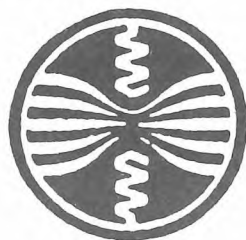


THE BRITISH SOCIETY OF RHEOLOGY

BULLETIN



1988, Vol. 31 No. 2

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THE BRITISH SOCIETY OF RHEOLOGY
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1987/88

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THE CARRI-MED RHEOLOGY SEMINAR

1st - 2nd November 1988

Dorking, Surrey

Rheology specialists, Carri-Med Limited are holding a two day Rheology Seminar. The Seminar will cover both rheology theory and practice, with emphasis on industrial applications. Our guest speakers offer a combination of academic and industrial expertise.

Tuesday, 1st November 1988

The first day is structured to provide a general introduction to rheology with lectures covering the following subjects:- The theory of flow, creep and oscillation; Interpretation of data, with resulting industrial implications.

Wednesday, 2nd November 1988

The content of the second day will be a little more advanced than the previous day, with such topics covered as:- The advanced theory of rheology; Controlled Stress Techniques; On Line Measurements; Rheology at the Molecular level.

For further details please contact:-

**Mrs. A.J. Cooke
Carri-Med Limited
Glebelands Centre
Vincent Lane
Dorking
Surrey
RH4 3YX**

Telephone: (0306) 886180

NOTICE OF THE ANNUAL GENERAL MEETING

The 44th Annual General Meeting of the British Society of Rheology will be held on Thursday, 7th September 1988 at 5.15 p.m. in the Queens Building (Earth Sciences Block) Royal Holloway and New Bedford College at Egham, near Staines, Middlesex.

Members are reminded that under Rule 7(b) the business of the meeting includes:

- i. The election of a President for 1988 - 90.
- ii. The election of other Officers and Members of the Council, 1988 - 89.
- iii. The receipt of a report and audited accounts from Council.
- iv. Dealing with matters raised by Council or by any Member, and receiving suggestions from Members for consideration by Council.

Nominations received to date are as follows:

President:	Dr. J. Ferguson
Secretary:	Mr. R.E. Carter
Treasurer:	Dr. A. Evans
Membership Secretary:	Mr. H. Schimanski
Editor (Abstracts):	Mr. S.T.E. Aldhouse
Editor (Bulletin):	Professor P. Townsend
Ordinary Members:	Mr. P.C. Anderson
	Dr. R. Buscall
	Dr. G.J. Brownsey
	Dr. A.A. Collyer
	Dr. D.J. Hourston
	Mrs. C.A. Moules
	Dr. D.R. Oliver

Nominations for Council or for any of the Offices are invited. Nominations should be sent to the Secretary or may be made at the Meeting (see Rule 5(b)).

The Secretary would be pleased to receive notice of any matter that any Member wishes to raise.

R.E. Carter

THE SCOTT BLAIR BIORHEOLOGY SCHOLARSHIP 1988

In memory of the work and example of Dr. G.W. Scott Blair, Pergamon Press will sponsor a scholarship to encourage excellence in research in biorheology, and to enable the recipient to undertake research activities which would not normally be possible without such a grant, such as a period of work at an overseas University. The scholarship will be administered by the Council of the British Society of Rheology.

PhD students, or equivalent, who are completing their first year of research in the field of biorheology may apply to become a Scott Blair Biorheology Scholarship Awardee.

The scholarship will have a value of £500 per annum to be used at the absolute discretion of the Awardee. Subject to a satisfactory report from his supervisors, the scholarship will be renewable for a maximum of one more year. Thus it will usually be available during the second and third years of a normal PhD project.

In addition to the annual payment, Council will consider applications for funding to attend conferences. The Awardees will be expected to present the results of their research at meetings of the British Society of Rheology, and will be encouraged to publish them in the Journal "Biorheology" in accordance with its editorial policy.

The award of the scholarship will be decided by Council, who cannot enter into correspondence with unsuccessful applicants, and who reserve the right not to award a scholarship in any particular year.

Applications for the 1988 Scott Blair Biorheology Scholarship should reach the British Society of Rheology no later than 1 November 1988. The application should be on no more than two sides of A4 paper and contain: personal details of the applicant, a description of the research, notes on any special uses envisaged for a proportion of the scholarship, and an endorsement from a person with supervisory responsibility for the research.

EDITORIAL

I am pleased to include in this issue an article describing the work of Eirian Jones' group at Plymouth. Eirian who is a member of the 'ex-Aberystwyth' clan has been particularly successful in promoting collaborative work with a wide range of industrial companies.

The President reports on the recent Brunel Conference on Composite Materials. Although not a 'large' conference, this seems to have been very successful, attracting delegates from both Europe and the U.S.A. The final programme for the next BSR Conference, 'Conundra Rheologica' to be held in September, is also included in this issue.

Some news from Japan - the Annual Awards for 1988 of the Society of Rheology, Japan have been given to Professor Yasaku Wada and Dr. Yuji Aoki. The awards were presented at the Tokyo meeting in May.

Peter Townsend

Peter Townsend

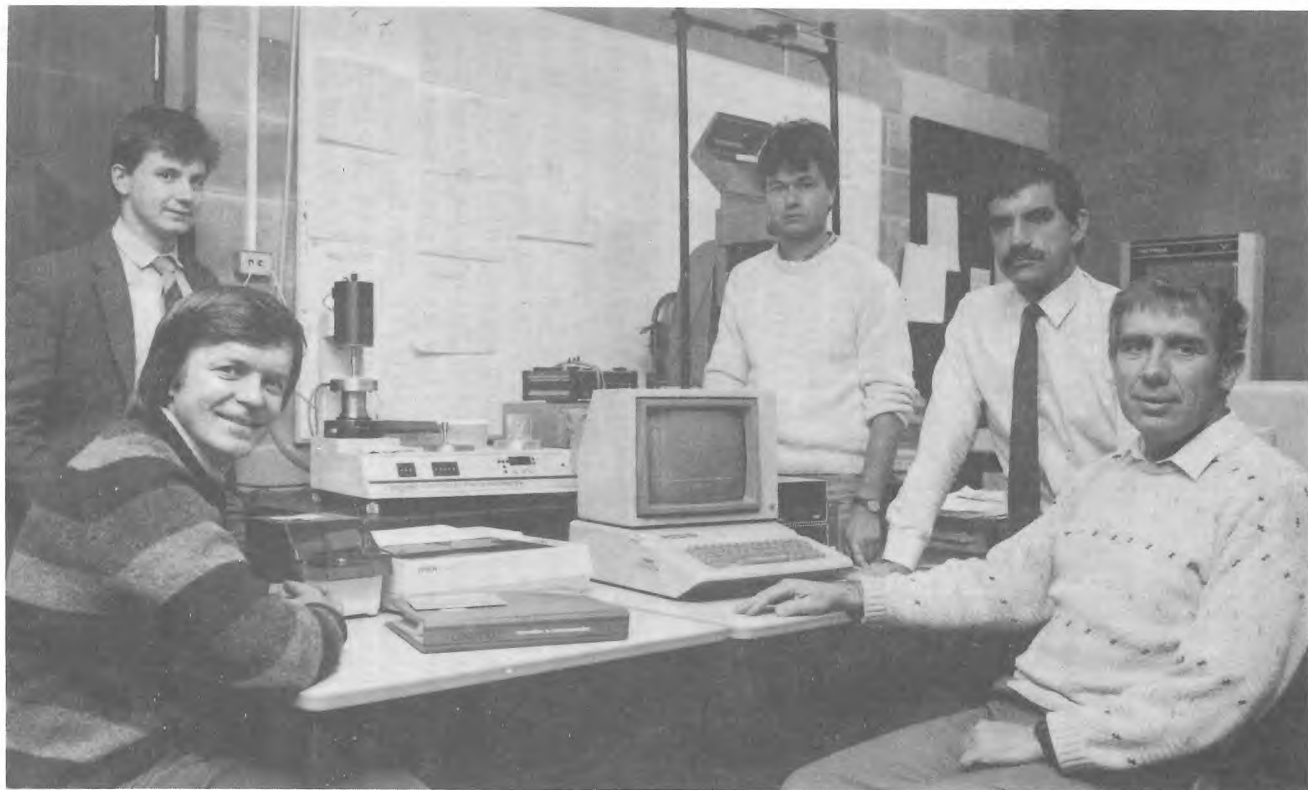


RHEOLOGY AT PLYMOUTH POLYTECHNIC

The Rheology Group was set up in 1971 and, since this time, most of the work of the group has been concerned with the characterization of materials. The basic aim of the research is to encourage the application of the theory so that a greater understanding of the flow properties of industrial materials can be gained. In order to achieve this aim, various projects have been carried out in close collaboration with research personnel in industrial and academic institutions.

The Rheology Group comprises three full-time members of staff (Dr T E R Jones, Dr J M Davies and Dr P W James), three research fellows, two research assistants and two technicians. The theoretical work of the group is carried out in parallel with experimental work in two rheology laboratories. Experimental equipment includes three Weissenberg rheogoniometers, a Carrimed controlled stress rheometer and a variety of flow measuring devices. This equipment allows a range of experiments to be carried out, under steady and oscillatory shear rate and steady and oscillatory stress. Most of the major development work is being carried out using the controlled stress technique since this method has the advantage of being able to provide data on properties such as yield stress and can be used at very low shear rates. However, the rheogoniometers can operate over a higher range of steady and oscillatory shear rate. One rheogoniometer has been converted to a squeeze film apparatus for the study of the behaviour of non-Newtonian lubricants in journal bearings.

Of the two laboratories, one is devoted exclusively to the study of the transport and settling characteristics of oil drilling fluids. A flow loop has been constructed using funding from the Marine Technology Directorate of the SERC. In this rig it is



PLYMOUTH POLYTECHNIC, RHEOLOGY GROUP

N RUDDOCK, J M DAVIES, K GOLDEN, P W JAMES, T E R JONES

Technology Directorate of the SERC. In this rig it is possible to observe and measure the motion of particles in simulated oil drilling fluids, using both visual (video camera) and computational (particle tracking) techniques.

An experimental facility is also available to study the pulsatile pipe flow behaviour of non-Newtonian fluids. These experiments have been used to verify combined steady and oscillatory stress data obtained from both a controlled stress and controlled strain rheometer.

The Rheology Group is actively involved in both theoretical and experimental aspects of rheology. The Marine Technology Directorate has supported a project to study hole cleaning on oil drilling rigs. The theoretical part of this project is concerned with the flow of fluids past regular shaped objects. Initially the work involved the prediction of the drag coefficient for a sphere moving through a power-law liquid at rest. Good agreement between data, obtained from the experimental flow loop described above, and theoretical predictions was obtained at low Reynolds numbers, where the 'slow flow' approximation can be made. This work is now being continued, with financial support from the British Petroleum Research Centre at Sunbury, so that the flow at higher Reynolds numbers and past non-spherical objects can be studied. Further financial support for this project has been obtained from the Department of Trade and Industry under a National Advisory Board initiative.

Another area of research in which the group is actively involved is controlled stress rheometry. This work is being carried out in conjunction with Carrimed U.K. Ltd. Initially an SERC collaborative award was used to support the work. This project showed, for the first time, that a controlled stress rheometer could be used to carry out oscillatory stress measurements. An important aspect of the work

was the control of the instrument via a microcomputer, which enables a high level of automation to be attained. A theory which included the effect of fluid inertia was developed to analyse the experimental data and it was shown that this effect could be large, especially when experiments were carried out on 'thin' fluids in a concentric cylinder geometry.

A distinct area of interest of the group is the determination of the dynamic properties of filled elastomers. The properties of solid elastomers can be dramatically changed by the inclusion of a filler, particularly carbon black, and several characteristics of industrial importance, for example resistance to abrasion, can be enhanced. In the rheology group the dynamic properties of two specimens of filled elastomer (supplied by RAPRA) have been determined using a Weissenberg rheogoniometer. The linear material properties have been thoroughly analysed over a range of temperature and frequency and the limit of applicability of the linear theory determined. A simple model of the linear response of the material has been obtained and attempts at modelling the non-linear response are well underway. It is anticipated that this work will be of significance to the modelling of large scale elastomer deformations, of the type that occur in industrial applications.

The rheology group has recently been awarded a grant by the Civil Engineering board of SERC to study the flow behaviour of cohesive sediments. An important aspect of this work is its application to erosion of muds in both estuarine and coastal environments. This is a collaborative project with Hydraulics Research Ltd, Wallingford, involving theoretical work at Plymouth and experimental work at both institutions. Experiments will be carried out at HRA using a circular flume to determine the critical stress condition under which cohesive sediments will erode. Critical stress experiments will be carried out at Plymouth, on a smaller scale, using a controlled

stress rheometer. The theoretical part of this project will involve the calculation of the bed shear stress under turbulent flow conditions.

In the future the characterisation of materials will remain a major interest of the group, but a wider range of problems is now being considered in which computational fluid dynamics plays an important part. The use and modification of existing computational fluid dynamics codes to analyse the flow of non-Newtonian fluids in complex geometries is an area into which the group is moving.

FLOW PROCESSES IN COMPOSITE MATERIALS

This meeting, organised by the British Society of Rheology in association with the British Composites Society, was held at the Brunel Campus on 17th and 18th May 1988. About sixty five people attended with most of the delegates coming from university groups, including a significant contingent from Europe, Scandinavia and the United States. It was a disappointment to find that there were very few delegates from the user side of the industry, but those who did attend indicated that both the formal presentations and the informal discussion periods addressed many areas of real industrial need. It was a pleasure to find that some of the university delegates were not currently working in this field but, recognising the potential rapid evolution in composites processing technology, attended the meeting in order to prepare themselves to contribute to this area. The technical session was divided into two groups: continuous fibre composites and short fibre moulding materials.

CONTINUOUS FIBRE COMPOSITES

Three papers addressed the issue of the permeability of resin through a fibrous bed. Short (Plymouth Polytechnic), studying vacuum impregnation methods emphasised that flow processes were far from uniform with the resin seeking, and following, the easy flow path with consequent jetting and instability. Morrison (Surrey) addressed the question of bleeding excess resin from prepreg layers using the "Springer" model as a basis. Having made direct measurements of permeability using classical methods, she was disappointed to find that the predictions of the model were in error by more than an order of magnitude but declined to use "adjustable parameters" to accommodate this discrepancy. Killesreiter (Clausthal Zellerfeld), who was unable to present his paper in person, used an analogy drawn from the field of enhanced oil recovery to point out the potential significance of surface tension effects. It is clear that in the study of permeability of composite materials, an issue so critical to the quality of the finished product, we cannot rely simply on D'Arcy's law: what we need to replace this is unclear, but it is clear that considerable effort is being directed to resolve this matter.

Two contributions discussed methods of measuring the rheology of preimpregnated product forms. Groves (ICI) presented oscillatory rheometry data for continuous fibre reinforced thermoplastic melts. By presenting the data as the apparent Maxwell viscosity as a function of maximum shear rate he obtained a normalisation of experiments at different strain amplitude and excellent agreement with steady flow data. Rogers (Nottingham) reviewed the interpretation of such experiments, pointing out that the data actually reflected a compound deformation involving both axial and transverse intraply shear. By using off axis measurements, Rogers demonstrated that it should be possible to resolve between these two. The tools are clearly being sharpened and substantial bodies of data should become available in the near future.

In a pair of papers again dealing with thermoplastic systems Wheeler (Aberystwyth) and Barnes (ICI) addressed the transverse flow process. Wheeler demonstrated how the transverse flow viscosity could be measured from such experiments and that it increased with deformation. Barnes discussed the factors influencing this limiting deformation and traced the microstructural factor controlling this effect to slight twisting of the inextensible fibres. Transverse flow is perhaps the simplest deformation process for composite materials and it may be a useful tool for qualitative evaluation of the "flowability" of different materials.

O'Neill (Nottingham), who studied the interply slip processes of plies of different orientation, concluded that such flows, which are clearly apparent during the formation of moulding with simple curvature, do not induce any reorganisation of the fibre orientation. While one can have sympathy for his disappointment at this negative result, the designers and moulders amongst his audience gave an audible sigh of relief: only by such rigorous theoretical studies can full confidence be established.

In a joint paper Zahlan (ICI) and O'Neill (Nottingham) explained the mechanisms of "spring forward" by which angular shapes distort due to the difference in thermal contraction in the plane and through the thickness of a composite laminate. An analytical solution, finite element analysis and experiment all showed that a right angle section narrowed during cooling from the moulding temperature by about 2° . The use of finite element tools then enabled the prediction of spring forward phenomena in double curvature structures, with satisfactory agreement with experiment. The designer can now accommodate those phenomena.

There were two contributions on fabrication technology. Mallon (Galway) presented his experiences with polymeric diaphragm forming of high performance thermoplastic composites including structures of single curvature, double curvature and a prototype trailer body moulding including reversed curvature at the wheel arches. His paper emphasised the process variables which must be closely controlled in order to make high quality products with this versatile technology. Batch (Minnesota) outlined his work to model the pultrusion process emphasising the interaction between compaction of the fibres and permeation by the resin. Such papers chart significant advances in our understanding and pave the way for improved process design.

SHORT FIBRE COMPOSITES

There were two provocative theoretical contributions. Balasubramanyam (Aberystwyth) charted the shape of a flexible fibre in a flowing melt, emphasising the importance of stretching flows. Many model systems rather arbitrarily presume that reinforcing fibres are rigid: this contribution showed theoretically how they should deform and was warmly supported by comments on experimental results from the floor. Folkes (Brunel) drew together a variety of observations

which suggest that, for high molecular weight polymers, thin layers (10 μm) are very much more mobile than the material in bulk. Many speakers were describing systems in which the resin layers were 2 μm or less but where bulk properties were assumed. Clearly in both these areas we require precisely defined experiments and rigorous understanding if we are to achieve a full appreciation of the technical implications.

Several papers considered the extrusion or injection moulding processes for short and long fibre reinforced thermoplastics. Bevis (Brunel) recorded the latest developments in multi live feed injection moulding where, by the use of two sets of opposed gates, and reciprocating flow through the mould during cooling, he is now able to create a laminate structure in an injection moulding including an effective cross ply and even quasi isotropic organisation. Modelling of fibre orientation during flow was presented by Henry de Frahan (Louvain-la-Neuve). The precise modelling is so far only limited to two dimensional studies but the problems which must be surmounted to obtain a full rigorous three dimensional solution are identified. Potts (Brunel) described work which had been initiated by Westland Helicopters. His main conclusion was that, to study the rheology of fibre reinforced materials opposite injection moulding applications, it is essential to use an injection machine as preplasticiser and to deliver the very high rates appropriate. Studies with conventional rheometry are of limited value because the preplasticisation history is a major source of fibre attrition. Nevertheless conventional capillary extrusion studies indicate that a significant level of fibre attrition occurs in the entrance region of the capillary where the flow is dominated by extension. Fibre attrition was also the subject of a study by Franzen (Gothenburg) using conventional compounding extruders. With conventional systems, attrition rapidly produces short fibre lengths independent of the length of the fibres fed to the machine: typical fibre lengths are 0.25 mm for carbon and 1 mm for metallic fibres. Analysis of length distribution lead to the postulation that fibre breakage is predominantly in the middle of the fibre rather than random and is initiated by compression buckling. Longer fibres are retained in the new generation of 'Verton' materials, where even the most dramatic compounding left a substantial fraction of fibres in excess of 1 mm long. These long fibre moulding materials were the subject of a detailed study by Gibson (Liverpool) who, like Potts, used a screw injection machine for preplasticisation. Gibson emphasised the importance of stretching flow with such materials and presented a method of analysing converging flow for a complete range of die angles, predicting and observing, a minimum in pressure drop for convergence angles of about 20°. For such materials it is not enough to study only the shaping process: the whole flow history must be taken into consideration.

SPECIALITY MATERIAL SYSTEMS

Fibre reinforced plastics are only one member of the class of composite materials. Raines (London School of Pharmacy) described the extrusion of composites of drugs and their carriers. Microcrystalline cellulose is the principal carrier and the

rheology is markedly sensitive to the various grades available. Baker (Royal Ordnance) dealt with composite materials based on nitrocellulose and nitroglycerine. The safety constraints imposed by working with such "energetic" composites had led to the development of impressive remote sensing techniques. There was no difficulty in establishing a common rheological language between these speciality systems and fibre reinforced plastics: the inclusion of these papers in the conference served to remind us that the latter are relatively simple composites.

GENERAL OBSERVATIONS

Following the tradition of meetings of the British Society of Rheology the sessions were accompanied by lively discussion periods extending, in at least one case, past 2 a.m. The hospitality offered by Brunel was of a very high order, adding to the enjoyment of delegates. Such was the satisfaction with the local arrangements that one delegate felt certain that his registration fee could not have covered the full cost of the meeting, and sought out the organiser with cheque book in hand.

Although there are no proceedings for this conference, authors have been invited to submit their papers to the journal Composites, and Butterworth Scientific have agreed to publish as many papers as possible together in a single issue around November 1988.

F.N. COGSWELL

FINAL ANNOUNCEMENT

CONUNDRA RHEOLOGICA

Dr. G. W. Scott Blair Memorial Conference

The Annual Meeting of the **British Society of Rheology** is to be held at the

Royal Holloway and New Bedford College
Egham Hill, Egham, Surrey

7-9th September 1988

A provisional programme for this conference on 'The Unsolved Problems in Rheology' is published in this Bulletin. The final version will be published in the next issue in the summer.

Conference Fee

The fee of £120 (£130 for non-members of the BSR) includes three nights accommodation in single study bedrooms with private facilities in Reid Hall on the campus and all meals from dinner on the evening of Tuesday, 6th September to lunch on the afternoon of Friday, 9th September, in addition to registration for the conference. The meeting will be held in the Earth Sciences lecture theatre in the Queens Building adjacent to the students' accommodation in Reid Hall. For participants who arrive on the morning of Wednesday, 7th September and who do not need the first night's accommodation, the fee will be reduced by £25.

The meeting will include a Scott Blair Memorial Lecture and the presentation of the first Scott Blair Scholarship (if awarded). A Gold Medal Address by Prof. J.R.A. Pearson will also be included. The Annual General Meeting of the Society followed by a sherry reception and a Conference dinner will be held on the evening of Wednesday, 7th September.

Any enquiries or offers of additional short papers should be addressed to the organiser as soon as possible. If you are intending to participate, whether presenting a paper or not please complete the attached registration form and send it with the appropriate fee to: -

Mr. P.C. Anderson,
Petroleum Engineering Branch (B180/106),
BP Research Centre,
Chertsey Road,
Sunbury-on-Thames,
Middlesex,
TW16 7LN
England

CONUNDR RHEOLOGICA

Dr. G.W. Scott Blair Memorial Conference

Royal Holloway and Bedford New College, Egham,
September 7-9th, 1988

PROGRAMME

Tuesday, 6th September 1988

- From 4.00 p.m. *Registration*
- 5.00 p.m. *Council Meeting*
- 7.30 p.m. *Dinner*

Wednesday, 7th September 1988

- From 8.30 a.m. *Registration. Entrance lobby, Earth Sciences Block*

This lobby will also be used for serving coffees and teas during the conference and for displays of rheometer manufacturer's equipment or literature.

- 9.10 a.m. *Conference opens.*
- 9.15 a.m. *Will We Ever Know the Truth About Polymer Melts?*
Mr. S.T.E. Aldhouse, B.P. Chemicals, R&DD., Grangemouth
- 9.45 a.m. *Prediction of Dilute Polymer Solutions: Using a Two Phase Media Approach*
Mr. W.F. Schierholz, Lehrstuhl für Strömungsmechanik, Universität Erlangen-Nürnberg, West Germany
- 10.15 a.m. *Coffee*
- 10.45 a.m. *The Rheology of Concentrated Suspensions*
Dr. T. Tadros, ICI Plant Protection Div., Jealott's Hill
- 11.15 a.m. *The Non-linear Behaviour of Structured Polysaccharide Systems*
Dr. G. Brownsey, Food Research Institute, Norwich

- 11.45 a.m. *The Scott Blair Memorial Lecture*
Dr. J.H. Prentice & Prof. P. Sherman
Dept. of Food and Nutritional Sciences, King's College London
- 12.30 p.m. *Lunch* (Mrs. Scott Blair as Guest)
Presentation of Scott Blair Scholarship
- 14.00 p.m. *The Application of Surface Rheological Techniques to Biological Problems: A General Review*
Dr. B. Warburton,
The School of Pharmacy, University of London
- 14.30 p.m. *Does Extensional Viscosity Exist?*
Mr. F.N. Cogswell
ICI New Science Group, Middlesbrough, Cleveland
- 15.00 p.m. *Some Unsolved Problems in Liquid Crystal Theory*
Prof. F.M. Leslie
Dept. of Maths, University of Strathclyde, Glasgow
- 15.30 p.m. *Tea*
- 16.00 p.m. *Deformation of Droplet Suspended in a Stretching Flow*
Mr. I.P.T. Moore
Dept. of Chem.Eng., University of Birmingham
- 16.30 p.m. *The Art of Coarse Rheology*
Dr. D. C-H. Cheng
Warren Spring Laboratory, Stevenage, Hertfordshire
- 17.15 pm. *AGM*
- 19.30 p.m. *Reception*
- 20.00 p.m. *Conference Dinner*
Presentation of BSR Annual Medal Award

Thursday, 8th September 1988

- 9.00 a.m. *Viscoelastic Properties of Clay Suspensions*
Dr. G. Maitland
Schlumberger Cambridge Research Ltd., Cambridge
- 9.30 a.m. *What is the Rheology of Foam in Porous Media?*
A Micromodel Study
Mr. P. Armitage and Dr. R. Dawe
Dept. of Mineral Resources Engineering, Imperial College,
London
- 10.30 a.m. *Coffee*

- 11.00 a.m. *An Experimental Study of Drilled Cuttings Transport in Deviated Wellbores*
Dr. P.A. Bern
BP Research Centre, Sunbury-on-Thames, Middlesex
- 11.30 a.m. *Rheological Properties of Surfactant Solutions*
Prof. Dr. P.O. Brunn, A. Wunderlich & J. Holweg
Lehrstuhl für Strömungsmechanik, Universität
Erlangen-Nürnberg, West Germany
- 12.00 noon *The Difficulties of Getting a Rheological Test Accepted as a British Standard*
Dr. G.H. Tattersall
Dept. of Civil & Structural Eng., University of Sheffield
- 12.30 p.m. *Lunch*
- 14.00 p.m. *Is there a Universal Rheological Law?*
Dr. H. Barnes,
Unilever Research Ltd., Port Sunlight Laboratory
- 14.30 p.m. *What is the "Viscosity" of a Suspension?*
Dr. L.V. Woodcock
Schools of Chemical Engineering, University of Bradford
- 15.00 p.m. *Highly Filled Systems. A Rheological Problem.*
Dr. F. Baker & Dr. R. Mortimer,
Royal Ordnance Explosives Ltd.,
- 15.30 p.m. *Tea*
- 16.00 p.m. *Viscoelastic Properties of Concentrated Ludox-sols*
Dr. E.P. Honig
Philips Research Laboratories, Eindhoven, The Netherlands
- 16.30 p.m. *Sedimentation of Colloidal Suspensions*
Dr. R. Buscall
ICI Corporate Colloid Science Group, Runcorn, Cheshire
- 17.15 p.m. *The Gold Medal Address,*
Prof J.R.A. Pearson
Rheology and Transport Phenomena
Schlumberger Cambridge Research Ltd., Cambridge
- 18.00 p.m. *Close*
- 20.00 p.m. *Dinner*

Friday, 9th September 1988

- 9.00 a.m. *Approximate Methods and Simulations for Models with Hydrodynamic Interactions*
Dr. H.C. Ottinger
Albert-Ludwigs-Universität Freiburg, West Germany
- 9.30 a.m. *Pure Liquids (Molecular-, Molten Metals and Molten Salts) Rheologically Described as Concentrated Cluster-Dispersions in a Low-density, Low-viscosity, Low-surface Tension Medium*
Mr. J. Kunnen
Mgr. Westerwoudlaan 13, Noordwijkerhout, The Netherlands
- 10.00 a.m. *Rheological Characterization of Suspensions - Comparison of Steady and Dynamic Techniques*
Dr. A. Franck
Rheometrics Europe GmbH, Frankfurt, West Germany
- 10.30 a.m. *Coffee*
- 11.00 a.m. *A Novel Design of On-line Process Control Rheometer*
Dr. J. Ferguson & Xu Zhenmiao, Dept. of Pure and App.Chem,
University of Strathclyde, Glasgow
- 11.30 a.m. *Measurements of Rheological Properties with a Modern Computerized Rotating and Oscillating Viscosimeter*
Mr. B. Zoeller, Brabender OHG, Duisberg, West Germany
- 12.00 noon *Capillary Rheometer Data Analysis: Optimisation by Shear Heating and Non-Newtonian Behaviour Corrections*
Dr. M.D.H. Thomas
RAPRA Technology Ltd., Shawbury, Shrewsbury, Shropshire
- 12.30 p.m. *Lunch*
- 14.00 p.m. *The Influence of Stress on the Rate of Cosmic Nucleation in Dilated Liquids*
Dr. A. Evans, Decompression Sickness Research Laboratory,
R.V.I., Newcastle-upon-Tyne
- 14.30 p.m. *Title?*
Dr. A.M. Keeley, Pilkington PLC and
Dr. G. Rennie, Unilever Port Sunlight Laboratory
- 15.00 p.m. *Tea*
- 15.30 p.m. *Close*

Registration Form

CONUNDRA RHEOLOGICA

Royal Holloway and New Bedford College

7-9th September 1988

NAME: _____ Date: _____

ADDRESS: _____
(For correspondence)

Affiliation (e.g. University or Company)

FEE - Member of the British Society of Rheology (£120.00) _____

Ditto but two nights only (£95.00) _____

Non member - 3 nights (£130.00) _____

Non member - 2 nights (£105.00) _____

An accompanying person may register at the same cost
as the participant _____

To assist in room allocation, please indicate whether male or female _____

Please also indicate whether you have any special dietary requirements.

Please send your completed registration form and your cheque, made payable to the British Society of Rheology, to the address below. Overseas participants, paying in a currency other than Sterling, are requested to add 5% to cover bank charges for exchange.

**Mr. P.C. Anderson,
Petroleum Engineering Branch (B180/106),
BP Research Centre,
Chertsey Road,
Sunbury-on-Thames, Middlesex,
TW16 7LN England**

Prices include VAT, but as a charitable trust, the Society does not have a VAT registered number.

CONFERENCE DIARY

Date	Place	Details
Summer 1988	U.S.A.	Various courses operated by the Polymer Processing Institute. 'Polymer Blends and Alloys' (Princeton, September 26-30) 'Reactive Extrusion' (Williamsburg, October 24-26) - contact Polymer Processing Institute, Castle Point, Hoboken, NJ 07030, U.S.A.
14-20/8/88	Sydney, Australia.	'Xth International Congress on Rheology' contact Professor R.I. Tanner, Dept. of Mechanical Engineering, University of Sydney, Sydney, N.S.W. 2006, Australia.
21-27/8/88	Grenoble, France	'17th International Congress of Theoretical and Applied Mechanics' IUTAM: contact Professor D. Caillerie, Secretary ICTAM 1988, Institut de Mecanique de Grenoble, Domaine Universitaire - B.P.68, 38402 Saint-Martin-d'Heres, CEDEX, France.
7-9/9/88	Egham, Surrey U.K.	'Conundra Rheologica' British Society of Rheology contact - P.C. Anderson, BP Research Centre, Chertsey Road, Sunbury-on-Thames, Middlesex, TW16 7LN, U.K.
29/9/88 - 1/10/88	Drouzhbavarna, Bulgaria.	'Mechanics and Technology of Composite Materials' Bulgarian Academy of Sciences: contact Professor Y. Simeonov, Central Laboratory of Physico-Chemical Mechanics, Acad G. Bontchev Street, IV km, B1.1, Sofia 1113, Bulgaria.
3-5/10/88	Compiègne, France.	'Thermorheology of Complex Fluids' - contact Professor G. Antonini, Université de Technologie de Compiègne, BP 649, 60206 Compiègne Cédex, France.
19-21/10/88	Talence, France	'23 ème Colloque Annuel du Groupe Francais de Rheolgoie' - contact Conference Secrétariat, Laboratoire de Mécanique Physique CERMUB, 351 cours de la Libération, 33405 Talence Cedex, France.

Date	Place	Details
31/1/89 - 2/2/89	Chicago, Illinois	'ViscTech' - contact A.S. Goldberg, Cahners Plaza, 1350 E. Touhy Ave., P.O. Box 5060, Des Plaines, IL. 60017-5060, U.S.A.
26-30/6/89	Fort Collins, Colorado, U.S.A.	'Numerical Methods in Industrial Forming Processes' - contact Professor E.G. Thompson, Colorado State University, Fort Collins, Colorado, U.S.A.
10-12/7/89	Vienna, Austria	'Structural Failure, Product Liability and Technical Insurance', - contact Dr. H.P. Rossmanith, Institute of Mechanics, Technical University Vienna, Wiedner Hauptstrasse 8-10/325, A-1040 Vienna, Austria.
12-15/9/89	Warwick U.K.	'Rheology of Food, Pharmaceutical and Biological Materials' - contact Roy Carter, Royal Ordnance plc., Research and Development Centre, Sewardstone Road, Waltham Abbey, Essex, EN9 1AY
3-7/9/90	Edinburgh,	'The Third Conference of European Rheologists and Golder Jubilee Meeting of the British Society of Rheology' - contact Dr. C.J.S. Petrie, Dept. of Engineering Mathematics, University of Newcastle-upon-Tyne, Newcastle-upon-Tyne, NE1 7RU

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University of Warwick

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Titles and abstracts should be sent to:

**Roy Carter
Honorary Secretary,
The British Society of Rheology,
Royal Ordnance plc.,
Research and Development Centre,
Sewardstone Road,
Waltham Abbey,
Essex EN9 1AY**

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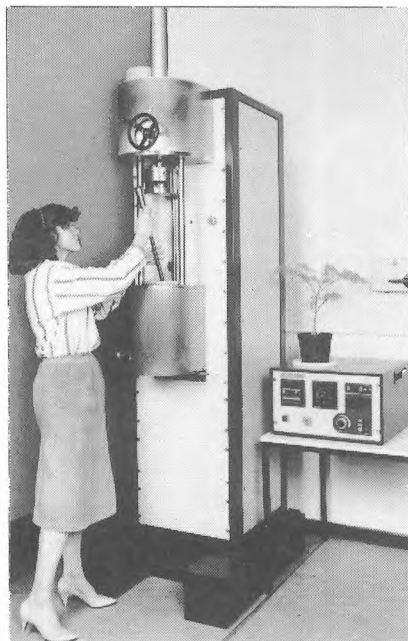
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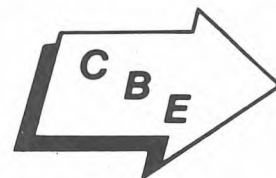
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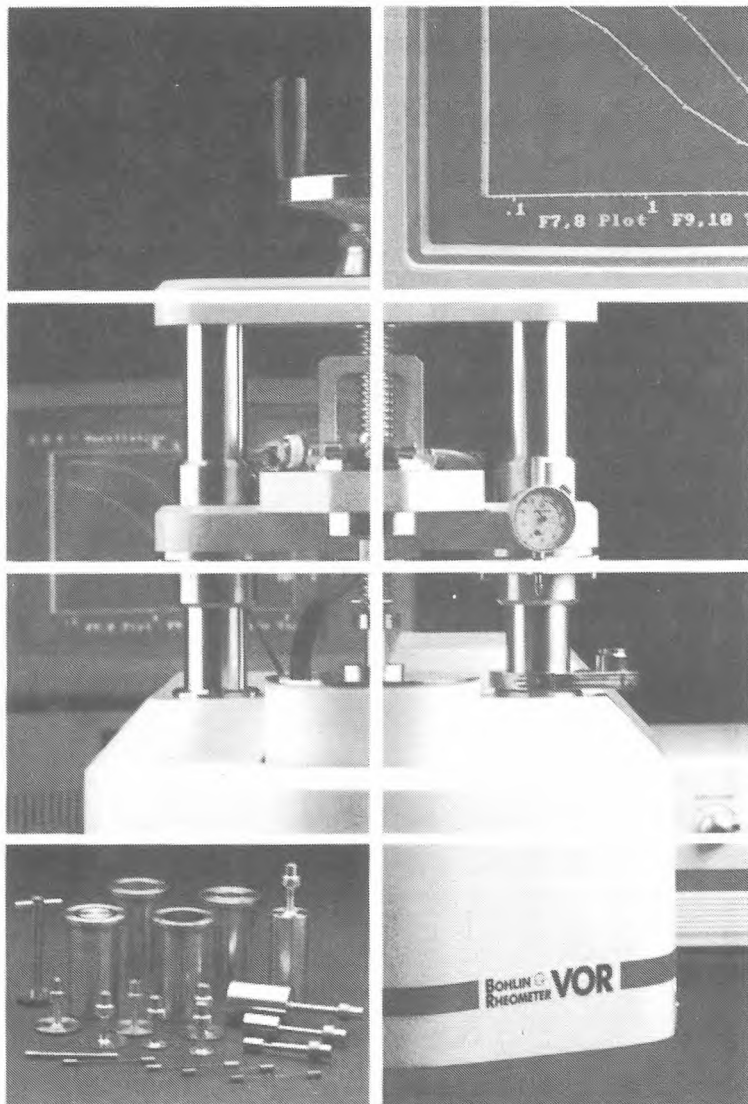
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