

THE BRITISH SOCIETY OF RHEOLOGY

BULLETIN — No. 3, 1962

Complete



Hon. Secretary :

DR. M. F. CULPIN,
8 The Broadway,
Pontypool,
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Hon. Editor (Bulletin) :

MR. P. E. KNAPP,
20 Wayside Avenue,
Harrogate,
Yorkshire.



BRITISH SOCIETY OF RHEOLOGY

Officers and Committee for 1962-1963

President:

Dr. R. Roscoe, Ph.D., F.Inst.P., King's College, Newcastle-upon-Tyne.

Honorary Secretary:

Dr. M. F. Culpin, Ph.D., F.Inst.P., 8 The Broadway, Pontypool, Monmouthshire.

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Dr. G. H. Tattersall, M.Sc., Ph.D., A.Inst.P., 32 High Storrs Drive, Sheffield 11.

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Mr. C. C. Mill, M.Sc., A.Inst.P., 19 Cray Avenue, Ashtead, Surrey.

Honorary Editor (Bulletin):

Mr. P. E. Knapp, B.Sc., A.Inst.P., 20 Wayside Avenue, Harrogate.

Honorary Editor (Rheology Abs.):

Mr. R. W. Whorlow, B.Sc., A.R.C.S., A.Inst.P., Physics Department, Battersea College of Technology, Battersea Park Road, London, S.W.11.

Committee:

Mr. J. F. Hutton, B.Sc., A.Inst.P., Shell Research Limited, P.O. Box No. 1, Chester.

Mr. R. J. Cole, B.Sc., F.R.I.C., A.M.I.Chem.E., Paint Research Station, Teddington, Middlesex.

Mr. G. K. Jones, B.Sc., F.Inst.Pet., The Copyhold, Nutfield Road, Redhill, Surrey.

Mr. D. R. Reid, M.A., 18 Wellesley Road, Colchester, Essex.

Dr. D. W. Saunders, Ph.D., A.R.C.S., F.Inst.P., College of Aeronautics, Cranfield, Bletchley, Bucks.

Dr. J. H. C. Vernon, B.Sc., Ph.D., 106 Monkswood Avenue, Waltham Abbey, Essex.

Secretary's Report for the Year 1961-62

The activities of the Society in the year 1961-62 have followed much the same pattern as in previous years. Two general meetings were held, and five committee meetings. The general meeting at Llandudno in September, 1961, on "Rheological Techniques" was held jointly with the (then) Non-Destructive Testing Group of the Institute of Physics and Physical Society. Over a hundred persons attended, and were accommodated mainly at the Imperial Hotel, where the business of the meeting took place. This arrangement was novel, as far as the Society of Rheology was concerned, but seems to have been generally approved by those attending. Most of the papers presented were published in "Laboratory Practice" in November and December, 1961. For the first time, a subsidy was offered to younger members, as the cost of attending the meeting was higher than usual. Seven members accepted assistance. From the Treasurer's report it will be seen that the financial aspects of the meeting were satisfactory.

A second general meeting on "Temperature Effects in Near-Newtonian Liquids" was held in the Physics Department of Battersea College of Technology in April, 1962, with overnight accommodation at the Ralph West Hall of Residence. This was a more specialised meeting attracting some fifty members. It was the first meeting to be held in London since 1959.

The year 1961-62 has been the second year of Professor Douglas' term as President of the Society. In addition to his Presidential Address on "The Rheology of Glass," given at Llandudno, Professor Douglas also gave a paper at Battersea, and has taken the chair at all committee meetings since September, 1960, except one which he missed through illness. The Society is very much indebted to Professor Douglas for his active participation in, and guidance of, its affairs in the last two years, despite his heavy commitments elsewhere during that time.

It is largely as a result of suggestions by Professor Douglas that a re-drafting of the Rules of the Society has been started. Although the membership of the Society remains fairly steady at about 350, the sums of money held by the Society have increased, and meetings of the kind held at Llandudno involve a turnover of about £1,000. The committee have, therefore sought legal advice regarding the Rules, and hope to present new Rules for consideration by a General Meeting next year. In addition to covering the question of financial liability, the new Rules will, it is hoped, put on a surer footing such things as the conditions of membership of the Society; the procedure for the arrangement of meetings; and the setting up and administration of Branches. The Society's activities in the past have been conducted mainly in an informal atmosphere. It is not intended that the introduction of new Rules should result in any change in this respect.

The Branches of the Society in Victoria and N.S.W. have been active during the year, and now number about thirty members each. A course

of introductory lectures on rheology has been arranged by the Victorian Branch: a copy of the summaries of these lectures is available if any member should wish to see them. The informal Cambridge Rheology Club organised by Dr. H. G. Muller has held four short discussion meetings during the year.

Arrangements are being made for three general meetings of the Society in the year 1962-3, in addition to the present meeting in Harrogate. In January, there will be a joint meeting with the Society of Glass Technology at Sheffield, on the subject of "Visco-elastic properties of glasses"; in April, the subject will be "Rheology of Metals" at Cranfield; and in September, "Rheology of Clays" at Keele.

The Editors of the Society's regular publications have agreed that this year the remarks they wish to make should be incorporated in the Secretary's report so that it shall be as complete as possible a record of the year's activities. At the last Annual General Meeting, Mr. R. W. Whorlow took over the editorship of Rheology Abstracts from Dr. J. H. C. Vernon, who was responsible for much of the work of starting the journal and retired "by rotation" after four years service. In 1961, 628 abstracts and titles were published, together with a subject index prepared by Mr. R. J. Cole. To him, and to the many abstractors who contribute to the journal, the Society is much indebted. The total circulation is roughly 800, including members. The Editor would be pleased to hear from anyone else who is interested in abstracting, and particularly from anyone who could assist with the Russian or English versions of several important Russian journals.

This year Mr. J. F. Hutton retires "by rotation" from the editorship of the Bulletin, as prescribed by the Rules. The thanks of the Society are due to Mr. Hutton for his work in compiling a quarterly journal from the very varied collection of notes, programmes, etc. which have been sent to him. It is a matter for regret that there have not been more contributions in the form of letters from members. The Bulletin is perhaps a good place in which to discuss subjects of controversy of the kind raised by Dr. Scott Blair in No. 1, 1962. Bulletin No. 2, 1962, having been issued later and in larger form than usual, will be followed by No. 3 in December.

A start has been made on the preparation of a new list of members. The Committee has suggested that, until the new Rules are operative, the existing Rule 3 should be interpreted as meaning that any person interested in rheology should be *eligible to apply* for membership. They are also anxious that all applicants for membership should be supported by a member, even at the risk of impertinence in the case of an applicant of distinction.

This year a large proportion of the administrative work of arranging the meetings has been done by members of the committee other than those whose official title ensures their special mention. The sharing of what were the duties of the Treasurer alone between the Treasurer and the holder of the new office of Membership Secretary has also eased a

burden. It is a pleasure to acknowledge the active co-operation of all committee members. Without this it would be impossible to run the Society, as we have no permanent premises or clerical staff. M.F.C.

Report on "Emulsion Rheology" Symposium, Harrogate, October, 1962

For the second time in its history the British Society of Rheology held a meeting in an hotel, namely the Hotel St. George in Harrogate, from the 1st-3rd October, 1962.

Gratitude must be expressed to the Conference Secretary, Mr. P. E. Knapp, for the arrangements were excellent, and the disadvantage of not having stepped seating in the room where the lectures were given (which occasionally meant some craning of necks at the back of the room to follow a demonstration on the blackboard) was more than compensated for by the presence of bar and large lounge immediately adjacent in which discussion could continue in comfort while the subject was still "hot". With the large majority of participants resident in the hotel the interchange of ideas and discussion took place into the early hours of the morning on both nights of the Symposium. This opportunity for the informal interchange of ideas and discussion of research in progress with other workers in the field is of course in the best traditions of the Society. Just over 100 members were present to take advantage of these opportunities.

The programme, on "The Rheology of Emulsions", was an extremely powerful one, and the proceedings will be published in due course in book form by Pergamon Press Ltd. There was an international flavour about the proceedings, with contributions being received from workers in Canada, U.S.A., France, Holland and Japan as well as Great Britain, while the range of nationalities of the delegates was wider still.

Summaries of the papers have been printed in the September 1962 issue of Rheology Abstracts. While it is perhaps invidious to select individual contributions for special mention when the general level of contributions was so uniformly high, I feel that Prof. S. G. Mason's beautiful apparatus and resulting cine film of the three types of drop deformation and break-up, dependent on the ratio of viscosities of the two media, and Dr. T. Hanai's admirably clear exposition of dielectric behaviour were especially memorable. The symposium struck a nice balance between the theoretical and experimental aspects of the subject and there was no lack of novelty in the material. The programme organiser (Mr. P. Sherman) is to be congratulated on his choices.

The meeting was treated to an unexpected and pleasant bonus in the form of a cine film on the flow of blood by Prof. Kniseley of South Carolina, shown during the break for coffee on the third day.

After dinner on the first day a motor coach excursion took members to see Fountains Abbey, most impressively floodlit.

The afternoon of the second day was spent in visits to either the Research Department of I.C.I. Ltd. (Fibres Division) or to Dunlop Rubber Company (Dunlopillo Division).

A pleasant Conference Dinner was held on the second evening, brightened by the appearance of the Members' ladies. Dr. R. F. Tuckett, Research Manager of I.C.I. Fibres Division, by whose kindness we visited the Research Dept., replied to the toast of "The guests", and proposed "The Society" to which Professor Oldroyd responded on the Society's behalf. Both achieved that combination of good sense, wit and brevity which members have come to expect.

The Annual General Meeting was the occasion of the retirement of Prof. R. W. Douglas. Dr. R. Roscoe was elected President in his stead, and paid a sincere tribute to Prof. Douglas, who had shown outstanding enthusiasm and catalysed much activity during his two years as President. The vacancy on the Committee was filled by Mr. R. J. Cole. The names of the new Committee and the balance sheet for the year ending 30th June, 1962, are printed elsewhere.

The Secretary created a precedent by presenting a much fuller, more detailed and more formal report of the work of the Committee and the doings of the Society during the year. This is printed in full elsewhere in the Bulletin.

The meeting broke up in some confusion, for whatever else was flowing in England that day, British Railways certainly were not. Some members stayed another evening to examine the amenities of Harrogate, others keen to get home all managed a lift, demonstrating that practical rheologists will always find solutions to discontinuities in transport phenomena.
D.R.R.

Future Meetings

Members should by now have received final details and application forms for the next meeting of the Society which is to be held in Sheffield, 8th-10th January, 1963, jointly with the Society of Glass Technology. Enquiries about the meeting which is entitled "The viscosity and viscoelasticity of glasses both inorganic and organic", should be addressed to The Assistant Secretary, Society of Glass Technology, "Thornton", 20 Hallam Gate Road, Sheffield 10.

The Spring meeting of the British Society of Rheology will be held at The College of Aeronautics, Cranfield, from 17th-19th April, 1963. The subject will be "Ductility in metals and its relation to fabrication processes". The programme will include the following papers:—

1. Professor A. J. Kennedy Fundamental factors influencing the Ductility of Crystalline Materials.
2. Dr. R. E. Smallman Yielding and Fracture in BCC Metals.
3. Mr. R. Eborall Hot and Cold Ductility of Commercial Alloys in relation to working processes.

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| 4. | Dr. A. Moore | Ductility in Beryllium. |
| 5. | Dr. J. F. Wallace | The Application of Extrusion Theory to Practical Problems. |
| 6. | Dr. J. M. Alexander | An Introduction to Slipline Field Theory. |
| 7. | Dr. P. B. Oxley | Variable Flow-stress Slipline Field Theory applied to the Problem of Orthogonal Metal-cutting. |
| 8. | Mr. R. Arnold | Strip Rolling—a Survey of the Process and its variables. |
| 9. | Mr. W. J. McG. Tegart | Metal Deformation by Hot Torsion. |
| 10. | Mr. R. Pearce | Desirable Mechanical Properties for Sheet Metal Forming. |
| 11. | Mr. W. Corbett | Problems in Sheet Metal Forming in the Gas-turbine Industry. |

The Conference will be residential and during the three days, there will be a Conference Dinner and a tour of the College.

Full details of the programme and other arrangements will be made available later. Communications regarding the meeting should be addressed to:

Roger Pearce, Organising Secretary,
The College of Aeronautics, Cranfield, Bletchley, Bucks.

A General Meeting will be called at Cranfield to consider, and if possible to adopt, the new rules mentioned in the Secretary's Report for 1961-62 which is included in this issue of the Bulletin.

Looking further ahead to the Autumn, the topic will be "Rheology of Clays" and this conference will be held at the University of Keele, Staffordshire. The dates are 26th and 27th September, 1963, and accommodation will be available at the University hall of residence. Enquiries about the meeting should be addressed to Mr. G. K. Jones, The Copyhold, Nutfield Road, Redhill, Surrey.

The Institute of Physics and the Physical Society are holding a symposium at Imperial College, London, on "Mechanical Damping in solids" on January 3rd, 1963.

Mr. B. Sugarman will present a paper to the North-West Section of the Society of Glass Technology at St. Helens Technical College at 6.15 p.m. on March 8th on the "Strength of glass".

The British National Society of Soil Mechanics and Foundation Engineering is holding a symposium on 22nd to 24th May, 1963. The subject will be "Grouts and Drilling Muds in Engineering Practice". Members of the British Society of Rheology are particularly invited to attend. Details are obtainable from the Secretary, at The Institution of Civil Engineers, Great George Street, London, S.W.1, where the meeting will be held.

Notes

1. The Cambridge Rheology Club holds several meetings each year. A brief account of these meetings is generally published in "Nature" and some references to these accounts covering the past year are given below.

A discussion on some recent research problems encountered in blood as a rheological fluid.

Nature, Vol. 190, 1062-3, 1961.

Exhibition and discussion of rheological equipment.

Nature, October 28th, page 308, 1961.

Rotation Viscometers and their application to Non-Newtonian measurements.

Nature, 193, page 430, 1962.

The rheology of clay soils.

Nature, 194, 143, 1962.

Visco-elasticity and Weissenberg Rheogoniometer.

Nature—accepted for publication.

Further details about the activities of the club may be obtained from Dr. H. G. Muller, Spillers Ltd., Station Road, Cambridge.

2. The Council of the Institution of Chemical Engineers has set up a working party to enquire into Materials Science and Technology in the U.K. It will be concerned with the state of research and teaching in this subject and with the identification of new fields of research.

3. Some members may be interested to know that an "International organisation for pure and applied biophysics" has been established. Its objectives are international co-operation and communication in biophysics and the encouragement of co-operation within each country between societies representing the interests of biophysics.

4. A special short course lasting one and a half days on "Flow Processes in Polymeric Systems", will be held at the Bradford Institute of Technology on the 8th and 9th March, 1963. Further details may be obtained from the Registrar, Bradford Institute of Technology, Bradford 7.

5. Notification has been received from Pergamon Press, Headington Hill Hall, Oxford, that a new quarterly journal "Biorheology" has been launched. The first issue was made in July. The editors-in-chief are Professor A. L. Copley of New York Medical College and Dr. Scott-Blair.

6. The annual meeting of the American Society of Rheology was held at Baltimore at the end of October. The following papers were presented.

"Rheo-Optical Properties of Polymers IV", D. G. LeGrand, General Electric Research Laboratory, Schenectady, New York.

"Response of a Distributed, Thermally Activated System", J. Ross Macdonald, Texas Instruments Incorporated, Dallas 22, Texas.

"Rheology of Human Blood Measurement Near and at Zero Shear Rate", E. W. Merrill, et al., Dept. of Chem. Eng., Massachusetts Institute of Technology, Cambridge 39, Massachusetts.

"A Rotational Viscometer Using an A.S. Torque to Balance Loop and Air Bearing", E. W. Merrill et al., Dept. of Chem. Eng., Massachusetts Institute of Technology, Cambridge 39, Massachusetts.

"Hydrodynamic Interactions of Submicroscopic Particles", Harold Wayland, et al., California Institute of Technology, Pasadena, California.

"Modern Theories of Flow in Tubes", Clifford A. Truesdell, Dept. of Mechanics, The Johns Hopkins University, Baltimore, Maryland.

"Physical Aspects of the Mammalian Circulatory System", R. H. Haynes, Committee on Biophysics, University of Chicago.

"The Flow of Blood Through Microscopic Vessels", Edward H. Bloch, Dept. of Anatomy, Western Reserve University, Cleveland, Ohio.

"A Survey of Attempts in the Mathematical Analysis of Blood Flow", Edward Saibel and Edward Fox, Dept. of Mechanics, Rensselaer Polytechnic Institute—Troy, New York.

"Effects of Fibrinogen upon the Fluid Structure of Erythrocyte Suspensions", R. E. Wells, Jr., T. H. Gawronski, R. D. Perera, and E. W. Merrill, Depts. of Medicine, Harvard Medical School and Peter Bent Brigham Hospital and Dept. of Chem. Eng., Massachusetts Institute of Technology, Boston and Cambridge, Massachusetts.

"Detailed Characteristics of the Flow of Blood in Vitro", George Bugliarello and John W. Hayden, Carnegie Institute of Technology, Pittsburgh 13, Pennsylvania.

"Viscoelastic Properties of Dilute Polyisobutylene and Polystyrene Solutions", Nicholas W. Tschoegl, J. E. Frederick and John D. Ferry, University of Wisconsin, Madison, Wisconsin.

"The Viscosity of Dilute Solutions of Linear Associative Colloids", Warner L. Peticolas, International Business Machines Corporation, San Jose 14, California.

"The Dynamic Mechanical Properties of Poly 4-Methyl Pentene-1", R. W. Penn, W. R. Grace and Co.—Research Div., Clarksville, Maryland.

"An Instrument for Measuring Torsional Creep and Recovery", Donald J. Plazek, Mellon Institute, Pittsburgh 13, Pennsylvania.

"On the Question of Molecular Entanglements in Concentrated Polymer Solutions", W. Philippoff, Esso Research and Engineering Co., Linden, New Jersey.

"Study of Entanglement of Polymers in Solution by Viscosity Measurements", Samuel H. Maron and Thomas T. Chin, Dept. of Chemistry, Case Institute of Technology, Cleveland 6, Ohio; Nobuyuki Nakajima, W. R. Grace and Co., Res. Div. Clarksville, Maryland.

"Viscosity and Thermodynamics of Moderately Concentrated Polymer Solutions", R. Simha, Dept. of Chemistry, University of Southern California, Los Angeles 7, California.

"Viscoelastic Properties of Concentrated Solutions of Polyisobutylene in Cetane", J. R. Richards, Kazuhiko Ninomiya, and John D. Ferry, University of Wisconsin, Madison, Wisconsin.

"Theory of Viscoelasticity in Temporarily Crosslinked Polymers", Part I: Treatment in a System with Single Relaxation Time, Part II: Relaxation Spectrum and Steady Flow Viscosity, Shizuo Hayashi, Dept. of Physics, Faculty of Liberal Arts and Education, Gumma University, Maebashi, Japan.

"The Effect of Molecular Weight Distribution on Polymer Rheology Near the Entanglement Region", Roger S. Porter and Julian F. Johnson, California Research Corporation, Richmond, California.

"A Recursive Approach to the Theory of Slow, Steady-State Viscoelastic Flow", W. E. Langlois, International Business Machines Corporation, San Jose Research Laboratory, San Jose, California.

"Some Interesting Aspects of General Linear Viscoelastic Deformation", W. G. Gottenberg and R. M. Christensen, Space Technology Laboratories, Inc., Redondo Beach, California.

"On Viscometric Flows of Simple Fluids", Walter Noll, Carnegie Institute of Technology, Schenley Park, Pittsburgh 13, Pennsylvania.

"The Exact Solution of General Plane Strain Deformation of an Incompressible Neo-Hookean Body", and "General Formulation of the Homogeneous Thermomechanical Deformation of an Elastomer", P. J. Blatz, California Institute of Technology, Pasadena, California.

"The Rheology of Primary and Secondary Consolidation", R. L. Schiffman, Rensselaer Polytechnic Institute, Troy, New York.

"Viscosity and Glass Transition Behavior of Polymer-Diluent Systems", L. J. Garfield and S. E. Petrie, Eastman Kodak Co., Rochester, New York.

"The Determination of Weight Average Molecular Weight from Melt Rheology Studies, J. R. Knox, AviSun Corporation, Marcus Hook, Pennsylvania.

"Experimental Determination of the Molecular Weight Distribution of Linear Polymers from Stress Relaxation after Steady Flow", Warner L. Peticolas, International Business Machines Corporation, Monterey and Cottle Road, San Jose 14, California.

"Determination of Transient Thermal Stresses in a Slab with Temperature-Dependent Viscoelastic Properties", John S. Humphreys and Charles J. Martin, Avco Corporation, Research and Advanced Development Division, Wilmington, Massachusetts.

"Determination of Non-Flow Shrink Ratio in Oriented Fibers", D. Prevorsek and A. V. Tobolsky, Textile Research Institute and

Frick Chemical Laboratory, Princeton University, Princeton, New Jersey.

"Viscoelastic Fluids: Development of a Simple Constitutive Equation", J. L. White and A. B. Metzner, University of Delaware, Newark, Delaware.

"Velocity Profiles for Two-Dimensional Flow of Milling Yellow Suspensions, as Determined from Birefringence Measurements", Keh-Chang Liu and Fred N. Peebles, Department of Chem. and Metallurgical Engineering, The University of Tennessee, Knoxville 16 Tennessee.

"A Dimensional Approach to Colloid Rheology", Irvin M. Krieger, Dept. of Chemistry, Case Institute of Technology, Cleveland, Ohio.

"Rotational Flow Generator for Rheological Studies", W. H. Hoppmann II, and C. E. Miller, P.S.C. Rensselaer Polytechnic Institute, Troy, New York.

"Mechanical Behavior of Raw Rubber in the Mooney Viscometer," Kazuhiko Ninomiya and Shusaku Ido, Japan Synthetic Rubber Co., Yokkaichi, Japan.

"The Extension of Unoriented Nylon 66 Filaments", Malcolm F. Bender and Malcolm L. Williams, The Chemstrand Research Center, Inc., Durham, North Carolina.

"The Rheology of Polyelectrolytes III—Experimental Determination of the correlation of M_t with Other Average Molecular Weights", John G. Brodnyan and E. L. Kelley, Research Laboratories, Rohm and Haas, Bristol, Pennsylvania.

"The Method of Force (or Stress) Circuit Diagrams in Rheological Applications", Nicholas W. Tschoegl, University of Wisconsin, Madison, Wisconsin.

"An Experimental Method to Measure the Strain Energy Function W", A. San Miguel—Jet Propulsion Lab., California Institute of Technology, Pasadena, California.

"Viscoelastic Stress Analysis of a Spinning Hollow Circular Cylinder with an Ablating Pressurized Cavity", A. H. Corneliussen, Sperry Rand Research Center, Sudbury, Massachusetts; E. F. Kamowitz, Boston, Massachusetts; E. H. Lee and J. R. M. Radok, Brown University, Providence, Rhode Island.

"Thermal Feedback in Liquid Flow: I", J. Gruntfest, General Electric.

"A Theoretical and Experimental Investigation of Finite Deformation in Viscoelastic Media", Part I: A Theory of Solids with Strain Energy and Memory, B. Bernstein, E. A. Kearsley and L. J. Zapas, U.S. Dept. of Commerce, National Bureau of Standards, Washington 25, D.C.; Part II: Stress-Relaxation Experiments and Comparison with Theoretical Predictions, L. J. Zapas, B. Bernstein and E. A. Kearsley; Part III: A Theory of Fluids with Strain Energy and Memory, E. A. Kearsley, B. Bernstein and L. J. Zapas.

"A Comparison of Streaming Birefringence and Rotary Strain Birefringence Measurements", W. Philippoff and S. J. Gill, Esso Research and Engineering, Linden, New Jersey and University of Colorado, Dept. of Chemistry, Boulder, Colorado.

"An Unusual Mechanism of Extrusion of Polytetrafluorethylene at High Temperature and Pressure", J. P. Tordella, Electrochemicals Dept., E. I. duPont de Nemours and Company, Inc., Wilmington, Delaware.

"Die Wall Restriction on the Elastic Shear Deformation in Viscoelastic Flow of Polymer Melt", Teikichi Ari—Tokyo Institute of Technology, Ookayama, Meguro-ku, Tokyo, Japan.

"Flow Behavior of Dimethylpolysiloxane Fluids in a Cone-Plate Viscometer", W. H. Bauer and A. P. Finkelstein, Rensselaer Polytechnic Institute, Troy, New York.

"Parallel Plate and Cone-Plate Normal Stress Measurements on Polyisobutylene-Cetane Solutions", Hershel Markovitz and David R. Brown, Mellon Institute, Pittsburgh 13, Pennsylvania.

"Large Longitudinal Retarded Elastic Deformation of Rubberlike Network Polymers. Application of Nakada's Formulation." Herbert Leaderman and Frank McCrackin, National Bureau of Standards, Washington, D.C., and Osamu Nakada, Hitachi Central Research Laboratory, Kokubunji, Tokyo.

New Members

NAME AND ADDRESS	INTERESTS
R. H. Norman, 77 Highfields, Shrewsbury, Salop.	Rubber and plastics. General Methods.
C. J. S. Petrie, 91 Thoday Street, Cambridge.	Molten thermoplastics and highly viscous silicones, especially at high rates of shear and conditions leading to melt instability.
J. Mewis, 26 Kasteelstraat, Antwerp 1, Belgium.	Rheology of printing inks. Elasto-viscometry.
M. J. Groves, 58 Patterdale Road, Woodthorpe, Nottingham.	Emulsions and suspensions.
K. Elliot, Messrs. Croid Ltd., Winthorpe Road, Newark, Notts.	Rotational viscometry. Emulsions.
R. F. White, R. & D. Pharmacy, Smith Kline & French Labs. Ltd., Mundells, Welwyn Garden City, Herts.	Emulsions and suspensions.
M. R. Nearn, Unilever Research (Isleworth), 455 London Road, Isleworth, Middx.	Toilet preparations.

W. A. Sammons,
20 Dellside, Harefield, Uxbridge Middx.

A. N. May,
5 Acorn Street, Hunsdon, Herts.

A. J. Gillham,
University of Cambridge,
Dept. of Chem. Eng.,
Pembroke Street, Cambridge.

E. L. Neustadter,
Gestetner Ltd.,
Tottenham, London, N.17.

T. R. Barnett,
26 Almsford Oval, Harrogate.

P. R. Pinnock,
2 Wensley Grove, Harrogate.

I. M. Ward,
I.C.I. Ltd., Fibres Div.,
Hookstone Road,
Harrogate, Yorkshire.

I. K. Lee,
c/o Civil Eng. Dept.
University of Melbourne,
Parkville, N.2,
Victoria, Australia.

J. J. Cairney,
Laboratory, Tullis Russell & Co. Ltd.,
Markinch, Fife.

G. B. Miller,
Technical Information Center,
Riegel Paper Corp.,
Milford, New Jersey, U.S.A.

G. W. Hallworth,
R. & D. Pharmacy,
Smith Kline & French Labs. Ltd.,
Mundells, Welwyn Garden City.

C. B. Duckham,
Alexander Duckham & Co. Ltd.,
Rainville Road,
Hammersmith, London, W.6.

W. G. Wilman,
Coal Tar Research Assocn.,
Oxford Road, Gomersal, Nr. Leeds.

G. W. Downs,
British Hydrocarbon Chemicals Ltd.,
Bo'ness Road,
Grangemouth, Stirlingshire.

O. Delatycki,
c/o C.R.L., I.C.I.A.N.Z., Newson St.,
Ascot Vale, Victoria, Australia.

J. S. M. Gourlay,
5 Pellew St., Sandringham S8,
Victoria, Australia.

Polymers, Adhesives.

Polymers, Adhesives.

Bingham and thixotropic fluids.

Oil emulsions.

Polymers. Synthetic fibres.

Fibres and films.

Polymers.

General.

Polymers and suspensions.

Fibre formation in fluids.

Emulsions.

Non-Newtonians, greases, etc.

Building and road materials.

Polymers.

Pigment suspensions.

ACCOUNTS FOR YEAR ENDING 30th JUNE, 1962

1960-61	INCOME	£	s.	d.
£		£	s.	d.
681	Balance on 1st July	841	11	11
325	Subscriptions	351	15	7
11	Interest P.O.S.B.	12	12	6
177	Subscriptions for meetings			
2	Casual sales Rheology Abstracts	4	0	0
—	Advertisements for members ...	5	0	0
—	Refund of Postage Deposit ...	7	0	0
	Total	£1222	0	0

1960-1961	EXPENDITURE	£	s.	d.
£		£	s.	d.
304	Printing and Distribution of Bulletin and Abstracts ...	256	8	9
50	Committee and administrative expenses	137	7	1
—	Subsidy of meetings	53	5	1
—	Income Tax	26	15	6
841	Balance 30th June	748	3	7
	Total	£1222	0	0

COLIN C. MILL,
Hon. Treasurer.

ALAN G. WARD,
Hon. Auditor.

Fletcher & Co.,
39 Osborne Road,
Farnborough.