

THE BRITISH SOCIETY OF RHEOLOGY

BULLETIN



1986, Vol. 29 No. 3

Contents

Officers and Members of Council	i
Editorial	iii
Minutes of the 46th AGM	24
Secretary's Report	27
Membership News	29
Gold Medal Presentation	33
1986 Annual Award	36
The Prague Conference	39
The Food Rheology Conference	42
Meetings	45

Hon. Editor
Dr. P. Townsend,
Department of Mathematics
and Computer Science,
University College,
SWANSEA, SA2 8PP.



ISSN-0045-3145

THE BRITISH SOCIETY OF RHEOLOGY
OFFICERS AND MEMBERS OF COUNCIL
1986/87

- President:** Mr F.N. Cogswell, Imperial Chemical Industries PLC,
New Science Group, PO Box 90, Wilton Centre,
Middlesbrough, Cleveland TS6 8JE
Tel: 0642-432663 Telex: 587461
- Secretary:** Mr R.E. Carter, Royal Ordnance Explosives Ltd.,
Research and Development Centre, Sewardstone Road,
Waltham Abbey, Essex EN9 1AY
Tel: 0992-713030 Ext.592 Telex: 267455
- Treasurer:** Dr A Evans, The Compression Chamber,
Royal Victoria Infirmary, Newcastle-upon-Tyne NE1 4LP
Tel: 0912-328511 Ext.3250
- Membership Secretary:** Mr P.C. Anderson, BP Research Centre, Chertsey Road,
Sunbury-on-Thames, Middlesex TW16 7LN
Tel: 09327-63351 Telex: 296041
- Abstracts Editor:** Mr S.T.E. Aldhouse, BP Chemicals Ltd.,
Research and Development Department, PO Box 21,
Bo'ness Road, Grangemouth, Stirlingshire FK3 9XH
Tel: 0324-483411 Telex: 333513
- Bulletin Editor:** Dr P. Townsend, Department of Maths and Computer Science,
University College, Singleton Park,
Swansea SA2 8PP
Tel: 0792-295398 Telex: 48358
- Ordinary Members:** Dr F. S. Baker, Royal Ordnance Explosives Ltd.,
Research and Development Centre, Sewardstone Road,
Waltham Abbey, Essex EN9 1AY
Tel: 0992-713030 Ext.470 Telex: 267455
- Dr J.J. Benbow, Department of Chemical Engineering,
University of Birmingham, PO Box 363,
Birmingham B15 2TT
Tel: 021-472-1301 Ext.2789 Telex: 338938
- Dr M.J. Folkes, Department of Materials Technology,
Brunel University, Uxbridge, Middlesex UB8 3PH
Tel: 0895-74000 Telex: 26173
- Mrs C.A. Moules, Rheo-Tech International Ltd.,
120-122 Woodgrange Road,
Forest Gate, London E7 0EW
Tel: 01-519-5578 Telex: 897521
- Dr D.R. Oliver, Department of Chemical Engineering,
University of Birmingham, PO Box 363,
Birmingham B15 2TT
Tel: 021-472-1301 Telex: 338938
- Mr T.A. Strivens, Physics Section,
Research and Development Department,
ICI (Paints Division) Ltd., Wexham Road,
Slough, Berkshire, SL2 5DS
Tel: 0753-31151 Telex: 847683



1986/87 Council

New Officers and Council Members present at the AGM

Back row (Left to Right):

**Dr D.R. Oliver, Dr J.J. Benbow, Mr S.T.E. Aldhouse
Dr F.S. Baker, Mrs C.A. Moules**

Front row:

**Dr A. Evans (Honorary Treasurer)
Mr F.N. Cogswell (President)
Mr R.E. Carter (Honorary Secretary)**

EDITORIAL

When asked to stand for election as Honorary Editor of the Society's Bulletin, I thought about the minimal contribution I had made to the running of the society and decided that perhaps it was time I did a little more. Now as I try to put together this first issue which bears my name on the front cover, I begin to wonder if I made the right decision.

However it's a good quarter with plenty of material. There are articles and photographs to record the presentation of the society's Gold Medal to Anthony Pearson, and the 1986 Annual award to Bryan Toms. Your officers and members of council are also featured in a photograph. I missed it (thank goodness!).

We have reports from the conferences at Norwich and in Prague as well as announcements of some future meetings.

One reminder - participants for the European School of Rheology should by now have registered. Anybody who still wishes to attend should contact Professor Wolfe immediately.

Finally, I cannot end this editorial without a sincere acknowledgment of the fine work of Howard Barnes, my predecessor, who has edited the Bulletin for the past four years. Don't go to far from your telephone, Howard, I may need your help.

A handwritten signature in dark ink, reading "Peter Townsend". The signature is written in a cursive style with a long horizontal line extending from the top of the "P" across the "e" and "t".

Peter Townsend

The British Society of Rheology

Minutes of the 46th Annual General Meeting

The meeting was held in Devonshire Hall at the University of Leeds on Wednesday 10th September, 1986.

The President, Professor I. M. Ward was Chairman. Twenty-four members were present. The meeting began at 5.25 p.m.

1. Minutes of the 45th Annual General Meeting

The minutes of the 45th meeting had been published in the Bulletin (Vol. 28, No 4). They were approved without alteration and were duly signed by the Chairman.

2. Matters arising from the Minutes

There were no matters arising from the minutes.

3. Chairman's Remarks

The President announced that the past year had been very successful for the Society. Several conferences had been organised, and the Society had ample funds. Future conferences were being planned.

4. Treasurer's Report

A draft report was circulated to members at the A. G. M. The treasurer, Dr. Evans, regretted that he was unable to provide the A. G. M. with an audited set of accounts. The accounts had been prepared, but had not been signed as the auditing accountant was on holiday. The audited accounts are printed in this Bulletin.

During the past year, the Redbridge bond had been disposed of, and the Society's Trustee Savings Bank account closed. The proceeds had been transferred to the Society's special deposit account at Lloyd's Bank, which was paying 11.5% pa interest gross of tax. Since the Society is a registered charity, it is exempt from income tax. Income for the year exceeded expenditure by approximately £2000, and similar performance was anticipated for the forthcoming year. Therefore, no change in the membership fee was proposed.

Dr Oliver remarked that the Society does perform some charitable functions. Some students are being sponsored to attend a Rheology School in France in January 1987. Five candidates were being considered currently. Dr Oliver said that any further nominations should be forwarded to him.

Mr Aldhouse proposed and Mr Schimanski seconded his proposal that the present auditors should be retained at the same level of remuneration for the year 1986-87.

5. Membership Secretary's Report

The Membership Secretary's report was presented by Dr Benbow in the absence of Mr Anderson. The number of members had increased over the year by 28. Nine Honorary Members had been appointed.

Nine members had been deleted because of non-payment of fees. Some 50 members were still in arrears. The meeting considered this to be a lamentable situation. Much work was caused for the Membership Secretary in sending reminders and chasing this money. A plea was made for all membership fees to be paid by Banker's Order. Professor Pearson suggested that Direct Debit collection rather than Banker's Order be used, but it was pointed out by the treasurer that Direct Debit collection needed more administrative support. Mr Singh suggested that a Banker's Order form should be printed on the Application for Membership form. Dr Evans suggested that a two-tier subscription be adopted, with higher fees applying to those not paying by Banker's Order. Dr Baker suggested that a cautionary notice and a Banker's Order form be printed in each bulletin over the coming year, and that, should no improvement in the situation be apparent, an increase in membership fees for those not paying by Banker's Order would be proposed at the next A. G. M. This latter course of action, together with a revision of the Application form to include a Banker's Order form, was agreed by consensus.

6. Bulletin Editor's Report

Dr Oliver read out the a statement on behalf of Dr Barnes, thanking those who had helped and supported him during his four years of editorship. His proposed successor was Dr Peter Townsend of the Computing Department at Swansea University.

7. Abstracts Editor's Report

Mr Aldhouse reported that there had been a slight fall in the number of abstracts published. Some remedial action had been taken, and the aid of members was sought to increase the number of abstractors and the number of journals and subject areas covered.

Rheology Abstracts was circulated to 550 subscribers as well as to members.

8. Secretary's Report

The Secretary's Report is published in this Bulletin. The President thanked Dr Benbow for his tremendous amount of work as Secretary over the past four years, and said that the success of the Society was due in great part to Dr Benbow's efforts.

9. Election of Officers and Council

In addition to the nominations proposed by the Council, Dr D R Oliver proposed Mrs C A Moules as an ordinary member of Council, and this was seconded by Dr

F S Baker. Mr Schimanski withdrew from the election, due to an increase in his work-load.

The modified proposals were then accepted by the meeting, and thus the full Council was elected as follows:

President:	Mr F N Cogswell
Secretary:	Mr R E Carter
Treasurer:	Dr A Evans
Membership Secretary:	Mr P C Anderson
Abstracts Editor:	Mr S T E Aldhouse
Bulletin Editor:	Dr P Townsend
Ordinary Members:	Dr F S Baker
	Dr J J Benbow
	Dr M J Folkes
	Mrs C A Moules
	Dr D R Oliver
	Mr T A Strivens

10. Any Other Business

Professor Ward thanked Dr Petrie and Mr Schimanski for their service on the Council.

Mr Cogswell thanked Professor Ward on behalf of the Members of the Society for his service for the past two years as President.

There being no other business

The meeting closed at 6.20 p. m.

R E Carter
14.9.1986

Secretary's Report 1985-86

This has been one of those special years during which our Society has awarded a Gold Medal. I will not try to pre-empt the compliments which will be paid to Professor Anthony Pearson this evening but on a personal basis I would like to express the pleasure it gives me to see his many contributions to rheology being recognised in this way. The 1986 Annual Award will also be presented tonight. I am pleased that this year's recipient is Dr. Bryan Toms who as well as being an active rheologist for many years has the very rare distinction of having a rheological effect named after him.

The past year has been a particularly full one for rheological conferences. Reports of these are given in Bulletins. Last autumn the theme of the conference at Reading was "New Techniques in Experimental Rheology", It was organised by Harry Schimanski and Trevor Strivens. This was followed by a one day meeting run by David Heyes on "Molecular Approaches to Rheology". In April a highly successful conference held at the Food Research Institute (Norwich) on "Food Rheology" was organised by Drs Baker and Brownsey. (My Council Minutes expressing our gratitude to the organisers of this meeting contained the Freudian slip that "the organisms deserved a special vote of thanks"!).

For those of us who were fortunate enough to attend it, the highlight of the year was the 2nd Conference of European Rheologists held in Prague on June 16th to 20th.

As Society members we owe the organisers of all these events a large debt of gratitude.

Conference plans for the future look similarly exciting. The current meeting proved extremely popular both in the number wishing to attend and those wishing to contribute.

For next April 9th and 10th we are planning a two day meeting on "Rheology of Dispersions and Particulate Solids" at Bath. In the Autumn of 1987 we intend holding a joint meeting with the Belgian Rheological Society

in S.E. England. It is expected that there will be two days devoted to "Entrance and Exit Effects" and one day to "General Rheology".

Early in 1988 we hope to hold a joint meeting on "Flow Processes in Composite Materials" with the newly formed Society of Composite Materials. On August 14-20th 1988 there is the Xth International Congress on Rheology in Sydney, Australia.

We plan to hold a conference with the stimulating theme of "Unsolved Problems in Rheology" in the Autumn of 1988. Looking further forward we expect to combine the 3rd European Conference of European Rheologists with our 50th Anniversary in 1990. Plans for this occasion are already being discussed by your Council. The wide range of subjects which are covered in our conferences well illustrate the variety of disciplines and materials which rheology encompasses. They emphasise the need and opportunities for good communications between experimentalists and theoreticians as well as the rewards of cross-fertilisation of ideas between workers in different industries.

When I agreed four years ago to become Honorary Secretary I expected to soon retire from active rheology, and have plenty of time to devote to being Secretary. In the event I now find my time fully occupied with rheological research at the University of Birmingham; I would like to express my thanks to the Head of the Chemical Engineering Department, Professor J. Bridgwater, for enabling me to carry out the Secretarial work in this Department. I would also like to express my thanks to the Departmental Secretaries for their enthusiastic assistance.

Finally I am extremely grateful to the two Past Presidents, Mr. John Hutton and Professor Ian Ward as well as the Members of Council for the help and support they have given me during the past four years.

J.J. Benbow
HON. SEC.

MEMBERSHIP NEWS

The following applications for Membership of the British Society of Rheology were approved at the Council Meeting on the 13th June 1986.

Miss Gillian M. ATKIN,
Food Science Department,
Kings College,
Campden Hill Road,
London W8 7AH

B.Sc.

fetsa L

Dr Alan E. BELL,
Department of Food Science,
University of Reading,
Whiteknights,
Reading.

HND, M.Sc., GRSC, MRSC, C.Chem.

fetsa FGLM

Ir R.A. de BRUIJN,
Unilever Research Laboratorium,
Postbus 114,
3130 AC Vlaardingen,
Netherlands.

Ir

fetsa BFGHL

Miss Julie CASTLE,
Procter Department of Food Science,
Leeds University,
Leeds LS2 9JT

B.Sc.(Hons) Food Science

fets FLN

Mr Michael J. CLEAVER,
International Paint,
North Woolwich Road,
Silvertown,
London E16 2AF

B.Sc., M.Sc., C.Chem, MRSC, GPRI

pea FG

Mr Elwyn C. DAVIES,
Department of Applied Mathematics,
University College of Wales,
Penglais, Aberystwyth,
Dyfed, SY23 3BZ

B.Sc. (Hons)

fetsa DFGLMN

Dr Bogdan J. DOBRASZCZYK,
Department of Engineering,
Biomechanics Group,
Whiteknights,
Reading, RG6 2AY

B.Sc., M.Sc., Ph.D.

petsa BEM

Mr David FARRER,
ITT Jabsco Ltd.,
Bingley Road,
Hoddesdon,
Herts.

ONC & HNC Mech Eng.

pea CDEFGJLM

- | | |
|---|---|
| Mr Nicholas J. FECITT,
Lucas Cookson Syalon Ltd.,
Cranmore Boulevard
Shirley,
Solihull,
West Midlands. | B.Sc. (Hons)

pea BFGHI |
| Mr Christopher D. IREDALE,
'Brymor Ltd.',
The Tannery,
Tonbridge Road,
East Peckham,
Kent. | HNC Physical Sciences

fea DG |
| Mr Keith R. LANGLEY,
Food Structure Department,
Institute of Food Research (Reading),
Shinfield,
Reading,
Berkshire. | M.Sc., M.Inst.P., C.Phys.

fesa L |
| Dr Russell MARTIN
Weston Research Laboratories,
644 Bath Road,
Taplow,
Maidenhead,
Berkshire. | HNC, B.Sc., Ph.D.

petsa FGL |
| Miss Margo J. McLEAN,
Devro Ltd.,
Gartferry Road,
Moodiesburn,
Chryston,
Glasgow, G69 OJE | OND, HNC

pesa EFGJL |
| Dr Andrew J. ROSENTHAL,
Department of Food Studies,
Humberside College,
Nuns Corner,
Grimsby, DN32 9LP | B.Tech., M.Sc., Ph.D.

petsa LM |
| Dr Andrew C. SMITH,
AFRC Institute of Food Research,
Colney Lane,
Norwich,
Norfolk, NR4 7UA | B.Sc., AKC, Ph.D.

fesa L |

NEW HONORARY MEMBERS

The following members have been elected to Honorary membership of the Society for long and distinguished service.

Mr E.B. Atkinson, Ipswich, Suffolk. He joined the Society in 1946 and served on the Council from 1952 to 1957.

Mr J.P. Berry, recently retired from RAPRA in Shrewsbury, Shropshire. He joined the Society in 1966 and served on the Research committee from 1968 to 1971.

Dr L. Dintenfass, recently retired from the Department of Medicine at the University of Sydney in Australia. He joined the Society in 1958.

Prof P. Feltham, Brunel University, Uxbridge. He joined the Society in 1948, served on the Council from 1950 to 1955 and was our President in 1972-74.

Dr D.W. Gillings, Department of Chemistry, University College, London. He joined the Society in 1943.

Prof J.R.A. Pearson, Cambridge. He joined the Society in 1960, served on the Council from 1968 to 1972, was our President in 1980-82 and has been awarded the Societies Gold Medal Award in 1986.

Mr J.E. Roberts, recently moved to Eastbourne. He joined the Society in 1955.

Mr G.H. Tattersall, Sheffield. He joined the Society in 1950 and served on the Council from 1957 to 1969.

Mr R.W. Whorlow, Cranleigh, Surrey. He joined the Society in 1948 and served on the Council from 1958 to 1974.

RESIGNATIONS

Dr B. Martin, The University of Aston. Joined in 1967.

MOVEMENTS

Dr J.D. Sherwood, from Dowell Schlumberger, St Etienne, France to Schlumberger Cambridge Research, Cambridge.

ANNUAL SUBSCRIPTION REMINDER

The annual membership subscription of £5.00 for the year 1986/87 falls due for payment on the 1st of October 1986. May I remind all members who have not paid in advance or who do not pay by Banker's standing order to send their payment now to:

The Hon. Membership Secretary
Mr P.C. Anderson,
32 Queensway,
FELTHAM,
Middlesex,
TW13 7NS

It would be very helpful if all those members who do not yet pay by Banker's standing order, could arrange so to do. It would save a great deal of time spent in sending out individual reminders. The order, to pay £5.00 each year on the 1st of October, should be made payable to the **British Society of Rheology Membership Dues account, number 0180985 at Lloyds Bank, 20 North Street, Leatherhead, Surrey. (Branch code number 30-94-94).** In addition please also notify me at the above address that you have so instructed your bank.

Overseas members, who pay their subscriptions in a currency other than Sterling, should add the equivalent of £3.00 to cover our exchange costs. A single payment may be used to pay for a number of years in advance and/or for any number of members to save exchange expenses. May I remind our North American members that a personal cheque in dollars has proved perfectly acceptable to our bank in the past. At present rates, \$7.50 (£5 x 1.5) per year per member plus \$4.50 per cheque is the amount to remit. For our European members, Eurocheques denominated in pounds sterling have proved acceptable. If used, please remember to write your card number on the back of the cheque, otherwise we do have to pay exchange expenses.

Gold Medal of the British Society of RheologyProfessor J. R. A. Pearson

There are always many unique features of a Gold Medallist of this Society and on this occasion there is a particular problem of nomenclature. It is not just a question of the title of Professor for someone employed in the oil industry, but of whether to refer to Professor John Richard Anthony Pearson as John or as Anthony. In fact a glance at the list of his achievements might lead one to suppose that there had been both a John Pearson and an Anthony Pearson at work. This remark is equally true with regard to the volume of work and to the range of interests of this rather young Emeritus Professor. (The title of Emeritus Professor is normally associated with a Professor who has retired on reaching the statutory retirement age).

To begin at the end, then, Anthony Pearson joined Schlumberger Cambridge Research as head of mathematical modelling in 1982, after taking deplorably early retirement from his Chair of Chemical Engineering at Imperial College, London. He might be regarded as this Society's first Gold Medallist actually working in industry, but it has to be admitted that between a time in the plastics industry (with I.C.I. and then the Metal Box Company) and his present involvement in the oil industry lie more than twenty years in the academic environments of Imperial College and Cambridge.

However there is no doubt that Anthony is a distinguished engineer and his career has been punctuated by technological accolades as well as academic distinctions. He is a Foreign Associate of the National Academy of Engineering (of the U.S.A.), a Member of the Institution of Chemical Engineers and a Fellow of the Plastics and Rubber Institute. Among his academic achievements are degrees of master of arts (A.M.) in applied mathematics from Harvard and doctor of science (Sc.D.) in engineering from Cambridge. He already has a silver medal to his credit, awarded by the Plastics Institute (as it then was) in 1964 for a series of papers on non-Newtonian flow and die design. He has, during his academic interlude, kept a firm hold on his engineering roots, both in choices of research topics and in industrial consulting which has involved long-term relationships with at least two major U.K. companies well known in rheological circles and also has taken him to Europe and North America.

Anthony is also a respected member of the applied mathematics community in Britain. He has been Assistant and Associate Editor of one of that community's most prestigious journals, the Journal of Fluid Mechanics. The description of a paper as a "classic" is perhaps dangerously subjective, but two of his early papers surely deserve that title. These dealt with low Reynolds number flow past a sphere and a cylinder (written with his Ph.D. supervisor, Ian Proudman) and with instability of flow under rollers and spreaders. Perhaps more typical of his research output are topics like the stability of fibre spinning and modelling of screw extrusion. Two books which represent major contributions in a campaign to bring rheological ideas into use in the polymer processing industry are the pioneering "Mechanical Principles of Polymer Melt Processing" of 1966 - a deceptively slim monograph - and "Mechanics of Polymer Processing" of 1985 in which Anthony has dropped his principles and filled over 700 pages with a magisterial coverage of his chosen topic.

His contribution to the rheological community includes service as chairman of the Research Committee of this society (which some older members may recollect) and as President. He has been involved in organising a number



Professor Ward presents the Society's Gold Medal to Professor J.R.A.
Pearson at the Conference Dinner following the A.C.M.

of successful conferences, notably in Cambridge. His presence can be counted on to live up a scientific discussion and even his absence has been known to affect presentations at conferences. A single sample from the catalogue of visiting appointments held at top American universities will suffice here - in 1978-79 Anthony was Sherman Fairchild Distinguished Visiting Scholar at California Institute of Technology.

He has also contributed through the inspiration and education of a number of rheologists who are scattered worldwide and through exposing many engineers to ideas of rheology and how it may properly be applied. Anthony is a person who does not tolerate misleading oversimplifications of complex problems and has little patience with those who demand simple answers where none exist. At the same time his physical insight does allow him to cut through some tedious thickets of formal mathematics, and his patience with applied mathematicians who are preoccupied with formality, rigour and abstraction is no greater.

At the risk of exhausting his patience, or that of the reader of this note, tribute should be paid to less forbidding aspects of our impatient gold medallist. He is no mean sportsman and has a strong commitment to the ancient craft of Real Tennis. His interest in wines is also well known and yet again we see a hobby, perhaps a passion, where patience is crucial. Judgements concerning patience or impatience can, of course, only be resolved by reference to relevant relative time-scales; it is left as an exercise to the reader to define an appropriate Deborah number. Here mention of the prophetic will serve as a rather contrived link with the feminine influence in Anthony's life. Many rheologists will have had the pleasure of meeting his wife, Emma, who has managed both to travel with Anthony on many of his wanderings and to provide the base in Cambridge which is so important to him. A student of instabilities, mathematical and rheological, clearly needs somewhere stable in which to put down roots. This turns out to be true in a more literal sense than was intended: families who plant trees for daughters and sons are rare nowadays, but the Pearson domain contains trees for two generations and betrays an attitude to gardening which is as full of patience and far-sightedness as the best of Anthony's gold-medal-winning rheology.

Perhaps a fitting conclusion to this attempt to convey something of the "flavour" of this complex person is a pair of excerpts from "Complex fluids in engineering", Professor Pearson's 1975 inaugural lecture at Imperial College. On engineering: "... progress in engineering depends on a synthesis of mathematical and scientific ideas culled from many apparently different disciplines ... It may be amusing or even comforting for undergraduates to believe that there is a separate and special body of knowledge known as chemical, electrical, mechanical, or whatever, engineering; ... but it will be disastrous for us ... if we come to believe it deeply". and, on himself and his fellow rheologists: "a mixed lot, some brutish, some genteel, they struggle with inadequate tools to cope with the less attractive aspects of the community's needs and duties, but yet may prove to be the source of some of its inspiration and progress".

This, then, is Anthony Pearson, whom the 1986 Council of this Society has judged to be a worthy recipient of the highest honour which it bestows.

Dr. B.A. TOMS

(Bryan Atkinson Toms, BSc., MSc., DSc.)

Bryan Toms was born and educated in Ulster; he graduated BSc with honours in Chemistry at the Queen's University of Belfast in 1936 and was subsequently awarded the higher degrees of MSc (1937) and DSc (1941) for research on oil-in-water emulsions. His first professional appointment (in 1937) was an Assistant (or junior lecturer) in the university chemistry department; but early in 1941 he obtained leave-of-absence to work for the Ministry of Supply at what was then the Chemical Defence Experimental Station, Porton Down, Wiltshire.

After completing his war service, Bryan resigned the Belfast post in order to join the newly-established Courtaulds Fundamental Research Laboratory at Maidenhead, Berkshire, late in 1945. When it was unexpectedly closed down in 1962 he transferred to one of Courtaulds industrial research laboratories at Coventry, Warwickshire, and worked there until 1970.

Bryan then started a new career in 1971 by accepting a welcome offer of academic re-employment as a Research Fellow in the University of Birmingham where he participated in various externally-sponsored projects in the departments of chemistry and chemical engineering. He eventually retired at the end of 1982 and continued to live at Leamington Spa.

Much of his research, both personal and collaborative, has been concerned with colloidal/quasi-colloidal systems such as emulsions, aerosols (smokes, mists), polymer solutions and clay suspensions; but he has also dealt with many diverse topics including pesticidal sprays and surface deposits, metal thio-carbonates, cellulosic fibres, bipyridyl herbicides, oil well drilling muds and stream sediment analysis. Not all of this extensive work could be reported openly but since 1940 he has made, or shared in producing, a variety of primarily factual contributions to both the scientific and patent literatures.

Bryan's principal and best-known contributions to rheology were made soon after World War II either alone or in collaboration with J.G. Oldroyd and/or D.J. Strawbridge. The topics investigated were the behaviour of non-Newtonian elasticoviscous liquids (a) in rapid flow through narrow tubes and (b) when confined between relatively rotating or oscillating coaxial cylinders. He has described (1974) how this remarkable period began with an

empirical study of turbulence in dilute solutions of poly(methyl methacrylate) which he had undertaken with the aim of accounting more precisely for the (undesirable) degradation of linear macromolecules in 'turbulent' mixing processes. However, as the work progressed it became obvious (in mid-1946) that an inexplicable reduction of turbulent friction by the dissolved polymer had been detected, apparently for the first time. When Oldroyd (then at Cambridge) was consulted about possible implications of the new phenomenon he suggested that the experimental observations might be explained satisfactorily as wall effect involving effective slippage of the turbulent mainstream and he later devised a procedure for identifying and quantifying such an effect. In due course the experimental results and their (tentative) interpretation were presented at the first international congress on rheology in 1948 and have since been widely accepted as the first scientific description of what is usually referred to nowadays as 'turbulent drag reduction' or, quite frequently, the Toms Effect.

Turbulent drag reduction later began to receive widespread attention and many hundreds of papers were published in the 1960s and 70s although the output has diminished in the present decade. The mechanism of the phenomenon is still not fully understood, but a number of potentially beneficial practical applications have been reported these include successful attempts to increase (a) the throughput of fire-hoses, oil pipelines and stormwater sewers and (b) the acceleration of hydrofoils and other high-speed boats. Ironically, the main obstacle to wider exploitation of turbulent drag reduction, especially in pumped circulatory systems, has proved to be the irreversible macromolecular degradation which originally led to its discovery 40 years ago.

Following that satisfactory experience of co-operation, Oldroyd and Toms undertook another joint enterprise which promised mutual advantage yet afforded ample scope for independent individual contributions. They were joined in this new research by D.J. Strawbridge, a practical chemistry with unusual mechanical aptitude. At the onset it was intended (a) to improve and rationalize the rheological characterization of some real elastico-viscous liquids by observing their behaviour under precisely defined conditions of stress and (b) to correlate some key rheological parameters with the (molecular) compositions of the experimental liquids. In the event those objectives were largely achieved between 1949 and 1953 and a series of

influential papers appeared through the 1950s.

Bryan's later work at Birmingham University involved his original discovery. He was able to show that the drag-reducing properties of certain polymers could be modified by changing the side branches of the polymer molecule, whilst leaving the backbone unaltered. It was also shown that polymers exist which reduce turbulent drag in aqueous solution and which are little affected in performance when sodium chloride is present; this could be significant in offshore drilling operations.

For the last few years, Bryan has been a most able Indexer of Rheology Abstracts, a contribution to the work of the Society which we value highly. His forty-five years of active "bench research" and development work suited his temperament well and enabled him to indulge an insatiable curiosity about the natural world.

D.R. Oliver



Professor Ward presents the 1986 Annual Award of the Society to Dr B.A. Toms at the Conference Dinner in Leeds.

Second Conference of European Rheologists, Prague, June 1986

In order to give Bulletin readers a balanced picture of the many and varied activities at and around the conference, four British delegates were coopted to produce this composite report. Ralph Oliver's impressions are followed by mildly edited extracts from Peter Anderson's account. Peter does not employ the royal "we"; his wife came with him and sampled the "programme for accompanying persons". The final remarks were put together, with the help of John Benbow's notes, by Chris Petrie who should be blamed for any infelicities in the final text. The subtitles are, of course, totally misleading.

A university view

Spring had become High Summer by the time we arrived in Prague. With temperatures in the eighties, colourful clothes were everywhere and first impressions were better than expected. With tall castles and churches, curving river and cloistered bridges, Prague is a fine city which combines ancient and modern in an excellent underground railway system. This "Metro" runs every two minutes at peak time, with vivid acceleration and braking, providing the 400 delegates with free transport to all parts of the city.

Those of us who stayed in the Panorama Hotel were fortunate in its comfort, heated swimming facilities and ease of access to the Palace of Culture, where the Scientific Programme was held. If the early (8.30 a.m.) start was a problem for some, then at least the Plenary lectures were grouped into two periods on either side of the lunch break, with most of the afternoon speakers capable of keeping the audience awake after the solid sustenance provided in the interval. I must admit that the dumplings I liked best were the ones containing plums which probably simulated the sweet course! This interior padding was fortunately not matched by verbal padding in the Plenaries (the usual problem in these lectures) but a reduction in length from 45 to (say) 35 minutes would certainly have done no harm.

The most stimulating pair of afternoon lectures were given by Professors Metzner and Astarita, the former in introducing the novel concept of high normal stress with almost no elasticity. It seems as though some liquid crystalline polymers are laced with steel chains when they are stretched! Professor Astarita's work dealt with the transport of heat from a gradually-crystallising polymer melt, with the freezing of water as a classical limiting condition,

Professor Walters again belied his mathematical background with a presentation which described the practical problems involved in two different forms of extensional flow equipment. This stimulating talk produced one of the liveliest discussions of the conference.

Dr. Petrie introduced his topic on draw resonance in melt spinning by showing a "dogs dinner" of a slide - a tangled statement of the many problems which beset the research worker in this field. He then proceeded to give possible solutions to the problems whilst including some beautiful slides of castles on the north-east coast of England and in the forests of Bohemia!

An industrial view

It was with just a little trepidation that we set out from Heathrow for Prague on Monday the 16th June. It was our first visit to a Socialist bloc country and there had been so little information back from the organisers that we could not be totally certain that we were expected. We need not have worried.

cont'd. ...

Prague was just like any other middle European city and the organisers were pretty well on top of the situation. There was just a little chaos at the registration with some six desks and no real indication of how many of them needed to be visited to pick up all the required paperwork. Once this hurdle was over and the lecture rooms had been located it was pretty well all plain sailing.

After a quick look at downtown Prague on Monday afternoon, it was down to the serious work from Tuesday morning. With six parallel sessions, there was little chance that there would be any time when there wasn't something of interest being presented. Often of course the problem was of trying to choose between two or three sessions which looked of equal interest. As is inevitable with a conference of this size, there was the problem of missing papers. This was perhaps the one of the few points that could have been improved. Notice boards were placed outside each lecture theatre and had posted on them the appropriate abstracts page from the conference program. They even had a pointer on them indicating the current paper being presented. That was the good news; the bad news was that these six individual notice boards were the only place where one could find out what papers were actually still to be presented in that session.

The sessions themselves were very well organised with three local people on hand in each room to assist the chair and operate the lights, sound and projectors. The time keeping was generally good, allowing some interchange between sessions, although not all the rooms were immediately adjacent. The technical content and standard of presentation was, as ever, pretty variable. I did very much like the idea of each morning and afternoon being divided into a period of parallel sessions of short (15 min.) papers and a period with a single session with two invited plenary papers. Not having to make a choice between simultaneous plenary papers was a pleasant change at a big conference. The standard of these papers was generally very high and among the highlights of the conference. For those moments between papers of interest there was also the opportunity to renew acquaintance either with the viscometer manufacturer's representatives and discuss and see their latest offerings or have a cup of coffee or glass of beer in the coffee bar with other colleagues. Lunches too provided some interesting experiences, particularly to the food rheologists with all the variations on dumplings that the Czechs seem so keen on.

A further excellent idea that I had not encountered before was the provision of a reading room where copies of a number of the conference papers were available for reading on the spot. The only pity was that not more presenters were able to be persuaded to submit copies of their papers for this purpose. I found it very useful either to read some of those papers I had had to miss through being in another session, or to fill in the detail I had missed in the lecture due to the understandable difficulty some of the speakers had with their English.

In addition to the excellent program of lectures there was also a program of daytime tours of accompanying persons and a number of social events in the evening for all participants. These latter included a very interesting visit to the National Theatre to see Smetana's Bartered Bride and a couple of informal banquets. The tours visited many fascinating sites in the city and beyond, although on one occasion the prior arrival of a large party of local school children meant that the foreign tourists did not get to visit Konopiste Castle despite an hour's drive into the country. Being the international event that it was also meant that the English were often outnumbered on these tours and had to try and understand the guide's commentary in German. The hotels were generally excellent, although we had

to pity those of our party who found themselves in a five-star hotel whose hot water system was out of action for three weeks. The late nights in the hotel's bar consuming quantities of vodka, slivovic and Becherova with one's colleagues was also one of the memorable highlights of the week. An early morning swim at 6 a.m. was enough to set one up for another long day at the Palace of Culture.

Views of two secretaries

After an opening session, which happily only involved two brief speeches although these were a platform party of nine (including a Vice-President of Czechoslovak Academy of Sciences and Secretaries the Central and District Committees of the Communist Party of Czechoslovakia) it was a relief to discover that the itinerant photographer was from the Institute of Hydrodynamics and not the secret police. Photographs from various sessions were displayed each day for participants and clearly proved popular. Among other impressions carried away from the meeting are of the very noisy plastic carrier bags (in which our conference literature was put) and of an enormous notice at the exit from the Metro advertising "EURO-RHEO-86" which was replaced at the end of the conference by the following week's attraction at the Palace of Culture, "ROCK 86".

Both social and scientific events were interesting and enjoyable, organisation was efficient and coped well with the usual problems like failed projector bulbs. There is something to be said for supplying participants with a programme of events and timetable of papers before the conference - but of course the sooner this is prepared the more inaccurate it is likely to be, because of papers that are withdrawn or just don't turn up. As at Acapulco (and many other large meetings) the gaps in the timetable tend to give the proceedings, especially towards the end of the conference, a slightly chaotic feel. This conference was no worse than most in that respect.

Criticisms of presentations does seem appropriate if it can help to persuade speakers at future conferences to be considerate of their audiences. The fact that a pair of opera glasses was in use during some sessions is perhaps all that need be said. However guidelines for visual aids are not easy to give when one slide with only 5 lines of text proved illegible from the middle of a medium sized lecture room while others with as many as 20 lines of text were legible (though perhaps not from the back of the room). Discussions of papers were frequently lively but would newcomers to the rheological conference circuit have preferred it if questioners had identified themselves? The participation of many rheologists from Eastern Europe was particularly welcome, both so that we could meet some whose names had been well known to us for over twenty years and so that we could hear younger rheologists. Many of the latter obviously were from the host country, and some presented interesting work very competently. It is to be hoped that we shall see them again at future European meetings.

Conclusion

Each of us came away from Prague wondering if we can do as well in 1990. If we (the British Society of Rheology) can organise and run the next major European conference as well, we shall have done something to be proud of. Our thanks and congratulations to our hosts in Prague are sincere - we enjoyed an excellent conference.

Conference Report
FOOD RHEOLOGY

University of East Anglia, Norwich. 15 - 18th April, 1986

This meeting was jointly organised by Dr Geoff Brownsey of the Institute for Food Research, Norwich, and Dr Frank Baker for the British Society of Rheology. Originally scheduled to be a three day event, the conference had to be cut back to two days due to a lack of timely response to the call for papers. Because the Sainsbury Centre on the campus had to be booked for the Conference Dinner at an early date, the removal of the third day from the schedule led to the somewhat unusual feature of the Conference Dinner being held after the presentations had finished. This was unfortunate in that many delegates, myself included, could not justify a third night away in order to attend the meal. Such a complication was doubly unfortunate in that several eleventh-hour submissions were received which would have justified an extra morning of presentations, but instead made for a somewhat intensive timetable.

The range of topics, disciplines and materials covered by the conference was impressive, as was the overall standard of the presentations. Mr C J Parkinson of the Express Foods Group provided a fascinating introduction by describing some rheological problems in dairy processing. No instrumental means had yet been found to replace the traditional dipping of the craftsman's arm into the vat of whey in cheese making in order to determine the "cut point". Rheological problems in determining the texture and flow properties of cheeses were also discussed, along with pumping and mixing problems associated with milk processing. Concluding by expressing the wish that he could spend the rest of his life studying the rheology of yogurt, Mr Parkinson had set the scene for a conference concerned with the complex vagaries of natural materials.

Dr Stainsby of the University of Leeds presented some work of his team on rheology of protein-stabilised emulsions, using model systems based largely on casein and gelatin, in order to establish a relationship in concentrated protein-stabilized emulsions between the bulk rheology and surface visco-elasticity of the protein at the oil-water interface. Dr Green of the Institute of Food Research at Reading discussed the work of her team to study by instrumental means the mechanical properties of cheese and similar materials. The problems were highlighted again of choosing or developing testing methods which realistically reflect the textural qualities sought by the consumer. Much progress had been made by comparing scanning electron micrographs of laboratory-fractured surfaces with those of samples which had been bitten. Ms Atkin of the Kings College, University of London continued the theme of instrumental testing by describing her research with Professor Sherman on the influence friction can have in laboratory firmness evaluation.

Sadly, Professor Crochet was not able due to illness to travel from Belgium to give his paper on mathematical modelling of flow as applied to food processing. I had the privilege to attend a demonstration of Prof Crochet's "Polyflow" suite of computer programmes some weeks after this conference, and was greatly impressed by the range, ease of use and graphic presentation of results of this software. Dr Bohlin of Bohlin Reologi, Sweden, kindly filled the gap by explaining the principles of some of his instruments.

Another overseas presenter was Dr van Lengerich of Werner and Pfleiderer, USA, who described his work to analyse using a capillary viscometer plastified wheat

starch which had been processed on a co-rotating twin-screw compounder-extruder. The effects of key processing conditions was reported, and it was found that the shear stress was proportional to the specific mechanical energy input. Mr Towers of Cadbury Schweppes had analysed for some confectionery materials the slippage observed in uniaxial compression testing. In-house modifications to an Instron compression tester had allowed a computer to monitor the crosshead velocity during testing in order to control both shear and strain rates.

Dr Boyar of the Leatherhead Food Research Association had tackled, with his co-author Dr Kilcast, the instrumental measurement of the food texture by the technique of electromyography. Assuming Dr Boyar's slides to be representative, this technique involves wiring-up a series of charming young ladies in order directly to record the electrical activities produced in muscles during chewing. Although the apparatus would have fitted well into a Vincent Price film, the technique produced good correlations for several well-characterised test materials between different subjects. Having calibrated the apparatus by persuading the subject to bite on a load-cell, the experiments showed that the integrated wave-form obtained was proportional to the force exerted during chewing. Mr Jones presented some work conducted with Dr Dransfield at the Institute of Food Research in Bristol to examine the textures and mechanical properties of different types of ham. I was amazed to discover that processed hams can contain in excess of 70% by weight of water, and that the outer layer of white fat is an extruded product. This paper reported the results of a punch-and-die test over a range of speeds to measure the shear strength of hams. Tensile and stress relaxation behaviour were also examined. Dramatic differences were observed, especially in the shear strengths, between "traditional" and "modern" hams. The first day of the conference was concluded with a paper by Dr Gearing and associates of Polymer Laboratories Ltd, in which the principle features of dynamic mechanical thermal analysis (DMTA) were explained, and applications of the technique to foodstuffs were detailed.

The second day of the conference opened with a persuasive paper by Dr Dransfield in which meat was considered as a fibrous composite with several levels of structural hierarchy. Ms Donnelly, also from IFR, Bristol presented the results of some work carried out with Dr Purslow to determine the variations in the tensile adhesive strength of myosin gel/meat interfaces in reconstituted meat products such as re-formed steaklets and beefburgers. In this study, both the geometry of the adhesive joint and the deformation rate were examined, and the results demonstrated the need for caution when extrapolating data from laboratory test samples to real products. Dr Purslow continued the theme of the characterisation of meat products in his paper "Modelling the Mechanical Effects of Intramuscular Collagenous Perimysial Network Reorientation Stretching Meat". The experimental logistics of getting the neck muscle from a bullock into the Instron testing machine within three minutes of slaughter were, to say the least, intriguing. This enabled mechanical properties of the sample to be observed as a function of time as the meat progressed through rigor mortis to its edible condition. A range of techniques was used to equate the morphological changes taking place within the muscle to the observed mechanical behaviour. The final paper on meat characteristics was given by Dr Dobrasczczyk of Reading University on the fracture mechanisms in frozen meat.

Mr McEvoy of Unilever Research applied the theories used to explain the behaviour of synthetic polymer networks to biopolymer gels, especially mixtures of agarose and gelatin. A blending law was partially successful in relating the modulus of the mixed gels to the moduli of the component phases. The models employed were of necessity extended to permit simulation of large deformations. Dr Tyson of Devro Ltd explained some applications of rheology to the processing of collagen protein products. By breaking down a raw material from cattle hides, products are obtained

which are used in food and medical applications, and, by re-constitution, as sausage skins and other films for the food and medical industries. Torque and capillary extrusion rheometry, in conjunction with optical microscopy, were used to develop collagen products with specific physical characteristics. Dr Doublier of the Institut National de la Recherche Agronomique in Nantes observed thixotropy in his study of cereal starch pastes. The sensitivity of the pasting conditions for wheat, maize and oat starches were compared as a function of heating and stirring rates using a coaxial cylinder viscometer. Flow behaviours could be interpreted qualitatively by comparing the swelling and solubility patterns for each starch.

Messrs Berrington, Bradley and Mitchell from the University of Nottingham described a slit viscometer which they had developed to measure the viscosities of aqueous liquids at temperatures up to 130°C. Air pressure was used to force the sample back and forth through a slit in a temperature-controlled cell, and liquids with apparent viscosities of 10^{-3} to 10 Pa.s could be measured at shear rates between 10 and 10^4 s $^{-1}$. The apparatus was used to investigate the thermal degradation of polysaccharide solutions. Mr McMaster of IFR, Norwich described a slit die equipped with pressure transducers and an ultrasonic probe which Mr Senouci, Dr Smith and he had used to study on a twin-screw extruder food polymer melts derived from potato powder and maize grits. The viscosities of the melts were determined as function of shear rate, die temperature and moisture content. Initial results indicated that the velocity of ultrasound in the melt was sensitive to processing parameters and to the rheology of the melt, and may thus be useful for on-line process control applications.

The mechanism by which lecithin and other emulsifiers reduce the viscosity of molten chocolate was modelled by Messrs Mackie, Hey and Mitchell of the University of Nottingham, using a dispersion of silica particles in alkanols. A Deer rheometer was used to measure the rheological properties of silica dispersions having a known coverage of lecithin, and it was observed that the results obtained were dependent upon the preparation method. It was thought that this was due to the configuration of lecithin on the particle surface. Dr Heyes of the Royal Holloway College explained his technique of molecular dynamic computer simulation to model the rheology of liquids and suspensions starting from first principles.

As a venue for the conference, the University of East Anglia provided an excellent lecture theatre, and the eight or nine firms who had set up a mini exhibition of their rheological equipment in the foyer of the lecture theatre was very effective and useful. Reports from colleagues indicate that the Conference Dinner was excellent. On the negative side, coffee breaks and lunch involved queuing at the campus cafeteria, which limited opportunities for informal discussions. However, the campus pub provided a satisfactory evening venue for such discussions, followed by a short taxi-ride into the City where a couple of night clubs provided a further venue for the more hardy discussers (discretion prevents me from naming the Sales Manager who fell asleep in one such establishment!). A shadow was cast when one delegate had her handbag stolen in a night club.

To summarise, the conference was an excellent admixture of practical and theoretical rheology of some very complex materials. Clearly, much progress is being made in Food Rheology, and there is much overlap with other industries. I look forward to the next conference in this area. Many congratulations and thanks must go to Geoff Brownsey and Frank Baker for organising the conference, and for their persistence when it seemed that there would be insufficient interest. I would like to issue a plea to workers in this field - please try and get your papers and abstracts in promptly for future conferences. A long-faced organiser is not a pretty sight!

"Entrance and Exit Effects"

Pactical, theoretical and computational aspects of flow into and out of ducts"

is being organized as a European Research Meeting in Rheology by the Belgian Group of Rheology and the British Society of Rheology. The meeting will be held in the University of Kent at Canterbury on Wednesday 2nd and Thursday 3rd September 1987, with accommodation arranged on the campus for 1st-3rd September inclusive. The annual conference of the British Society of Rheology, on General Rheology, will follow the conference, finishing in the early afternoon of Friday 4th September.

The organising committee consists of Professor M. Crochet (B.G.R.), Dr. J. L. Leblanc (B.G.R.), Dr. C. J. S. Petrie (B.S.R.) and Mr. H. Schimanski (B.S.R.). The intention is to arrange two or three review lectures and some round table discussion sessions as well as accepting contributed papers on Entrance and Exit Effects. Offers of papers should be sent to either or both of

Dr. J. L. Leblanc,
Monsanto Europe S.A.,
Avenue de Tervuren 270-272,
Letter Box No. 1,
B-1150 Brussels,
Belgium.

Dr. C. J. S. Petrie,
Department of Engineering Mathematics,
The University,
Newcastle upon Tyne, NE1 7RU
United Kingdom.

including a title and short abstract. The language of the conference is English.

Further information for contributors and details of registration and accommodation arrangements and fees will be sent to all European rheological societies and to anyone who offers a paper or requests further details from any of the organising committee. Offers of papers received before the end of December 1986 are guaranteed careful consideration by the organisers, and acceptances will be notified by February 1987.

Offers of papers and enquiries about the session on General Rheology should be addressed to Dr. Petrie or Mr. Schimanski.

XTH INTERNATIONAL CONGRESS ON RHEOLOGY

14-20 AUGUST, 1988, SYDNEY, AUSTRALIA

The xth International Congress on Rheology will be held on the campus of the University of Sydney, 14-20 August 1988. Hotel and student dormitory accommodation will both be available. Pre- and post-congress tours are being planned. 1988 is Australia's bicentennial year, so the organizing committee will welcome an early response to requests for intentions to attend and/or present a paper. Information about the congress can be had from the chairman:

**Professor Roger I. Tanner, Department of Mechanical Engineering,
University of Sydney, 2006, Australia.**

THE CARRI-MED RHEOLOGY SEMINAR

11th - 13th November 1986 - Dorking, Surrey.

Proven by its popularity - Carri-Med are pleased to announce their third annual Rheology Seminar.

..... For a comprehensive insight into the theory and practice of rheology.

This year our eminent guest speakers include :-

Dr. J.Ferguson - University of Strathclyde
Professor K.Walters - University College of Wales, Aberystwyth
Dr. T.E.R.Jones - Plymouth Polytechnic

Subjects to be covered include :-

- * General introduction to rheology.
- * Over-view of current rheological instrumentation techniques.
- * The theory and applications of flow, creep and oscillation.
- * Demonstrations and handling experience of Controlled Stress Rheometer and Weissenberg Rheogoniometer.

Fee: Non-Residential - £90 (inclusive of all refreshment)
 Residential - £190 (inclusive of accommodation and meals)

THE CARRI-MED SEMINAR IS AIMED AT ANYONE WITH AN INTEREST IN RHEOLOGY BE THEY INDUSTRIALISTS, LABORATORY TECHNICIANS OR ACADEMICS.

For further details or an application form please contact :-

Carri-Med Limited
Glebelands Centre
Vincent Lane
Dorking
Surrey RH4 3YX

Telephone: **Dorking (0306) 886180**
Telex: **859115**

COURSE IN FLUID RHEOLOGY 17-21 NOVEMBER 1986

AT

WARREN SPRING LABORATORY

Warren Spring Laboratory is organising a 5-day Course in Fluid Rheology.

The Course is aimed at the rheologist, physicist, chemist or engineer who deals with rheological problems.

The Course will summarise current theory and practise and introduce several new concepts. It will consist of lectures on the principles involved in rheology practise and theory, and a survey of industrial applications; practical periods on the measurement of non-Newtonian viscosity; seminar sessions on industrial-related topics and an introduction to thixotropy and viscoelastic measurements.

The fee is £925 + VAT and includes bed, breakfast, lunches, refreshments and a course manual.

Further details and a registration form can be obtained from Miss P Madhvi, Warren Spring Laboratory, Department of Trade and Industry, Gunnels Wood Road, Stevenage, Herts SG1 2BX. Telephone (0438) 313388.



France, September 15th opening for a postdoctoral in polymer solutions rheology and/or physics to participate in an EEC - supported cooperative research programme. Salary will be approximatively 130 000 FF. Some knowledge of French will be helpful but is not required. The position is open for 2 years. Applicants must be EEC citizens and should send a resume and arrange to have 2 letters of recommendation sent to :

Prof. C. WOLFF
Laboratoire de Physique et Mécanique Textiles
ENSITM
11, rue A. Werner
68093 MULHOUSE CEDEX, France

Tél. : 89 42 46 22

Télex : 881913 (CERMAT)

Mulhouse is a nice city very close to the borders of France with Switzerland and Germany (~ 35 km), to the Vosges (~ 35 km) and Alps (~ 100 km) mountains.

France, September 15th, opening for a graduate student to prepare a Ph. D. in polymer solutions rheology and/or physics and to participate in a EEC - supported cooperative research programme. Some knowledge of French will be helpful. Salary will be approximatively 85 000 FF. The position is open for 3 years. Applicants must be EEC citizens and should send a resume and arrange to have 2 letters of recommendation sent to

Prof. C. WOLFF
Laboratoire de Physique et Mécanique Textiles
ENSITM
11, rue A. Werner
68093 MULHOUSE CEDEX, France

Tél. : 89 42 46 22

Télex : 881913 (CERMAT)

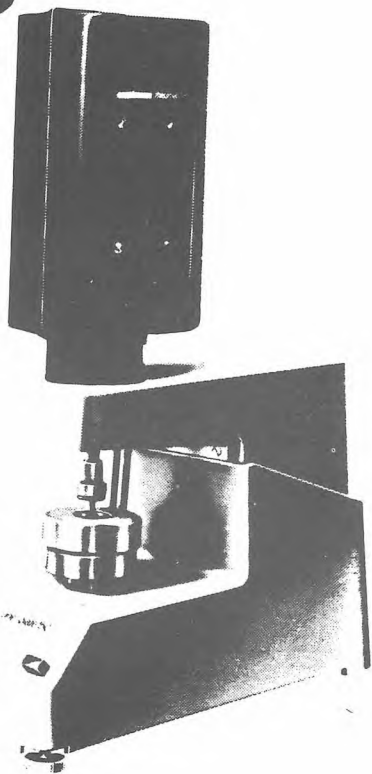
Mulhouse is a nice city very close to the borders of France with Switzerland and Germany (~ 35 km), to the Vosges (~ 35 km) and Alps (~ 100 km) mountains.



sticky viscosity problem?

Perhaps you need the Contraves
CPI50 or CP400 Cone and Plate
Measuring System

- Self compensating gap during ramped temperature measurements.
- Fast and easy to clean.
- Rapid sample throughput.
- Applications – Oil, Paints, Pharmaceuticals.
- Robust and reproduceable for Quality Control.
- Precise and accurate for Research and Development.
- Ambient temperature to $+150^{\circ}\text{C}$
($+400^{\circ}\text{C}$ for CP400)



a state of the
art system from

contraves

Contraves Industrial Products Limited, Times House, Station Approach, Ruislip,
Middlesex. HA4 8LH. Telephone: (0895) 630196. Telex: 935129.

Instruments for Material Evaluation



- Viscosity
- Elasticity
- Yield stress
- Thixotropy
- Cure behavior
- Thermo-mechanical properties
- Impact

Rheometrics Europe GmbH
Hahnstrasse 70
D-6000 Frankfurt 71
West Germany
Phone (069) 6 66 68 36/37
Telex 411577 rheo d
Facsimile (069) 6 66 2007

**Rheometrics
Peter Robinson**
GB-Lightwater Surrey GU18 5UL
Phone 0044/276-76443
Car-Phone 0044/860-320359

Rheometrics

The more complete approach to understanding the flow behaviour of your products



**If you have a flow behaviour problem or have use
for a viscometer, the Carri-Med Rheometer offers a very
competitively priced state of the art instrument.**

The Rheometer provides the technologist with a powerful microprocessor based instrument, capable of measuring the effect of minute non-destructive forces, as well as measuring shear stress/shear rate relationships at high stress, giving a more complete analysis than conventional Rheometers.

When coupled with a Micro-Computer full automation, data logging and analysis with hard copy printout is available in a variety of hardware and software packages to suit your needs.

Whether you're an industrialist, pharmaceutical, medical or academic rheologist, if you want flow, creep and oscillation curves from one instrument the Carri-Med Controlled Stress Rheometer can do all this and more.

For further details or a demonstration please contact: **Carri-Med Ltd**

CARRI-MED

Glebelands Centre, Vincent Lane,
Dorling, Surrey RH4 3YX
Telephone: Dorling (0306) 886180