and 1972 was rather poor with only 173 members replying (and 120 non-members). A second mailing is being sent out with this bulletin. If you did not complete the questionnaire before, we urge you to take a few minutes and do so now. A successful survey will provide valuable information to help your Society serve you better.

PROPOSED POLYMER RESEARCH FOUNDATION

Malcolm C. Williams, of the Department of Chemical Engineering of the University of California at Berkeley, seeks our support for the following idea, abstracted from his proposal, but paraphrased only in order to preserve continuity. Inform President Eirich of your opinion.

What appears to be needed is an independent funding agency which supports the type of polymer research which is judged by the industry to be relevant to both its short-term and long-term needs. There is ample precedent for such an agency — e.g., the Petroleum Research Fund itself, the Paint Research Institute, the American Petroleum Institute — and moreover there now exists a very real threat that academic polymer programs will shrivel unless new funding sources arise rather soon.

To avoid the charge of self-interest and parochialism, it is probably necessary that the learned societies initiate study and (hopefully) implementation of "Polymer Research Foundation."

Before December 1973. Would you appoint a study group within your society, whose charge would be to recommend whether you could separately support its formation.

A joint committee (ACS-APS-SPE-SOR) could explore financing and legal aspects.

The Foundation would be tax-exempt entity, administered by its own directors who would be appointed by the founding Societies.

NOMINATIONS

The nominating committee, consisting of Hershel Markovitz, Carnegie Mellon University, chairman, assisted by George Lianis and Charles Sieglaff has proposed the following slate of officers for 1974-76:

President: R. S. Rivlin

Vice President: J. R. Knox, C. L. Sieglaff

Secretary: R. A. Mendelson

Treasurer: E. A. Collins

Editor: R. R. Myers

Executive Committee: I. M. Krieger, G. Lianis, S. Sternstein & L. J. Zapas

According to Article V Section 2 these nominations may be supplemented by additional nominees named by petition forwarded to the Secretary and signed by at least fifteen (15) members in good standing of the Society. The nominations must be received by Secretary Miller, Union Carbide Corporation, Bound Brook, New Jersey 08805 before July 1, 1973.

MINUTES

EXECUTIVE COMMITTEE MEETING

APRIL 27, 1972

Executive Committee members present: F. R. Eirich, R. R. Myers, J. C. Miller, and R. S. Rivlin.

Others present: R. S. Marvin.

1. The meeting was called to order at 4:30 p.m. by President Eirich.
2. The minutes of the previous meeting in Knoxville were approved as sent the Executive Committee.

3. The Secretary reported that we had 60 members delinquent in dues for 1972 and 70 last year. This number has substantially increased the last two years. The possibility that some of these members might be unemployed was raised and after some discussion the Secretary was instructed to arrange to keep unemployed members on the roster without payment of dues.
4. A proposal from the advisory committee for Physics Today to publish review of tutorial papers from technical meetings from the individual Societies was reviewed. It was decided to answer the proposal affirmatively and instruct the program chairman for the next meeting to submit titles of appropriate papers to the editor of Physics Today.
5. R. R. Myers, the Editor, passed out a brief report on the status of papers for the Transactions. At present there are enough papers to publish Volume 16.
6. A brief report on the treasury was given by President Eirich. The balance appears to be adequate to pay our expenses at this time.
7. The International Congress on Rheology to be held in Lyon was discussed thoroughly because of the confusion surrounding the registration. Some members who desire to go have not received their registration forms. The Secretary will write to the organizing committee to obtain registration forms. The question of how the International Committee could help administer an International Congress was discussed. No recommendations were found suitable.
8. R. S. Marvin, the Society representative on the International Committee presented the desire of the International Committee to join the International Union on Theoretical and Applied Mechanics. Some form of International affiliation seems desirable to avoid Congress conflicts and have a voice in an International Union.
Various objections to affiliation with IUTAM have been voiced by member societies and after discussion by Executive Committee members present it was decided to postpone a decision until the next meeting.
9. The Annual Meeting for 1972 will be held in Cincinnati on January 29-31, 1973.
10. The Annual Meeting for 1973 will be held in Montreal at the Sheraton Mount Royal Hotel, October 28-30, 1973.
11. No decisions on future meetings were made pending further invitations.
12. President Eirich pointed out that he received information from AIP which would be available to members of the Executive Committee if they desired the information.
13. In March, the Presidential Science Advisor, Dr. David, gave a briefing to the officers of member societies of AIP on the science and technology budget and current policies. F. R. Eirich, H. Markovitz, and J. C. Miller attended. The emphasis was on applied science in the field of environmental technology and mass transportation.
14. President Eirich brought up the question of the "Rheology Gap" which created considerable conflict at an evening meeting in 1972. It was the President's opinion that it will be necessary to build a bridge between the academic and industrial workers and new means of creating this bridge should be sought. The short course on rheology taught by Professor Bird at the Annual Meeting last fall was considered

very successful but incomplete. A suggestion was made that a session devoted to applied rheological problems from industrial scientists might be useful. It is apparent that the desire for a bridge between theory and practice is one sided at this time. Another short course on rheology will probably be offered at the next Annual Meeting.

15. President Eirich proposed that efforts be made for the Society to grow up to 30% in membership over the next 5 years. Methods for doing this are, possibly, to include in the program rheological work in fields besides the more conventional areas. Food rheology, dispersion rheology and plastics processing were considered good areas to develop. The Secretary suggested that a continuing effort be made over a period of years because similar developments in the past had been somewhat unproductive because of lack of continuing effort.
16. The meeting was adjourned at 8:30 p.m.

Respectfully submitted
John C. Miller
Secretary

STOFFER CINCINNATI INN EXECUTIVE COMMITTEE MEETING

JANUARY 28, 1973

Executive Committee Present: F. Eirich, R. Rivlin, R. R. Myers, F. Collins, A. Gent, Graessley, H. Markovitz.

Others present: G. Fulmer, L. Marker, R. Chartoff, A. Strauss, R. S. Marvin, L. Zapas.

1. The meeting was called to order at 8:50 p.m. by Vice-President Rivlin.
2. Minutes of the last meeting were not available because the Secretary was detained in Cleveland.
3. The Treasurer reported that we have no present financial difficulties except getting current balances out of AIP. R. S. Rivlin will contact G. Gilbert at AIP. A question of earning interest on the account was raised since the Society has about \$8000 which is not necessary to have immediately available.
4. A motion to amend the estimated budget for 1973 to show improved publication charge receipts was made, seconded and passed. The budget was adopted as amended.
5. The local arrangement chairman for Montreal October 1973 is H. Schrieber. The meeting hotel will be the Sheraton Mount Royal. L. Zapas the program chairman has no plans yet.
6. Program Committee is R. Landel, B. Coleman and a third man to be chosen.
7. Deadline for abstracts is August 10, 1973. Abstracts to be mailed to the Editor by August 15th.
8. Topics suggested for the Montreal meeting:
 1. Flow Birefringence
 2. Tensile Failure and Crazing
 3. New Viscoelastic Phenomena
9. E. Collins reported a significant difficulty in taking slides and manuscripts into Canada recently. R. S. Marvin will check with Canadian consulate in Washington.
10. A special committee to pick future meeting sites was appointed. E. Collins is the chairman with R. Marvin, R. Myers and Chartoff as members. Grainsville, Fla. and Williamsburg, Va. were discussed as possibilities for future meetings.

11. N. Tschoegl will be asked to check the possibility of a West Coast Meeting in January, 1974.
12. A short course at Montreal is considered a desirable attraction and F. Eirich will ask Mr. Birnboim to consider it.
13. The following were appointed to Standing Committees:
Nominating: H. Markovitz, Chairman
Bingham: A. Gent, Chairman, D. Kaeble and E. Baer added to the committee
14. The Nomenclature Committee was reorganized: C. Sieglaff will be chairman, Bird, Dicke, Myers, and Eirich are members. It was suggested that an additional member be added who will concentrate on International Nomenclature Committee.
15. An Industrial-Academic Cooperation Committee will be formed to investigate needs and investigate possible activities.
16. A motion to amend the By-Laws of the International Committee to admit a voting delegate from IUTAM was seconded and passed.
17. E. Collins reported the response of SOR members to the rheological survey was poor. A second questionnaire will be sent out.
18. The meeting adjourned at 12:30 a.m.

Respectfully submitted,
John C. Miller
Secretary

SOCIETY RHEOLOGY BUSINESS MEETING

JANUARY 29, 1973
Stouffer Cincinnati Inn

1. The meeting was called to order by President Eirich at 5:30 p.m.
2. Minutes of the previous meeting in Knoxville were approved as printed in the Bulletin, April 1973.
3. The reports of the Secretary, Treasurer and Editor were read. H. Markovitz suggested that the Secretary's report recognize that this meeting is the 1972 Annual Meeting.
4. A motion to present Mrs. Emily Wolf, of AIP, with a gift up to \$500 was made, seconded and passed.
5. R. S. Marvin reported on the activities of the International Committee on Rheology. A Congress in 1976 will probably be held in Czechoslovakia. The ICR will join IUTAM and IUPAC. The necessary change in the By-Laws is presently being approved by the National Societies.
6. President Eirich announced that the International Congress in France was a good meeting.
7. R. S. Marvin reported that ICR had acted formally to retain the poise and stoke, although an IUPAC committee had suggested they be abandoned.
8. The Fall meeting in 1973 will be in Montreal at the Sheraton Mount Royal Hotel. H. Schrieber is the Local Arrangements Chairman and L. Zapas the Program Chairman.
9. An ad hoc committee to investigate meeting sites was formed by the President, Chairman is E. Collins.
10. The possibility of a 1974 West Coast meeting will be investigated by N. Tschoegl.
11. The possibility of a short course for Montreal is being investigated.
12. N. Nakajima is the chairman of a committee to investigate Industrial Academic cooperation.
13. The meeting was adjourned at 6:15 p.m.

Respectfully submitted,
John C. Miller
Secretary

Application for Membership in the SOCIETY OF RHEOLOGY

I hereby desire to apply for membership in the SOCIETY OF RHEOLOGY dating from
January 19.....

Name
(Include Title, e.g., Mr., Dr., Prof., Miss, etc.) Please print.

Mail Address

Mail Address

Professional Connection

Position

Chief Interest

Highest Academic Degree

Date

Enclose Remittance of \$10 for Regular Annual Dues or \$100 for Sustaining Annual Dues
and Mail to:

SOCIETY OF RHEOLOGY
American Institute of Physics
335 East 45 Street
New York, New York 10017

**AMERICAN INSTITUTE OF PHYSICS INCORPORATED
FOR SOCIETY OF RHEOLOGY**

Statement of Receipts and Disbursements — Year Ended December 31, 1972

Balance in Account - January 1, 1972		\$17,175.56
RECEIPTS (January 1 - December 31, 1972)		
Dues Collections:		
1971 Dues	(\$ 20.00)	
1972 Dues	8,070.44	
1973 Dues	<u>10.00</u>	8,060.44
Miscellaneous Income:		
Interest Income on U. S. Government Bond	60.00	
Income from Fall Meeting	<u>1,267.00</u>	1,327.00
Transactions of the Society of Rheology (Schedule A)		1,612.40
Total Receipts		<u>\$28,175.40</u>
DISBURSEMENTS (January 1 - December 1972)		
Charge for Dues Billing and Collection	\$ 551.91	
Charge for Preparation and Maintenance of Member Record File	912.02	
Financial Handling Charge - 1972	167.64	
Member Society Dues - 1972	788.00	
Editorial Expenses:		
Salaries, Telephone and Postage	1,398.99	
Directory and Bulletin Mailing	312.80	
S of R Transactions - Mailing Expense	1,153.31	
Spring Bulletin	262.44	
Winter Meeting	249.39	
Winter Bulletin	116.34	
Miscellaneous	<u>457.04</u>	6,369.88
Balance in Account - December 31, 1972		<u>\$21,805.52</u>

TRANSACTIONS OF THE SOCIETY OF RHEOLOGY

Statement of Income and Expense — Year Ended December 31, 1972

INCOME		
Publication Charges		\$4,380.00
Reprint Sales		<u>1,027.73</u>
Total Income		<u>\$5,407.73</u>
EXPENSE		
Publishing Expense	\$1,300.52	
Printing Reprints (Wiley)	1,793.96	
Printing Mailing Labels	24.41	
Reprint Order Handling Charge	<u>676.44</u>	
Total Expense		<u>\$3,795.33</u>
Net Income or (Expense)		<u>\$1,612.40</u>

1973 BUDGET FOR THE SOCIETY OF RHEOLOGY

(As Modified at the Business Meeting - 1/30/73)

Balance 1972 (Estimate)	\$17,500
RECEIPTS:	
Dues Collected	10,000
Income from January Meeting (Cincinnati - Annual 1972)	500
Income from Fall Meeting (Montreal)	1,000
Total Receipts	<u>\$29,000</u>
DISBURSEMENTS:	
Charge for Dues Billing and Collection	\$ 420
Charge for Maintenance and Society List	600
Contribution for Support of AIP	900
January 1973 Meeting (Annual 1972) Bulletin	350
Spring Bulletin	250
Fall Meeting (Montreal)	1,000
Fall Meeting Bulletin	350
Transaction Subscription Charge (Wiley) (\$.003 per page/member)	1,920
AIP Expenses Related to Transactions	300
Transaction Expenses (Scheduled at 60%)	4,800
Editorial Expenses	900
Mrs. Wolf (AIP) Secretarial Duties	100
Other Miscellaneous Expenses	500
Survey	100
Gift for Mrs. Wolf	300
Total Disbursements	<u>\$12,690</u>
Estimated Balance December 31, 1973	<u>\$16,310</u>

Respectfully submitted by
Edward A. Collins,
Treasurer