

Definitives Blq.
Borrow copy. p 25.

BULLETIN



BRITISH SOCIETY OF RHEOLOGY

1976, Vol. 19, No. 2

CONTENTS

Foreword	i
Officers and Members of Council	ii
Swinburne Award	13
The Belgian Group of Rheology	13
P.R.I. Netherland Section	15
Spring Meeting—Rheology of Colloids	15
Rheological Terminology in France	16
Rheology and Semasiology	17
Paint Research Association—Golden Jubilee	19
Call for Papers	20
Mixing and Polymer Processing	21
Future Meetings	
A.G.M. and Scientific Session	23
The Technology of Plastics and Rubber Interface	24
Recent Advances in Fluorocarbon Polymers	25
New Journal	25
Note—The Society's Records	25
Research Studentship	25
Applications for Membership	27
Obituary—Professor (Em.) Dr. Karl Weissenberg	28
Diary	30

Hon. Editor:

M. CAMINA,

Paint Research Association,

Waldegrave Road,

Teddington,

Middlesex.

FOREWORD

The proliferation of Universities over the last two decades has led to many more research units each needing financial support. In such research, both pure and applied, problems can be asked and solved on topics which appear to be no more than interesting intellectual riddles. The attitudes adopted by people to such work becomes important in times of financial difficulties. Subjects which seem to be more closely linked to a world need and fashionably harnessed for the present good of Society generally attract more money for research into them.

Quite often, however, in the history of science a new idea is put forward which is contemporarily unattractive and unacceptable, until after some years that idea becomes an important part of the subject to which it pertains. Funding for such work would be negligible. One wonders, therefore, if the time and money spent in the formation of committees to present funds for selected research could not be better spent. But what criteria should be applied to the distribution of available money, other than by the use of Ernie?

OFFICERS AND MEMBERS OF COUNCIL 1975-76

President: PROFESSOR K. WALTERS, Department of Applied Mathematics, University College of Wales, Aberystwyth.

Secretary: MR. F. N. COGSWELL, I.C.I. Ltd., Plastics Division, Welwyn Garden City.

Treasurer: DR. D. R. OLIVER, Department of Chemical Engineering, University of Birmingham, Birmingham B15 2TT.

Membership Secretary: DR. T. E. R. JONES, School of Mathematical Sciences, Plymouth Polytechnic, Plymouth.

Abstracts Editor: DR. D. MARSHALL, Institute of Polymer Science, Loughborough University of Technology, Loughborough.

Bulletin Editor: MR. M. CAMINA, Paint Research Association, Teddington, Middlesex.

Ordinary Members:

DR. K. M. BEAZLEY, 44 Brockstone Road, Boscoppa, St. Austell PL25 3DP.

DR. D. C-H. CHENG, Warren Spring Laboratory, Stevenage.

MR. T. C. DAVENPORT, B.P. Research Centre, Sunbury-on-Thames, Middlesex.

MR. A. EVANS, Department of Surgery, Royal Victoria Infirmary, Newcastle-upon-Tyne NE1 4LP.

DR. J. FERGUSON, Department of Fibre Science, University of Strathclyde, Glasgow G1 1XW.

DR. J. M. HOBBS, National Engineering Laboratory, East Kilbride, Glasgow.

NINTH SWINBURNE AWARD GOES TO SCHNELL

Dr. Hermann Schnell, formerly Director of Central Research for Bayer AG, Leverkusen, has been awarded the 1975 Swinburne Gold Medal by the Plastics and Rubber Institute. The award was made in recognition of his outstanding work on polycarbonates. Dr. Schnell will receive his award at the Royal Institution, Albermarle Street, SW1, on Thursday October 28th, 1976, at 1800 hours when he will present an address on a subject concerned with some aspect of polycarbonates.

Previous recipients of the award are Professor G. Gee (1960), Dr. J. C. Swallow (1962), Professor K. Ziegler (1964), Professor C. E. H. Bawn (1966), Dr. H. F. Mark (1968), Professor L. R. G. Treloar (1970), Dr. R. F. Boyer (1972) and Professor A. Keller (1974).

THE BELGIAN GROUP OF RHEOLOGY

1. Historical background

At the VIth International Congress of Rheology (Lyon 1972), the Belgian participation counted 23 people and nine papers were presented. As most of these rheologists had normally little or no communication with each other, Dr. W. Bontinck and the writer realised there was an opportunity to create a "Society" of rheology in Belgium.

The first assembly, held in Brussels in October 1973, saw the foundation of the "Working Party" with the financial support of the chemical societies: the "*Vlaamse Chemische Vereniging*" and the "*Société Chimique de Belgique*". At this stage, the objects of the group were defined. They are very similar to those of the British Society of Rheology: to promote collaboration between academic institutions and industrial laboratories. Assisting each other by recording the instrumental and literature facilities in the rheological field was another goal. With this objective, an application form was distributed to all interested persons. The results of this investigation are given hereafter.

2. Activities

The first *Annual Meeting* of the group took place at the Federation of the Chemical Industries on January 11th, 1974, with a lecture given by Mr. Cogswell (I.C.I. Ltd.) on "Elongational flow of polymer melts" and another given by Dr. Heijboer (T.N.O.—Delft) on "Secondary mechanical transition in amorphous polymers".

Several weeks later, on May 29th, a national conference was organised at the University of Mons dealing with an introduction to the various Belgian laboratories. This subject attracted more than 50 registrations and one among them came from the Netherlands.

During this one-day session, nine papers were presented by Prof. J. C. Bauwens (University of Brussels), Prof. J. Mewis (Katholieke Universiteit Leuven), S. Boucher (Faculté Polytechnique de Mons), Prof. M. Crochet (Université Catholique de Louvain), Dr. W. Bontinck (UCB-Sidac S.A.), J. Leblanc (University of Liège), Dr. J. Chauffoureaux (Solvay Co.), Ing. G. Patfoort (C.R.I.F.), Dr. C. Marco (University of Mons) and Ir. L. Boiy (Agfa-Gaevaert N.V.).

The second Annual Meeting gave young rheologists the opportunity of presenting their main interest in the field.

Mr. G. Pilate (Univ. of Louvain) spoke on "Numerical Study of Viscoelastic Streamings" and Dr. E. Deprez (UCB-Sidac S.A.) dealt with "Rheology of molten polymers in extension".

Other lectures were given at different times when the Group met. We had the visit of Dr. A. R. Berens (Goodrich) to the University of Liège and Prof. A. B. Metzner (Univ. Delaware) to the University of Leuven.

Some other activities are in progress, such as comparing the different rheological teaching given at the various institutions.

At the moment, which is expected to be only temporarily, the activities are reduced principally for financial reasons as some aid has not been renewed.

3. Membership

The Belgian Group of Rheology has a small membership of 89, which lies in the same order of magnitude as other rheological Societies, when the size of the country is taken into consideration.

The above-mentioned inquiry represents about 44 per cent of the membership. It represents people from many scientific interests. About 60 per cent of them come from academic institutions and 40 per cent are active in the industry.

For 35 per cent, rheology represents a full-time study. Seventy per cent answered they are involved simultaneously in experiments and theory, and only 10 per cent are pure theoreticians. When asked if their rheological interest was mainly pure and applied science, there were 70 per cent affirmative answers and only 18 per cent for technology!

In respect of materials of interest, we noticed:

- 64 per cent are dealing with polymers (molten or dissolved)
- 43 per cent with solid polymers
- 36 per cent with suspensions
- 23 per cent with emulsions.
- 28 per cent with theoretical models.

Metals, biological materials, foodstuffs and oils concern very few people, taken as whole 7 per cent each.

The remaining materials such as glass, ceramics, composites lie between these limits.

So far, the organisation of the Group is very informal and there is neither president nor secretary but a council formed by six members who act as the organising committee.

To inquire about the Belgian Group of Rheology mail should be addressed either to:

Dr. W. J. BONTINCK: UCB-SIDAC S.A.
Ottergemse Steenweg, 801
B-9000-GHENT (Belgium)

or to

Dr. C. MARCO: University of Mons
Avenue Maistriau, 19
B-7000-MONS (Belgium)

C. Marco.

P.R.I. FORMS NETHERLANDS SECTION

The Plastics and Rubber Institute has formed its 11th Overseas Section, the Netherlands Section. The first Chairman is Dr. Ir P. J. Bakker, F.P.R.I., the Director of the Plastics and Rubber Institute, TNO, Delft, and Honorary Treasure is Mr. T. C. N. Belgraver, c/o Stichting Opleiding Rubber en Kunststoffen, Balistraat 97 (P.O. Box 1806), The Hague, to whom further enquiries should be addressed.

The first meetings of the Section, which has nearly 100 members, will begin later this year.

SPRING MEETING—RHEOLOGY OF COLLOIDS

Held at Bristol University April 8th-9th

The first joint meeting organised by the B.S.R. and the Chemical Society's Colloid and Interface Group attracted an audience of 130 with almost two-thirds coming from both Societies.

Professor I. M. Krieger introduced the subject matter of the conference with an excellent survey of the rheological properties of colloids. Starting with the various formulae relating viscosity to volume fraction, he followed by describing equations for different morphological macromolecules in solution and he also mentioned the simplicity of using dimensionless groups. Via the subject of packing fractions of particles he ended by producing a beautiful picture of the hypothetical spherical milk producing cow.

The following lecturers kept up the good standard and abstracts of their talks will appear in the Rheological Abstracts. The interesting

papers that were given were certainly not flattered by the written abstracts presented to the delegates. Perhaps in mathematical papers, assumptions made and a few equations should be included.

The number of people attending and the interest shown by them suggests that another conference on this subject should be held soon but lasting longer. This conference went very smoothly and the organisers at Bristol University, Professor R. H. Ottewill and Dr. J. W. Goodwin, are to be congratulated.

RHEOLOGICAL TERMINOLOGY IN FRANCE

The Bureau of Groupe Francais de Rhéologie have submitted the following definitions for discussion. Any comments should be sent to Dr. J. D. Weber, Faculté des Sciences, Université de Metz, Ile du Saulcy, 57000 Metz, France.

Reconstitution (Recovery?)

An operation in which the strain tensor is restored to zero. In a homogeneous and continuous deformation the body returns to its initial shape and dimensions.

After an operation of *reconstitution* the phenomenon of *effacement* is usually observed.

Complete *effacement* characterises the behaviour of a viscoelastic material.

Effacement (Fading?)

Following an operation of *reconstitution* the decrease of the difference between the actual stress and the stress existing before any deformation. If at the end of a sufficient period of time this difference becomes and remains zero the *effacement* is called total. If the different remains non-zero whatever the duration of the observation, the *effacement* is called partial.

N.b.—*Effacement* is the phenomenon that is the dual of *recouvrance* (published definition 19).

[*Recouvrance* is defined as the decrease in strain resulting from the removal of a system of loads.—D.W.H.]

Comportemente Viscoélastique (Viscoelastic behaviour)

The rheological behaviour (published definition 66) of a material such that after deformation followed by *reconstitution* the *effacement* becomes total.

In the general case the response of a viscoelastic material comprises an instantaneous component (definition 16) and a delayed component (definition 17).

Viscoelastic behaviour includes as limiting situations on one side the purely elastic case (see definition 18), and on the other the purely viscous case (see definition 50). In the purely elastic case only the instantaneous response differs from zero.

Viscoelastic behaviour may be linear (definition 71) or non-linear. In the unidimensional linear case it can always be represented, completely and as closely as one wishes, by a rheological model containing only Hookean springs and Newtonian dashpots.

Viscoélasticité (Viscoelasticity)

The property of a material manifesting viscoelastic behaviour. By extension the science and study of that behaviour.

In English "recovery" is a general term where precise meaning becomes evident only when it is expressed in mathematical form. In France the terminology would appear to be more exact. I interpret the phrase that *effacement* is the dual of *recouvrance* as drawing attention to the former term referring to observed stress and the latter to observed strain. Bearing this situation in mind I would welcome suggestions for the most appropriate English synonyms for *reconstitution* and *effacement*.

D. W. Hadley.

RHEOLOGY AND SEMASIOLOGY

by G. H. Tattersall

I have long had an uneasy feeling that an invitation to serve on a committee might have some rather disturbing undertones in that it might be the result of a somewhat unflattering assessment of one's character. Am I really thought to be so concerned with the trivial, to be so expert at coded talk, and to be so interested in the minutiae of previous discussions as to make a good committee man? And if the invitation is to serve on a committee concerned solely with the formalising of definitions does not suspicion become certainty?

I honestly cannot remember the circumstances under which I was asked to become a member of the committee that was to produce the British Standard Glossary of Rheological Terms, nor can I remember the details of my acceptance except that I am sure I made my customary disinterested enquiry to discover who would pay my expenses.

Many years ago when it was decided to expand the abstracting services of the Society, the name proposed for the new journal was "Rheological Abstracts" and it was due to my intervention that it was changed to "Rheology Abstracts". The decision not only had what may be construed as the advantage of symbolically aligning

us with the sponsors of "Physics Abstracts" rather than with those of "Chemical Abstracts", but had the merit of being philologically correct, and I may say I have derived considerable satisfaction from the quiet and hitherto unpublicised knowledge that it was because of me. When my mortal frame has acquired a coating of dust similar to that which already protects many of my research reports, the words "Rheology Abstracts" will still be frequently uttered. As everyone used to remark at my old school "Non sibi sed posteris".

Perhaps somebody who knew of my secret self-satisfaction said "This chap is just the pedant we want".

I must hastily add here, in parenthesis, that I know my fellow committee members were not chosen on any such basis; their qualities of academic distinction, long experience, and, above all, good humour, automatically selected them as suitable to provide the substance on which the pedantry could feed and without which it would be helpless.

When I received my committee papers, I was somewhat disquieted to find I was on committee C41 because I am rather aggressively a pro-Michelin ZX man, although I have to confess that the experimental evidence on which that prejudice is based, would not be accepted in my laboratory as being statistically significant.

The work of the committee proceeded and one of my memories is that the two definitions that had the most agonising birth pains were those relating to "deformation" and "viscosity". That might surprise you, but it should not. We were helped tremendously in our work by the use of glossaries drawn up by distinguished colleagues and, because rheology is a relatively young science, we were sometimes able to work directly with advice from those who had been concerned in the early work on particular phenomena. On reflection, perhaps that is why we had more difficulty on words like "viscosity"; but it is sure that we would have obtained the advice of Newton himself if we could have procured the services of a medium suitably qualified technically.

It is a matter of regret for me that it is only since the completion of the committee's work that I have been able to compile another list that, if it had been ready in time, might have added interest to our deliberations. I give it now at this late stage as an alternative to the official glossary and with full permission to anyone who so desires to choose from it a definition that attracts him, and substitute it for the rather more prosaic one in the British Standard. Every one of these definitions was produced by a student under some stress, and almost certainly with more heartfelt emotion than was ever experienced by any member of C41. It is a fundamental principle of modern education that creativity should be encouraged, even if it is at the expense of such minor matters as accuracy and discipline, and it is in that truly progressive spirit that I now make this offering to fellow rheologists.

List of Definitions

Anisotropy

rate of change of viscosity

an anisotropic material is one whose centre of curvature is not on the same side as its surface.

an anisotropic material is one which will rip or shear in all directions, e.g. paper and unlike isotropic only goes with the grain, or at least, one way, e.g. timber.

Bingham Model

is a model for metals similar to the Hooke's Law graph it shows that a metal when stretched will return to its original length unless it is stretched past its limit of proportionality into the plastic region when it will receive a permanent set.

Newtonian Liquid

means a liquid which follows Newton's Laws such that it behaves predictably

is one which will return to its original shape after loading has been applied and removed.

obeys Newton's Law that change in pressure of a liquid is directly proportional to a change in temperature at constant pressure.

is one which has no viscosity.

flows under the assumption that it will flow no matter how small the forces on it are.

Proof Stress

You go up to the elastic limit where everything is recoverable, this point is called the 0.1 per cent proof stress.

Thixotropic Material

is one which is quite still when left to rest but when a stress is applied to it, it runs or spreads like a normal liquid.

is one which increases in strength when worked, e.g. a pin, which becomes more brittle after being bent.

Timber is a thixotropic material important in building.

PAINT RESEARCH ASSOCIATION—

GOLDEN JUBILEE 1926-1976

Founded in September 1926, the roots of the Paint Research Association go back to the First World War, when amid the stresses and perilous shortages and weaknesses in the industrial structure, the idea of a co-operative movement in industrial research with Government assistance first took shape. Today the Paint R.A. is an international research organisation having members in many countries, including manufacturers of paints, polymers, pigments, printing ink,

papers and pharmaceuticals as well as shipbuilders and other major users of paint.

The Golden Jubilee will be marked by an International Conference on "Paint in the Service of the Community" on September 21st-23rd, 1976, at the Excelsior Hotel (London Airport). This two-day Conference will take stock of the present situation and look forward to the future. The four sessions on:

Paint World—State of the Art

Protection (Technology & Economics)

Paint and the Community

Next Fifty Years

will provide ample scope for technical discussion on matters of national and international importance. An Exhibition running concurrently with the Conference, will illustrate Paint R.A.'s past work and aims for the future. The highlight of the celebration will be a Jubilee Dinner on the evening of September 22nd graced by the presence of distinguished guests. The Paint R.A. will also publish a booklet in commemoration of the first fifty years, which will be circulated to industry throughout the world.

Details of the Conference Programme will be released shortly. Further information on hospitality suites at the Conference and advertising in the booklet can be obtained from:

D. Dasgupta, Head of Information Department, Paint Research Association, Waldegrave Road, Teddington, Middlesex TW11 8LD. Tel.: 01-977 4427. Telex 928720.

CALL FOR PAPERS

AMERICAN SOCIETY OF RHEOLOGY

47th ANNUAL MEETING

February 27th—March 2nd, 1977

Biltmore Hotel

New York, N.Y.

Deadline for Submission—November 1st, 1976

The submission of contributed papers for presentation at the Annual Meeting is open to both members and non-members of the Society. There will be four symposia.

An Abstract of 250 words or less is required prior to November 1st, 1976. Abstracts should be sent *directly* to the appropriate symposium chairman whose address is given below.

1. Symposium on Suspension Rheology

Chairman: Professor Irvin M. Krieger, Chemistry Department,
Case Western Reserve University, Cleveland, Ohio 44106.

2. Symposium on the Rheology of Plastics Processing

Chairman: Professor James L. White, Department of Chemical
Engineering, University of Tennessee, Knoxville, Tennessee
37916.

3. Symposium on the Rheology of Food Products

Chairman: Dr. Alina S. Szczesniak, General Foods Corporation,
Corporate Research, White Plains, New York 10625.

4. Symposium on Biorheology

Chairman: Professor Larry V. McIntire, Department of Chemical
Engineering, Rice University, Houston, Texas 77001.

5. General Papers Session

Chairman: Professor C. D. Han, Department of Chemical Engi-
neering, Polytechnic Institute of New York, Brooklyn, New
York 11201.

**CONFERENCE ON MIXING AND POLYMER PROCESSING
at Delft University, July 2nd**

GENERAL THEORIES (lecture room C)

- 9.30 Arrival and coffee.
- 10.00 R. M. Wellek, T. Gürkan, University of Missouri-Rolla,
Rolla Mo. (U.S.A.).
*Effect of Non-Newtonian fluid behavior on dispersed phase
mass transfer.*
- 10.20 R. T. Balmer, J. Brinkley, P. Notheis, R. G. Griskey,
University of Wisconsin-Milwaukee, Milwaukee Ws. (U.S.A.).
*Transition and turbulent flow of dilatant Non-Newtonian
fluids.*
- 10.40 Discussion.
- 11.10 Coffee.
- 11.40 J. E. Porter, C. Bell, University of Newcastle-upon-Tyne
(G.B.).
Liquid flow across a horizontal, rotating disc.
- 12.00 I. Fořt, O. Jaroř, M. Hořtálek, Inst. of Chem. Techn.,
Prague (C.S.).
*Homogenization of stream line field in modelling equipment
for crystallization.*
- 12.20 Discussion.
- 12.50 Lunch.

MIXING (lecture room C)

- 14.00 J. R. Bourne, G. K. Giger, W. Richarz, R. Riesen, E.T.H., Zurich (C.H.).
A new tracer system for residence time measurements in highly viscous fluids.
- 14.20 S. J. Chen, Kenics Corporation, North Andover, Mass. (U.S.A.).
Post-extruder mixing and thermal homogenization: Key to improved polymer processing.
- 14.40 M. Creissels, Société Procédés S.E.M., Cachan (F.).
Industrial scale of high viscosity mixing.
- 15.00 Discussion.
- 15.30 Tea.
- 16.00 A. W. Nienow, D. J. Wisdom, University College, London (G.B.).
Power consumption of aerated, turbine-agitated vessels.
- 16.20 J. Ulbrecht, A. Q. Quraishi, R. A. Mashelkar, University of Salford (G.B.).
Torque suppression of agitators with drag reducing additives.
- 16.40 Discussion.
- 17.10 Cocktail Hour.
Conference Dinner.

POLYMER EXTRUSION (lecture room D)

- 9.30 Arrival and coffee.
- 10.00 J. R. A. Pearson, Imperial College, London (G.B.).
Dimensional analysis for screw design.
- 10.20 G. M. Gale, R. W. Sambrook, R.A.P.R.A., Shawbury (G.B.).
Masterbatch flow patterns in polyethylene extrusion.
- 10.40 Discussion.
- 11.10 Coffee.
- 11.40 J. T. Lindt, Koninklijke/Shell Laboratories, Amsterdam (N.L.).
Pressure development in the melting zone of a single-screw extruder.
- 12.00 L. P. B. M. Janssen, J. M. Smith, University of Technology, Delft (N.L.).
Pressure development in twin-screw extruders.
- 12.20 Discussion.
- 12.50 Lunch.

POLYMER NON-EXTRUSION (lecture room D)

- 14.20 H. Janeschitz-Kriegl, J. Lavèn, University of Technology, Delft (N.L.).
Non-isothermal capillary flow of polymers.
- 14.40 F. Dobbels, J. Mewis, K. U. Leuven (B.).
Numerical analysis of nip flow.
- 15.00 Discussion.
- 15.30 Tea.
- 16.00 E. P. B. Jongen, S. F. Bush, I.C.I. Europa Ltd., Everberg (B.).
Interaction of reaction and flow in polymer melts.
- 16.20 E. B. Christiansen, University of Utah, Salt Lake City (U.S.A.).
Forced convection combined with natural convection heat transfer to Non-Newtonian fluids in vertical tubes.
- 16.40 Discussion.
- 17.10 "Borrell".
Conference Dinner.

GENERAL INFORMATION

This one-day conference is organised by the European Federation of Chemical Engineers Working Party on Non-Newtonian Fluid Processing on July 2nd, 1976.

The conference will be held in the "Aula" of the Delft University of Technology, Mekelweg 1, Delft (The Netherlands). Organising committee: R. H. Holslag ir, L.P.B.M. Janssen, Laboratory for Physical Technology, Prins Bernharlaan 6 Delft.

FUTURE MEETINGS

A.G.M. AND SCIENTIFIC SESSION

FUTURE DEVELOPMENTS IN RHEOLOGY

In a subject when "everything flows" we must expect and encourage changes. To look into the future the Society is holding a half-day meeting with the title "Future Developments in Rheology" at the Institute of Electrical Engineers in London on the afternoon of Friday, October 1st. The speakers will include the President, Professor K. Walters, and Professor W. Wilkinson from Academy, and Mr. T. C. Davenport, and Dr. A. A. C. Challis from Industry. We expect that the contributions will be controversial and there will be ample opportunity for discussion. This could be a significant meeting in determining future research policies in industry and the universities and delineating any initiatives which the society should undertake in the immediate future.

The Annual General Meeting of the Society will follow the Scientific session at 17.30. This year we shall be electing a new President and members are reminded that all the other officers and members of Council are elected each year.

To follow the A.G.M. a dinner (lounge suits) has been arranged at the Connaught Rooms convening at 19.30. This will provide an ideal opportunity to continue the afternoon's discussions to renew old acquaintances and to make new contacts. Members may introduce guests to this function and spouses will be particularly welcome.

Registration charges will be as follows:

Scientific Session only £2.00 members, £5.00 non-members.

Scientific Session plus Dinner, £7.50, members only.

Dinner Guests, £7.50.

There is, of course, no charge for attending the A.G.M.

To avoid disappointment would those wishing to attend the dinner please register with the Secretary,

F. N. Cogswell,
67 Daniells,
Welwyn Garden City,
Herts. AL7 1QT,

not later than September 1st.

THE SECOND EUROPEAN CONFERENCE

(The technology of plastics and rubber interface)

Venue: The Sheraton Hotel, Brussels.

Date: September 29th–October 1st, 1976.

Theme: The developments and use of blends, grafts and synthesised materials having properties intermediate between plastics and rubber has gained momentum over recent years. This interface area has tended to fall between the plastics and rubber industries and a conference devoted to the major aspects of technology of the plastics and rubber interface is of topical interest.

Exhibition: To complement the Conference, an exhibition of instruments, materials, news and information is being arranged adjacent to the Conference room.

General enquiries from the Continent and the U.K. should be addressed as follows:

Continent and elsewhere:
R. de Wilde,
111 Park Laan,
9200 AALST
Belgium.

U.K.:
R. H. Craven,
The Plastics and Rubber Institute,
11 Hobart Place,
London SW1W 0HL,
England.

RECENT ADVANCES IN FLUOROCARBON POLYMERS

A Conference, designed to promote a greater awareness of fluoro-polymers, their properties and design capabilities and the important contribution they make to solving some of the problems of a wide cross section of modern industry, is being organised by the Plastics and Rubber Institute.

The Conference will be held at the Leofric Hotel, Coventry on November 30th and December 1st, 1976. Further information from the Assistant Secretary (Activities) Plastics and Rubber Institute, 11 Hobart Place, London SW1W 0HL (telephone 01-245 9555).

NEW JOURNAL

We are pleased to welcome to our libraries a new journal entitled *Journal of Non-Newtonian Fluid Mechanics*.

The journal will appeal to people working on basic rheological science and applications. It will deal with (a) the development of rheological equations of state for non-Newtonian liquids from both a continuum and microstructure starting point; (b) the use of rheological equations of state in the solution of meaningful flow problems involving one or more fluid phases; (c) experimental work associated with non-Newtonian liquids; (d) problems involving heat and mass transfers and mixing in flowing non-Newtonian liquids; and (e) instabilities and turbulent flow characteristics in non-Newtonian fluids.

Published in one volume yearly of four issues, the subscription rate is U.S.\$47.95/Dfl.120.00, postage included.

Free sample copies are available on request from Elsevier Scientific Publishing Company, P.O. Box 211, Amsterdam, The Netherlands.

NOTE

The Society's Records

The Secretary is anxious to borrow a copy of the Bulletin No. 4 of 1962 so that he can copy it to complete this aspect of the records of the Society. }

F. N. Cogswell,
67 Daniells, Welwyn Garden City,
Herts. AC7 1QT.

RESEARCH STUDENTSHIP—APPLIED RHEOLOGY

Applications are invited for an S.R.C. Research Studentship for research leading to an M.A. or Ph.D. on a topic concerned with the rheology of fresh concrete.

Candidates should hold, or expect to obtain, a good Honours Degree in an appropriate subject. Normally this would be in Physics, Chemistry or Materials Science, but the particular slant of a project will depend on the student's qualifications and interests and there are opportunities also for those with a degree in Ceramics, Mathematics or Civil Engineering.

All the work fits into an overall programme concerned with the flow properties of fresh concrete which includes investigations ranging from fundamental laboratory work to practical site work. In addition to the intrinsic interest there are important practical connections with major industry and a student can reasonably expect his study to lead to good employment possibilities.

Remuneration is by S.R.C. grant which may be supplemented by some demonstrating work.

Applications to and further information from Dr. G. H. Tattersall, Department of Building Science, University of Sheffield, Western Bank, Sheffield S10 2TN. Telephone Sheffield (0742) 78555.

APPLICATION FOR MEMBERSHIP

March 1976

Dr. B. J. Briscoe, B.Sc., M.A., Ph.D. f,e,sa,B,C,D,E,G,J.	Physics & Chemistry of Solids, Cavendish Laboratory, The University, Cambridge, C830HE.
Miss Rosaleen M. Burke, B.Sc.	Elsevier Scientific Publishing Co., P.O. Box 330, Amsterdam, Netherlands.
Dr. I. Barnett, M.Pharm., Ph.D., M.P.S., p,e,a,F,G,H.	Welsh School of Pharmacy, U.W.I.S.T., Cardiff.
Dr. Anthony L. Challis, Ph.D., B.Sc., F.R.I.C. p,et,a,B,C,D,H.	Science Research Council, State House, High Holborn, London, WC1R 4TA.
Dr. Costel D. Denson, B.S., Ch.E., M.Ch.E., Ph.D., Ch.E. f,et,sa,C,D,G.	General Electric Co., Appliance Park, 35-1113, Louisville, Ky. 40225, U.S.A.
Dr. Richard J. Fort, M.Sc., Ph.D. p,et,sa,C,D,M.	School of Polymer Science, University, Bradford, Yorks.
Douglas J. Harrop, B.Sc., API. p,e,a,D.	Elastomer Products Ltd., St. Mary's Mills, Ind. Estate, Marlborough Road, Leicester.
E. J. Tolle, B.Ch.E. f,e,a,B,C,D,E,F,G,L,M.	Imass, Inc., P.O. Box 134, Accord (Hingham) MA 02018, U.S.A.
Mr. Ian Gordon Turner, B.Sc. f,e,a,C,D.	Nobels Explosives Co., Nobel House, Stevenston, Ayrshire.
Mr. J. Green, B.Sc.	Physics Dept., Penglais, U.C.W., Aberystwyth.

RESIGNATION

Mr. J. W. Redman,
20 Morrell Avenue,
Horsham,
Sussex.

OBITUARY

PROFESSOR (Em.) DR. KARL WEISSENBERG

Karl Weissenberg was born in Vienna, Austria, on June 11th, 1893, and attended many different schools in Austria, Germany and France before matriculating in Frankfurt a/Main at the age of 16½ years.

His subsequent studies were fostered at the Universities of Vienna, Berlin and Jena, taking Mathematics as his main subject, with Physics and Chemistry as subsidiaries, touching also upon Law and Medicine. His Doctor of Philosophy degree was conferred in 1916 in Jena. He became a Private-Dozent and later, Professor of Physics in the University of Berlin.

He had a catholic interest in the sciences and held professorships and guest professorships in a variety of subjects during his long and fruitful scientific career; Physics at the Universities of Berlin and Southampton, Physical-Chemistry at the University of Paris, Civil Engineering and Engineering Mechanics at the Columbia University of New York and Human Anatomy at the Medical School in South Carolina.

In addition to his teaching activities he was at various times a scientific consultant to a number of large scale industries in Germany, Britain and the U.S.A., and also to diverse Ministries and Health organisations.

The publications of Karl Weissenberg range through Mathematics, Medical X-Rays, X-Ray Crystallography and Rheology in that order, and bear witness to his significant scientific research contributions.

In 1922 he joined the research team of M. Polyani at the Kaiser Wilhelm Institute fuer Fraserstoffchemie in Dahlen, Germany, and there for a period of about six years contributed to the X-Ray crystallography work. His acknowledged fame in this field rests on a paper published in 1924 in Volume 23 of *Zeitschrift fur Physik* describing his new X-Ray Goniometer. This allowed for the first time, a unique determination of crystallographic structure in three dimensions in space. The idea was only slowly adopted and it was not until after the 1939-45 war that the Weissenberg X-Ray Goniometer, as it is known, came into general use. More recently the automatic diffractometer has come into use, but this has not rendered Weissenberg's method, which depends upon photography, obsolete.

By 1929 his attention was turning from crystallography towards the field of rheology and during the 1930's he became associated with another person also destined to become well-known in the field of rheology, namely, W. Philippoff.

In 1929 he submitted his first important contribution in rheology with R. Eisenschitz and B. Rabinowitsch, it appeared in Volume 9 of *Mitteil deutsch Materialspruefungsamt*, and presented a general

analytical method for finding the shear rate at a capillary wall, now widely used.

Just prior to the 1939-45 war, Karl Weissenberg became a refugee and took up residence in Britain and there turned his attention to elastic liquids, particularly as exemplified by flame-thrower fuels. This proved to be a most productive period and his experimental observations were published somewhat later, due to war-time conditions, in 1947 in Volume 159 of *Nature*. This did much to stimulate curiosity and interest in the so-called anomalous liquids, and hence in the field of liquid rheology itself. Another important publication of that period was in the proceedings of the International Congress on Rheology held in 1948 in Holland, in this Karl Weissenberg demonstrated by means of rubber and fabric sheets, the importance of rotation of the embedded co-ordinate system in a flowing continuum. He had much earlier conjectured that certain fluids were elastic and now came the inference of the existence of a tension along the streamlines, since amply demonstrated. The earliest quantitative assessment of elasticity came from the work of a post-graduate student at Imperial College of Science and Technology, London, namely, R. J. Russell who worked under the supervision of Karl Weissenberg and submitted his Doctoral Thesis in 1946.

At this time also, the essence of the Weissenberg Rheogoniometer was established. The principal behind this second major invention was that it allowed the stresses around the full solid angle in a flowing continuum to be experimentally determined. Like the Weissenberg Goniometer, this is now commercially produced and has come into widespread use throughout the world.

The similitude of anisotropy of stress and strain in an initially isotropic medium and biorheology represent the more recent work of Karl Weissenberg, the latter up to the time of his death.

The fundamental ideas, of which he is the source, are pervasive and implicit in most of the published work on elastic liquids, including the considerations of thermodynamics.

Amongst his most cherished associations was that of Scientific Member of the Kaiser Wilhelm Gesellschaft and to its Institute of Physics, a special honour which he shared, it is believed, only with A. Einstein and the celebrated physicist M. von Laue. He was a life member of the Royal Institution, London, and was awarded in 1946 the Duddell Medal and Prize of the Physical Society of London for his invention of the Weissenberg Goniometer.

In addition to a deep and sensitive appreciation of a range of natural phenomena, Karl Weissenberg was an entirely engaging and unselfish person. His accord with nature was faithfully mirrored in that with his fellow human beings. He was notable in his scientific achievements and noble in personal qualities.

John Harris,
University of Rhodesia.

MARCUS REINER

"Since going to press news has been received of the death of Marcus Reiner. An obituary will appear in the next edition."

DIARY

1976

28 June–1 July. "World Congress on Chemical Engineering", Amsterdam.

5–9 July. "International Symposium on PVC", Lyon.

23–27 August. VIIth International Congress on Rheology, Gothenburg, Sweden.

1 October. "Future Developments in Rheology", B.S.R. Autumn Meeting, A.G.M. and Dinner, London.

29 September–1 October. "The Technology of Plastics and Rubber Interface", Brussels.

30 November–1 December. Recent Advances in Fluocarbon Polymers.