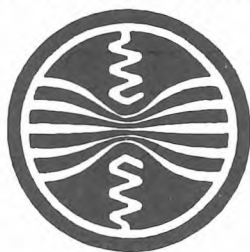


THE BRITISH SOCIETY OF RHEOLOGY

BULLETIN



August 1996

1996, Vol. 39, No. 2

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Hon. Editor
Mr P.C.Anderson,
32 Queensway,
Feltham,
Middlesex,
TW13 7NS



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THE BRITISH SOCIETY OF RHEOLOGY

OFFICERS AND MEMBERS OF COUNCIL. 1995/96

- President:** Prof H.A.Barnes, Unilever Research Ltd, Port Sunlight Laboratory, Quarry Road East, Bebington, Wirral, Merseyside, L63 3JW
Tel: 0151-471-3529 Fax: 0151-471-1829 E-Mail: barnes_h@urpsi.co.uk
- Secretary:** Dr G.J.Brownsey, Institute of Food Research, Norwich Laboratory, Norwich Research Park, Colney, Norwich, NR4 7UA
Tel: 01603-255201 Fax: 01603-507723 E-Mail: brownsey@bbsrc.ac.uk
- Treasurer:** Dr M.F.Webster, Dept of Maths & Computer Science, University College Swansea, Swansea, West Glamorgan, SA2 8PP
Tel: 0179-229-5656 Fax: 0179-229-5708 E-Mail: m.f.webster@swansea.ac.uk
- Membership Secretary:** Dr N.E.Hudson, Dept of Pure & Applied Chemistry, University of Strathclyde, 295 Cathedral Street, Glasgow, G1 1XL
Tel: 0141-552-4400 Fax: 0141-552-5664 E-Mail: n.e.hudson@strath.ac.uk
- Abstracts Editor:** Dr G.H.Meeten, Schlumberger Cambridge Research Ltd, High Cross, Madingley Road, Cambridge, CB3 0EL
Tel: 01223-325204 Fax: 01223-467004
E-Mail: meeten@cambridge.scr.slb.com
- Bulletin Editor:** Mr P.C.Anderson, 32 Queensway, Feltham, Middlesex, TW13 7NS
Tel: 0181-890-6586
- Ordinary Members:** Prof P.F.G.Banfill, Dept of Building Engineering & Surveying, Heriot-Watt University, Riccarton, Edinburgh, EH14 4AS
Tel: 0131-449-5111 Fax: 0131-451-3161 Email: bdgpgfb@bonaly.hw.ac.uk
- Prof A.R.Davies, Dept of Mathematics, University of Wales, Aberystwyth, Dyfed, SY23 3BZ
Tel: 01970-622755 Fax: 01970-622777 E-Mail: ard@aber.ac.uk
- Mr P.D.Doody, National Starch & Chemical Ltd, Galvin Road, Slough, Berkshire, SL1 4DF
Tel: 01753-533494 Fax: 01753-577704 E-Mail: paul.doody@nssgb.sprint.com
- Prof T. McLeish, IRC in Polymer Science & Technology, University of Leeds, Leeds, W. Yorkshire, LS2 9JT
Tel: 01132-333845 Fax: 01132-333846
E-Mail: phy6tcbm@phys-irc.novell.leeds.ac.uk
- Mrs C.A.Moules, Camtel Sciences, 5 Carrington House, 37 Upper King Street, Royston, Herts, SG8 9AZ
Tel: 01763-244280 Fax: 01763-244298
E-Mail: 101526.3666@compuserve.com
- Mr S.L.Robinson, Bohlin Instruments, Unit 6, The Corinium Centre, Cirencester, Glos., GL7 1YJ
Tel: 01285-644407 Fax: 01285-644314 Mobile: 0374-154471



EDITORIAL

It will be time for our AGM again soon, early in September in Coventry. The formal announcement is made elsewhere in this Bulletin, together with the minutes of last year's meeting. Please read these as they will be taken as read at the meeting. Please also make every effort to attend as we always fear that one of these years we won't be able to proceed, for the lack of a quorum. Please also support our annual meeting, advertised again on page 51. The deadlines have been extended a little due to the poor response so far. If you have students or recent graduates working on any rheological topics, please encourage them to participate in our Young Rheologists Day.

In this issue we have some very interesting reports on meetings held as a part of the 6 month 'Dynamics in Complex Fluids' workshop at Cambridge. For one of the meetings we have the contrasting views of a professor and one of his students. From another meeting we have the views again of Watson and Holmes, this time found and kindly forwarded to me by Professor Manfred Wagner. If any other reader should chance upon articles mislaid by these authors, please let's have them. May I remind our readers that due to the diverse origin of material published here, the views expressed are not necessarily those of the BSR Council, who should not be held responsible for them.

I must apologise to the Nordic Rheology Society for an error in the last issue on their views about the European Society of Rheology. I had been lead to believe (and not by them) that they had approved of the ESR and of joining it. I have since received a copy of their newsletter, for which I am most grateful. I have reproduced from it, a letter from their President to their members, which reports that they will be putting to a vote at their annual meeting on June 12th, whether they should join the ESR.

You may be interested to know that the BSR is making a bid to host the next International Rheology Conference due in the year 2000. The proposal is that the meeting would be held at Cambridge University. We understand that the Korean and Chinese Societies are also considering bids for this meeting.

You will find enclosed with this Bulletin a flier reminding you that the payment of your annual subscription to the BSR is due soon. We have experienced considerable problems with standing orders and would encourage members to pay by direct debit or by credit card using the form supplied.

The final copy date for the next issue, which should reach members by the end of October, is September 15th, 1996.

COMMENTARY: COUNCIL MEETING, JUNE 6th 1996

It was the hottest day of the year so far as 10 members of Council gathered at Schlumberger's tentlike research centre near Cambridge. A sympathetic welcome was extended to Peter Townsend, attending as a guest, who, as Council's nominee for incoming President, will have to take over this arduous role soon. Apologies were received from Mike Webster, Phil Banfill and Tom McLeish (with some excuse about neutron bombardment or scattering). The previous meeting's minutes were unquestioned, but a number of matters arose. Carole has been looking at new designs for the cover of this Bulletin. The accepted design will come into use in the new year, with the start of Volume 40. As issue 1 has normally only appeared about May each year, it was agreed to speed things up a little, by producing a special issue later this year devoted to reports on the 'Dynamics in Complex Fluids' Workshop recently held in Cambridge. The Rheology Abstracts journal will also get a similar new cover a little later now that it is being produced in-house.

Russell reported on the Scott Blair collection at Aberystwyth and his desires to see it become available on the internet. Much of the current catalogue is already in electronic form, so he did not feel it should be difficult to achieve. Chris Petrie has been working on world wide web (www) pages for the American and British societies, which Council will be studying and which they hope can go public soon.

Our President, Howard reported that a formation meeting for the new European Society of Rheology had been arranged for the 27th June. Treasurer Mike Webster was absent but an E-mailed report was read by Secretary Geoff. Much irrelevant (& irreverent) discussion took place regarding a payment of 35,000 received from Elsevier (former Abstracts publisher) and Mike's request for 3500 for a new computer printer and software updates. All was sorted out when a quick phone call revealed that a computer incompatibility regarding shifts meant the initial 3s were actually £ signs. Unfortunately auditing of the 1994/95 accounts has still not been completed, the auditors only recently having received a box of vouchers. The Society is however still flush with funds; some felt embarrassingly so. Nick Hudson has taken on two roles as Membership secretary and Publications manager. There was much discussion as to whether this was expecting too much of one person, and whether we needed to change our Council composition to 7 Officers and 5 ordinary members. In the end it was felt that as the role of individual officers often changed, there was no need to propose altering the Constitution on this account.

Nick offered to take on the role of Abstracts editor when Gerry's term is up in a year's time, as he was keen to see the electronic options pursued. He would like to see the whole of the Abstracts back to volume 1, available on a CD Rom. Now that the BSR is publishing the Abstracts themselves, it should prove a nice little earner, so much so, we will have to keep an eye on our VAT position again.

After lunch, there was much gloom about the state of the take up so far for the annual September meeting and AGM. There was a considerable fear that we might not even achieve a quorum, particularly if we attempted to hold an AGM without a scientific meeting. Nobody was quite sure what would happen if we didn't get one. In the end it was decided to reduce the meeting to one day (the Young Rheologists' Day) and that if arms were twisted, sufficient papers could be found. Given the society's surplus of funds, and to encourage our younger rheologists, it was decided that the meeting, including the lunch, would be entirely free.

The Council Conferences subcommittee of Russell, Tom and Paul intended to meet soon to urgently progress plans for the Annual BSR meeting in September 1997, which it is intended should be in the Dales. Carole will join them for further intensive discussions on changes that may be needed to our constitution to put our Society in better shape to face the future. The meeting finished at 3:30 pm and councilors dispersed to their various corners of the country feeling in the end that things were not quite as depressing as had they had seemed at one point.

Peter Anderson

Travel Grants for Students.

The Society makes grants to students engaged in research in rheology to attend and present their work at meetings on rheology, both its own and those of other societies. Members of the Society, who are full-time students, may apply in writing to the Secretary to be considered for an award and that application should be supported by the student's supervisor. The application should give details of the proposed expenditure, the title and date of the meeting and the title of the paper to be presented. They should be submitted in time for consideration at a Council meeting before the money is needed, i.e. by the beginning of March, June, September or December. The amount and number of such awards will be at the discretion of Council.

CONFERENCE REPORTS

NATO ADVANCED STUDY INSTITUTE: THEORETICAL
CHALLENGES IN THE DYNAMICS OF COMPLEX FLUIDS

Isaac Newton Institute for Mathematical Sciences,
Cambridge, 25th March - 4th April 1996

The Professor's View

The contribution of the BSR to this meeting was extremely generous, and undoubtedly contributed to the reasons that NATO chose to fund this exciting meeting, reviewing and suggesting avenues in many different rheological systems, and providing the lecturers and students with an excellent unifying picture of our field. The stress was on molecular approaches to polymers, colloids, surfactants and liquid crystals, and other techniques complementary to rheology were essential threads.

My overall impression of the meeting were those of delight and wonder as it took shape. It had a very special atmosphere. The steadier pace of the school, as compared to a normal research conference had tremendous advantages in allowing for stimulating and extended discussion periods, a truly pedagogical approach, and many opportunities for discussion in small groups around posters or blackboards throughout the meeting.

We were fortunate in acquiring a quite outstanding lecturing team from the outset: Masoa Doi (Nagoya), Mike Cates (Edinburgh), Jean Candau (Strasbourg), Pino Marucci (Naples), Sasha Semenov (Leeds), Michael Rubinstein (Chapel Hill) -the list just continued to sparkle...

This advanced study institute (ASI) was aimed at presenting progress to date in a rapidly-growing branch of statistical mechanics. Typical of such fields, similar problems have been addressed in a number of different systems by different research groups, sometimes unaware of the relevance of other, parallel work. The ASI compared problems and methods in Colloids, Polymers, Liquid Crystals and Surfactant Fluids. Although the thrust of the school was theoretical, each area was introduced by an experimentalist in the field who drew attention to both what observables were relevant, and to current puzzles raised. Among these were the relation of viscosities and mobilities in colloids and the "weak" melting behaviour of surfactant cubic phases.

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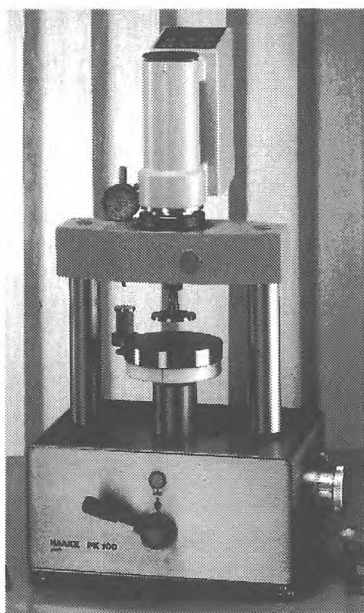


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Scientific highlights were many. Especially of note was the interesting juxtaposition of the polymeric and colloid theoretical approaches - where they differ and where they run along similar lines. The presentation of the entanglement effects in polymers was especially useful in pointing out current uncertainty in the basic underlying phenomenon and its scaling properties, outlining the possible alternative assumptions that can be made. Also important was the clear presentation of wormlike surfactants as a true model system for entangled polymers.

Following a review of molecular dynamics and flow of colloids and polymers, the effect of flow on phase transitions themselves was considered. Examples were nematic transitions, concentration fluctuations in polymer solutions (including demixing) and the non-equilibrium "shear-banding" flows suggested by experiments and theory for polymers and wormlike surfactants.

The last section of the school dealt with more exotic equilibrium and non-equilibrium self-assembled fluids such as "onion" phases, branched wormlike surfactants, two phase fluids in which the rheology is dependent on the non-equilibrium structure, and foams. In particular we discussed candidates for slow dissipation in random media, pointing to the absence at present of a tenable theory for the observed low-frequency dissipation in foams.

The book of the school, to be published by Kluwer, should emerge early next year.

Tom McLeish
IRC in Polymer Science and Technology
University of Leeds

NATO ADVANCED STUDY INSTITUTE: THEORETICAL CHALLENGES IN THE DYNAMICS OF COMPLEX FLUIDS

Isaac Newton Institute for Mathematical Sciences,
Cambridge, 25th March - 4th April 1996

The Student's View

The seminars started with an excellent introduction by Sir Sam Edwards, who illustrated some of the broader, unsolved problems of the physics of complex fluids, whetting our appetites for the fortnight's seminars and discussions to come.

The structure of this Cambridge-held course was terrific; well-spaced seminars gave a great deal of emphasis on having time to discuss the ideas contained in the lectures, and in one's own work with the people who really understand it well.

The seminars were broken into small series on topics ranging from polymers, branched wormlike surfactants, liquid crystals, colloidal systems, to self-assembling 'onion' phases aptly introduced by the Frenchman, Didier Roux. I learned many generally useful ideas, such as what is considered to be a good fit to data. The need for a good understanding of both experimental work and theory for the advancement in many fields became clear as the school progressed and public discussions broke out.

The questions raised after the lectures often hit fundamental questions on the head. It was exciting to be present at the pushing of scientific frontiers. I shall not forget Mike Cates' words which broke the silence after one of Michael Rubinstein's many searching questions: He said 'If no-one in this room knows the answer, then no-one knows'.

The most stimulating lecture series to me, personally, was that given by Michael Rubinstein. He started by giving a comprehensive overview of the Rouse model and Zimm model for the dynamics of entangled polymers. This is of great relevance to my own work which has included fitting Rouse models to the high frequency end of rheological spectra for star polymers. Michael Rubinstein then introduced the concept of entanglements, and outlined the Reptation model for the dynamics of entangled, linear chains. This was compared with the constraint release model for the dynamics of branched and linear chains, with the background to the Ball-McLeish theory for star polymers clearly explained.

As it was this theory that I fitted to rheological data, this lecture series was very valuable to me, condensing much of what I've learned in the last one and a half years.

The highlight of the fortnight was the scientific dialogue during the luxuriously long tea-breaks and lunch times. It was highly educational to be able to ask questions of the top experts in the field, who had previously only been names on papers to me. This was superbly easy to do as the atmosphere was open, frank and relaxed, with blackboards everywhere so that drawing and writing equations could happen quite spontaneously and in such a manner that many people could join in.

Experts of so many disciplines were brought together discussing related problems. It was thrilling to be able to discuss the NMR methods and analysis I've used for selectively deuterated linear and star polymers with Edward Samulski and Paul Callaghan, and to compare the results with tube-model theories. Tube-model theories were then discussed with Michael Rubinstein, Scott Milner, Tom McLeish and Mike Cates.

The school seemed like a hot-bed of ideas, and was particularly useful to me as it was there that I became involved in successful collaborative work with Scott Milner and Tom McLeish.

After long days of stimulating physics, we went next door for dinner, and the evenings began. It was great to get to know people from such diverse cultures as Russian, Dutch and Malaysian. Poker, pool and punting were enjoyed by all, including one of our number who became rather wet in the process of failing to punt!

In summary, this was an incredibly exciting time in which I learned a great deal, and commenced new work. I am grateful to the organisers and speakers and to the BSR for their financial contributions.

Christine Adams, PhD Student,
IRC in Polymer Science and Technology,
University of Leeds

RHEOLOGY/CHAIN STRUCTURE RELATIONSHIPS IN POLYMERS

Isaac Newton Institute/DSM Research Symposium

Isaac Newton Institute for Mathematical Sciences,
Cambridge, 14th - 15th May 1996

The following manuscript was apparently found on the newspaper desk of the library of Cambridge's Newton Institute after the recent Symposium on Rheology/Chain Structure Relationships in Polymers. The author seems to be a certain Dr Watson and as the finder could find no address to return it to him, and as he felt certain that the paper was intended for publication, he has instead forwarded it to us so that we might bring it to the attention of the wider scientific community by reprinting it in this Bulletin.

THE CASE OF THE MISSING INDUSTRIALIST:

The Outburst of the Newton Syndrome

"The President of France has a peculiarly Gallic smile, fastidious and slightly pained, like a cat with indigestion. To misquote, the French are so dammed French its looks like an affectation. None more so than Jacques Chirac, whom peers and MPs welcomed to Westminster yesterday with a display of tin soldiers and top-of-the-range Merrie England flummery in best Ruritanian tradition..."

I was reading aloud from The Times (1) in the quietness of the library of Cambridge's Newton Institute, when Holmes interrupted me with one of his rare outbursts of emotion: "Disgusting, Watson! Having brought the monarchy to the ridicule of the masses, these newspaper scribblers now turn to foreign heads of state, undermining an Entente Cordiale that dates from the days when I accepted the Légion d'Honneur from the President de la République after arresting the notorious Huret in the place de l'Opera! Besides my grandmother was the sister of Vernet, the French painter, as you well know!" Holmes stopped abruptly, shaking his head in anger and continued his scrutiny of a paper in front of him. "Forty-eight" he murmured, and some time later, he seemed stunned: "Thirty-four!"

I know when to wait patiently for the great mind coming to a conclusion. We had taken up belatedly the case of the missing industrialist (2), and having learnt from some obscure sources - Holmes mentioned only emanations of electromagnetic waves from the ether - that Cambridge was the meeting place of that elusive homo industrialis rheologicus, we had decided - in spite of the hefty 200 pounds registration fee for a one and a half day conference on Rheology/Chain Structure Relationships in Polymers, plus hotel costs in one of Cambridge's more fabulous hotels - to take part in this exclusive event. "If we can find half a dozen industrial rheologists - including the invited speakers - the money is well spent", Holmes had reasoned.

He seemed still to be in a strange state of mind this morning, a day after the conference had ended, and it was not quite clear to me, whether this was caused by the effects of the scientific content of the conference, or whether it was a consequence of the quantity of old port Holmes had tasted last night on the private invitation of a don to the high table of one of the more affluent of Cambridge's colleges.

"48", he murmured again, and "... after all these years, after all those despairing rheology conferences with hardly any sign of the industrial rheologist .."

He lapsed into silence again. "Port of vintage 1948?" I suggested hesitatingly. "My dear Watson", Holmes raised his educated voice, which caused the librarian further away to raise her eyebrows, "there were 48 industrialists at this conference!"

"Unbelievable!" I exclaimed, "True, there was the one or other odd face that I have missed for a long time, and there were many unfamiliar, mostly young faces - you mean, these were not just PhD students or post-docs, these were ... actually ... industrial ... rheologists?"

"Without any doubt, my dear Watson, without any doubt", Holmes responded grimly, "and this official list of participants contains just 34 names of academics!"

Holmes lapsed into silence again. I could see the great mind pondering the question why, by all means, 48 industrialists had come to a place like the Isaac Newton Institute for Mathematical Sciences, where one would expect scholars from mathematics and physics to stumble from black holes to topological chaos, and from Diophantine equations to Fermat's last theorem.

"The Newton syndrome.", Holmes murmured, and when he saw my incomprehension, he repeated: "It must be the Newton syndrome that has brought all those industrialists here."

Holmes saw that I could still not follow his arcane reasoning. "My dear Watson, the Newton syndrome is when alchemists mutate to non-Newtonians and turn to Newton for help!" And then he explained to me with his great insight in the workings of our ever more complex world: "After all those many years, when industrialists have watched their economic baseline, they suddenly realise that by downsizing, early retirement and sheer attrition of industrial research, they are in danger of losing their technological base. Then they flock to academia in the hope of finding salvation and simple answers to their generalized-Newtonian and non-Newtonian rheological woes."

"Of course!" I asserted, "but what caused this concerted outburst at this particular conference?" "Precisely, my dear Watson, this is precisely the question I am asking myself since we have arrived here in Cambridge!"

We spent the next hours carefully weighing the evidence:

There were 8 lectures read by academics, and 10 lectures read by industrialists. "This is certainly showing the prowess of industrial rheology when inspired by knowledgeable organisers", I observed, but Holmes seemed not quite to agree, and choosing his words carefully, he remarked: "Disregarding notable exceptions, some of these lectures rather demonstrated to me the deplorable state of industrial rheology", and he added one of his more cryptic Latin phrases: "Si tacuisses, homo rheologicus mansuisses."

"There was, in person, a real noble prize winner on stage", and I suggested to Holmes that this might have caused the outburst of the Newton syndrome. But Holmes remained gloomy, remarking that this charming chap, with his infectious laugh, was quite entertaining, but his advice to industrialists to look for artificial muscles could only be considered as an advice of last resort when being in danger of losing economic strength.

"Did you realise, my dear Holmes, that although the registration fee was announced at 200 pounds, we had to pay only half of this sum?" "This, my dear Watson", Holmes replied in his customary scholarly manner, "is an important piece of evidence. I remember that one of the organisers confided to me that this extravagant registration fee of 200 pounds was caused by a small and, as he hurriedly assured me, inadvertent accounting error - which, together with offering expensive hotel accommodation, instead of cheap college housing, had certainly helped the poorer and purer ones of the academic rheologists to shy away. But was this exclusiveness really enough to attract the industrialists?"

Holmes fell into deep brooding again for a time that seemed to be hours, until, suddenly, he exclaimed triumphantly: "Of course, Watson, the solution is right in front of our eyes!" And he pointed to the title of the conference: "A Newton Institute/DSM Research Symposium."

It took me some time before I managed to follow the reasoning of this great mind: "It is perfectly clear, my dear Watson, that an outburst of the Newton syndrome must occur with near certainty, whenever the name of a powerful industrial enterprise appears in the title of the conference: all their friendly competitors must come to the meeting, to prove - or at least to pretend - that they are still actively and successfully working in the field. They are also afraid that they might otherwise miss something of importance to their businesses, and, if one company is openly displaying an outburst of the Newton syndrome, all the others can easily confess to it. As you well know, the managers of those companies read all the same journals, and move perfectly in phase ..."

Exhausted, I fell back in my chair in the quiet of Cambridge's Newton Institute, relaxing after having been helpful in solving this mysterious case. I was surfing happily through *The Times* again, until I reached page 15:

"My dear Holmes", I exclaimed, "there is a new portrait of you published in today's issue!" Holmes seemed unmoved, but he could not disguise from me, his alter ego, a glance of pride in his eyes of being in *The Times* on the very day when he had solved one of his most difficult of cases. He asked me to give him a brief account of the article.

Running rapidly through the paragraph accompanying the portrait of the great detective, I exclaimed in protest: "By all the mad cows of Britain, my dear friend, the Eurosceptics seem to allude that you are not really English, but are of Continental origin: they cite your perfect mastery of French, your frequent trips to Europe for business and pleasure, and your French grandmeré. They also point out that you accepted the Légion d'Honneur, but turned down a customary English knighthood! No Englishman of pure stock could have made such a choice, they claim!"

This was the end of the case of the missing industrialist - for now at least, but it is the beginning of "The Strange Case of Monsieur Sherlock Holmes" (3), 221B rue de Boulangers (otherwise known as Baker Street).

References:

1. *The Times*, No. 65,581, Thursday May 16, 1996, p.2
2. *Bulletin*, British Society of Rheology, 38, No.3 (1995), p.88
3. *The Times*, No. 65,581, Thursday May 16, 1996, p.15

NOTICE OF THE 56th ANNUAL GENERAL MEETING

The 56th Annual General Meeting of the British Society of Rheology will be held on September 4th, 1996 at the De Vere Hotel, Coventry starting at 15.00 hrs.

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

- a) Election of Officers and Council Members for 1996-97.
- b) Receipt of a report and audited accounts from Council.
- c) Dealing with matters raised by Council or by any Member, and receiving suggestions from Members for consideration by Council.

Council's nominations are as follows, all the present members being eligible to continue in their present role with the exception of Howard Barnes, who has completed his two year term of office:

President:	Prof. P. Townsend
Honorary Secretary:	Dr. G. J. Brownsey
Honorary Treasurer:	Dr. M. F. Webster
Membership Secretary:	Dr. N. E. Hudson
Bulletin Editor:	Mr. P. C. Anderson
Abstracts Editor:	Dr. G. H. Meeten.

Ordinary Members of Council:	Prof. P. G. F. Banfill
	Prof A.R. Davies
	Mr P. D. Doody
	Prof T. C. B. McLeish
	Mrs C. A. Moules
	Mr S.L. Robinson

In addition one further nomination for Council has been received to date:
Mr J.W.E. Gearing

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

Council intend to put to the meeting a change in our rules in line with new Charity law, that we no longer have our accounts audited by professional accountants, but that they be subjected to outside scrutiny only.

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

Geoff Brownsey
Honorary Secretary.

**MINUTES OF THE 55th AGM HELD AT PENBRYN HALL.
UNIVERSITY OF WALES, ABERYSTWYTH.
SEPTEMBER 4th 1995, 17.50hrs**

PRESENT:

Prof. H. A. Barnes (President)
Dr G. J. Brownsey (Hon. Secretary)

1 APOLOGIES FOR ABSENCE

These were received from Dr R Burley, Dr P. F. G. Banfill,
Mr P. C. Anderson and Dr G. H. Meeten.

2 MINUTES OF THE 54th AGM

These had been published in the Bulletin Vol 38(2). There being no queries
the Minutes were duly signed by the President.

3 MATTERS ARISING

There were no matters arising.

4 REPORTS OF OFFICERS.

4.1 President

The President read his report which was to be published in the forthcoming
Bulletin (Vol 38/3)

4.2 Treasurer

Mr Roy Carter was unable to attend. (No report was available at the AGM
but one has subsequently been published in the Bulletin (Vol 38/3)).

4.3 Hon. Secretary

Dr Brownsey read his report, a copy of which was published in the Bulletin
(Vol 38/3). The concern over Rheology Abstracts was raised, chiefly one of
publication difficulties, but these are expected to be overcome for the next
year. Further progress on a European Society of Rheology is anticipated and
there is expected to be continual support for students through the grants the
BSR awards. The great efforts of fellow Council members were
acknowledged.

4.4 Membership Secretary

Dr Hudson presented his report. (see Bulletin Vol 38/3). A new membership list had been produced; this would be updated in two years. The Bulletin is now to be printed at the University of Strathclyde. Over the year, membership has fallen slightly but the figures now presented reflect the true state of the Society.

4.5 Bulletin Editor

Peter Anderson was unable to attend the meeting and his report was presented by the Hon. Secretary (see Bulletin Vol 38/3).

4.6 Abstracts Editor

Dr Gerry Meeten was unable to attend and his report (see Bulletin Vol 38/3) was tabled and presented by the Hon. Secretary. Elsevier are to cease publication of Rheology Abstracts at the end of 1995, when the publication responsibility will be taken over by the BSR with its anticipated printing being undertaken by the University of Strathclyde.

The meeting was then open to general questions.

Chris Petrie asked what the financial implications to the BSR were, given that Elsevier were pulling out. Another member asked if Council had access to the mailing list. The meeting was informed that Council were trying to obtain the mailing list and had every expectation of doing so. As regards the financial implications, the BSR last year received 'royalties' from Elsevier in the region of £6400 which was some 25% of the profits of the periodical. In the coming year anticipated income to the Society from Rheology Abstracts was projected to be significantly higher.

Chris Petrie noted that the accounts for last year had only just appeared; why? The meeting was assured that this was in no way a reflection on the auditors. The meeting was asked if the present auditors were to be retained. (Proposal by Paul Doody, seconded by Carole Moules). The proposal was carried.

5 ELECTION OF OFFICERS

This was to be the second year in office for the President, his position was not subject to election.

There being no nominations from the floor for the positions of Council Officers, the meeting voted en bloc (by a show of hands) to the nominations as presented in the current Bulletin.

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Seven people had been nominated for the six vacancies on Council as ordinary members. A vote was necessary after which the following were elected to the posts:-

President	Prof. Howard Barnes
Hon. Secretary	Dr Geoff Brownsey
Hon Treasurer	Dr Mike Webster
Membership Sec	Dr Nick Hudson
Abstracts Ed	Dr Gerry Meeten
Bulletin Editor	Mr Peter Anderson
Ordinary Members	Dr Phil Banfill
	Prof Russell Davies
	Mr Paul Doody
	Prof Tom McLeish
	Mrs Carole Moules
	Mr Steve Robinson

Roger Burley and Roy Carter were thanked for their support to the Council.

6. ANY OTHER BUSINESS

Discussions surrounding the possible formation of a European Society of Rheology ensued, principally led by the President. Art Metzner asked (through Morton Denn) whether the formation of such a society fragmented our discipline. Surely a single society of rheology, with reciprocal meetings was the preferred way forward. Russell Davies commented that this was a way towards this ideal. Prof Wagner said that we should not drag our feet any longer regarding this matter, the BSR should be seen to be pro-active. It was the general consensus that the smaller societies were supportive of an ESR.

Chris Petrie reminded the meeting that a year ago there had been a meeting in Seville to discuss such matters.

The following proposal was put to the meeting: **The British Society of Rheology becomes a founding member of the European Society of Rheology.** This was proposed by Carole Moules and seconded by Tom McLeish. It was carried unanimously.

The President awarded the 1995 Annual Award to Mervyn Jones who personally received the award and thanked the BSR and its members.

There being no further business, the meeting closed at 18.40.

BSR SCOTT BLAIR COLLECTION WORKING GROUP

The following notes on the recent activities of this group have been extracted from the minutes of their meeting at Aberystwyth on 1st May 1996. The meeting was attended by Dr Merwyn Jones (Chairman), Dr John Benbow (BSR Archivist), Prof. Russell Davies (BSR Council) Mrs C.R. Ghosal (Hugh Owen Library) and Dr Tony Evans (Secretary).

The Chairman welcomed Russell Davies who is to be the new link with the BSR Council, replacing Roy Carter. Russell assured the Group that Council had no plans to move the collection from Aberystwyth. However he was keen to facilitate access to the collection from afar by means of the Internet, preferably by a world-wide-web page, which could complement the BSR www pages introduced recently by Chris Petrie. For this a complete listing would be required, and it had been possible to extract one from the Hugh Owen Library catalogue and bring it up to date. This information is already in electronic form, but needs some modification to a suitable format. Russell thought this could be done as a student vacation job. He would also look into options for transcribing Harrison's original list of Rheological items, to be found elsewhere on the Aberystwyth campus, into a form suitable for also adding to the www.

Purchase of the proceedings of the 1994 NATO workshop was agreed for addition to the collection. John Benbow reported that he had extracted the significant papers from Dick Whorlow's collection and these had also been deposited with the collection. He also reported that he was assisting Ken Walters and Roger Tanner who are writing a history of Rheology.

APPEAL FOR ANECDOTES AND PHOTOGRAPHS

As mentioned in the above report, Ken Walters and Roger Tanner are writing a book on 'Rheology - An Historical Perspective'. They would much appreciate any contributions of anecdotes or photographs of the great and the good at work or receiving awards etc.

SURFACE / INTERFACIAL RHEOLOGY

1. Introduction

Frequently the theoretical basis for a subject emerges long before the practice. In many cases this early awareness is backed up by 'hand built' equipment to prove the hypotheses. This happened in the field of controlled stress rheology and it is not so many years ago that computer controlled instruments as we know them today, with the oscillation, creep and flow at very low shear rates, were introduced. In actual time, probably about 13 years. They monitor the bulk properties of fluids and when they were introduced and for many years to follow, they were treated as expensive tools for R&D and beyond the 'ken' of quality control. They are common in QC today and software is constantly evolving to control test procedures and monitor pass / fail situations using simplified menus for the plant operators.

There are many papers published on the subject of surface and interfacial rheology where experimental data has been produced from the author's own design of instrumentation. This makes it difficult to interpret the information between authors or to mimic the experiments. As a consequence, a commercial interfacial rheometer has been developed using the latest leaps in technology that the computer age has brought. No doubt others will follow.

The instrument probes the rheological properties at the boundary between two phases by oscillating a Pt/Ir du Nouÿ ring in the interface to obtain both viscous and elastic properties. As all the problems involved with good wetting, adhesion, stability of emulsions and micro-emulsions etc. have not been answered by the knowledge of interfacial tension and bulk rheology, this technique has shown that it can fill some of the gaps.

This article looks at the relationship between bulk and interfacial rheological properties and interfacial tension and interfacial rheological properties. The principles of the interfacial rheometer are described and examples are given to show the ageing of foam surfactants, the effect of additives and the growth and decay of foam.

2 Basic Principles

2.1 Definition

Interfacial rheology is the study of the deformation and flow of infinitesimally thin films of material at a liquid / gas or liquid / liquid interface. The 'thickness' of the interface and the extent to which the rheological properties of it differ from the bulk depend on:-

Molecules - Number, Type, Size, Shape, Flexibility, Interactions and the Space they inhabit.

Environment - Temp., pH, Ionic strength etc.

The words surface and interface are both used to describe a boundary. They are often assumed by the newcomer to mean two different things when in reality 'interface', which means a boundary between phases, is correct in all instances. For the purpose of this article the following definitions are assumed :-

Surface rheology - the study of the liquid / gas interface (L/G)

Interfacial rheology - the study of the liquid / liquid interface (L/L) and when the information applies equally to both circumstances (L/G & L/L)

For pure liquids, the molecules within the bulk can be seen to be subjected to equal forces of attraction in all directions but at the interface there is an imbalance of forces with a net inward pull, Fig. 1. The molecules leave the liquid surface for the bulk and the surface tends to contract spontaneously i.e. droplets of liquids and bubbles of gas take on a spherical shape. The surface tension of a liquid is the force acting at right angles to any line of unit length in the plane of the surface. It is this parameter which is dominant as pure liquids do not exhibit measurable 'rheological' properties i.e. there is no surface elasticity and the surface viscosity is so low that it is negligible.

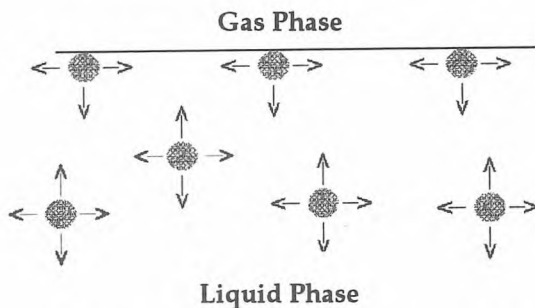


Fig. 1 Imbalance of Forces at Interface

However the boundary between two phases can be affected by surface active agents present either as an adsorbed layer (detergents, soluble polysaccharides) or by a deposition of insoluble materials spread as a film (long chain fatty acids, denatured proteins), Fig. 2. The result is that the interfacial tension is lowered and there can be pronounced interfacial rheological properties which are not necessarily mutually exclusive.

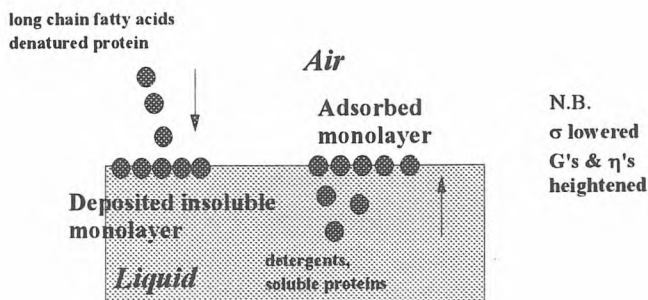


Fig. 2 Interface affected by Surface Active Age(a)nts

This surface must have a certain thickness which will depend on the type of molecules present, how much space they have and the environment they are in. The properties here differ from the phases on either side according to the number, shape, size, flexibility and interactions of the molecules. In fact these are the same factors which affect bulk properties and hence everything learned about bulk rheology applies to interfacial rheology with one major difference i.e. bulk rheology is 3-dimensional and interfacial rheology is 2-dimensional as by definition it lacks the dimension of height.

One further important criterion to consider at the interface is the ageing of materials which has been a major consideration in the data published on pharmaceutical products and the growth of membranes in emulsions and microcapsules. The term *chronotropy* has been accepted by the Chief Science Editor to the Oxford English Dictionary as the accepted definition of this process.

3 Relationship between Bulk and Interfacial Rheology

In practice it is obvious that an interface has a finite thickness, realistically at least one molecule thick, which for surfactants and polymers is ~ 5-8 nm. Multilayer films at the interface can be up to 100 nm which as planar concentrations of molecules, fade away exponentially from the interface. In theory the interface is assumed to be zero e.g. 1 cm depth is considered to be infinite by comparison to the bulk, and this simplifies the mathematics. The following examples highlight how incorrect assumptions can lead to gross errors.

If we assume the liquid phase is homogeneous throughout its depth and a simple relationship exists between bulk and interface then:-

$$\eta_s \text{ (mN.s.m}^{-1}\text{)} = \eta_b \text{ (N.s.m}^{-2}\text{)} \times h \quad (1)$$

a) substituting literature values of η_s and η_b

$$1 \times 10^{-3} = 0.05 \times h$$

$$\underline{h = 2 \text{ cm}}$$

b) substituting known values of η_s and h

$$1 \times 10^{-3} = \eta_b \times 1 \times 10^{-7}$$

$$\underline{\eta_b = 1 \text{ kN.s.m}^{-2}}$$

The equivalent viscosity of materials such as pitch, tar, grease and butter! The moral is 'Don't make unqualified assumptions'

4 Relationship between Interfacial Tension and Interfacial Rheology.

Consider the picture of a surface with surfactant molecules present and movable barriers. After a time a dynamic equilibrium with the bulk is set up such that the rate of adsorption is equal to the rate of desorption. If the central barrier is moved quickly to the left the molecules in the gap A - B (compressed surface) initially move to the bulk while those in the gap B - C (expanded surface) move from the bulk to the surface, Fig 3. Depending on the concentration the changes are not instantaneous. For a surface pressure, π , at time t , the dynamic surface tension, σ_t is:-

$$\sigma_t = \sigma_0 - \pi \quad (2)$$

where σ_0 is the surface tension of pure solvent.

N.B. Where there is no external factor influencing the rate at which a molecule reaches a new interface e.g. stirring, the early stage is described by :-

$$\frac{dn}{dt} = \left(\frac{D}{\pi}\right)^{1/2} C N_0 t^{-1/2} \quad (3)$$

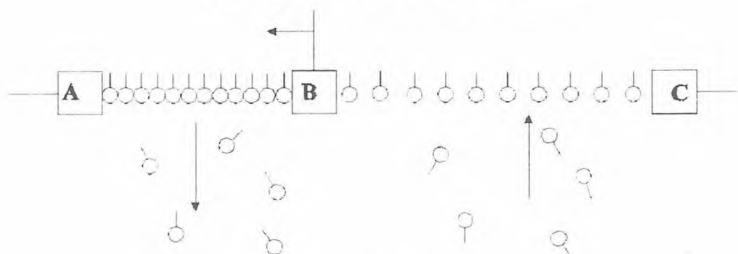
where :-

D = bulk diffusion coefficient

C = bulk concentration away from the interface

N_0 = Avogadro number

Adsorption Kinetics at Interface



*N.B. Dynamic equilibrium when
rate of adsorption = rate of desorption*

Fig. 3 Adsorption Kinetics of a Monolayer at an Interface

This is the behaviour which techniques such as the Krüss BP2 Maximum Bubble Pressure and DVT-10 Drop Volume Tensiometer systems use for dynamic tension measurement. On the assumption that the monolayer behaves ideally during the early stages of the adsorption the surface pressure is proportional to the surface concentration. Hence from the experimental $d\sigma/dt$ values the rate of diffusion to the interface dn/dt can be calculated. This is before desorption becomes significant.

Many people assume that the interface is characterised by the tension alone in which case there would be no such thing as interfacial rheology. However as stated before interfacial tension can only act in the plane of the surface and at right angles to a small line embedded in the surface. The total surface stress in dilation (elongation) and shear is made up of four components (2 normal, 2 shear) with the same units as interfacial tension i.e. mNm^{-1} . There is a functional dependence on surface tension which according to Vermaak et al¹ is :-

$$P_{ij} = \delta_{ij}\sigma + \frac{d\sigma}{d\varepsilon_{ij}} \quad (4)$$

where δ_{ij} = Kroneka Delta = 1 when $i = j$ and 0 when i does not = j

σ = surface tension

ε_{ij} = surface strain tensor

P_{ij} = surface stress tensor

In simple terms this mathematical term, δ_{ij} , means that surface tension has a functional effect in dilation where the force is in the same direction but it has no effect in shear.

Note that dilation describes a change of surface area and shear is the resistance to changes in shape, Fig. 4. For the purpose of this article we will be concentrating on interfacial shear rheology.

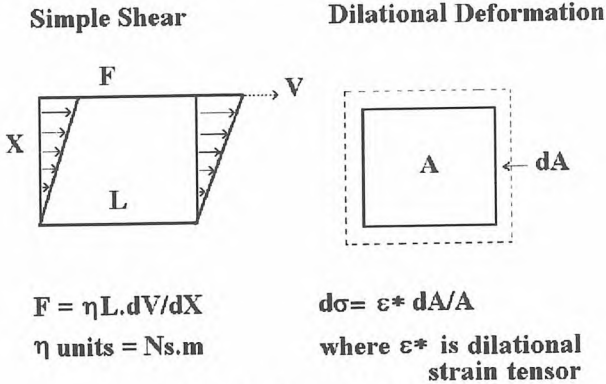


Fig. 4 Shear and Dilation

5 Oscillating Ring Technique for Interfacial Shear Rheology

By using an oscillatory method a given element of a surface can be sheared without changing the area of that surface i.e. the surface pressure is constant and there is no tendency for material to diffuse in or out of the surface.

The interfacial rheometer used for this work has MS Windows software for control, capture of data, analysis and storage of data. It is possible to run the sweep procedures as time, strain amplitude, frequency and temperature i.e. the range of tests associated with the bulk. The instrument is stress controlled and uses a virtually frictionless suspension mechanism, similar in principle to a taut band galvanometer movement, as the drive to which the measuring geometry is attached. The standard geometry is a Pt/Ir du Nouÿ ring. A high resolution displacement sensor is used to monitor strain amplitude over the range $\pm 1^\circ$, Fig. 5.

A microprocessor system forces the mechanism into a condition of resonance by adjusting various elements of the feedback network. The system can exhibit resonant behaviour at frequencies other than the natural frequency. This technique is known as normalised resonance.

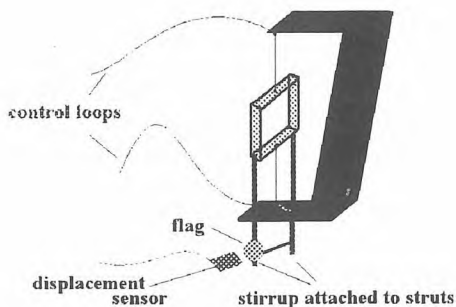


Fig. 5 Schematic Diagram of the Measuring Head

From vectorial analysis of the control system under these conditions the real and imaginary parts of the describing equation are mutually independent and proportional to G' and G'' respectively. As such the elastic (G') and viscous (G''/ω) constants are calibrated separately and the calculated values are obtained independently from the instrumental factors e.g. inertia, damping constant etc.

5.1 The Reference Test

The basis of any rheological measurement in the interface is that of comparison i.e. there are no 'calibration fluids' like those used in bulk rheology. A reference test is conducted at fixed frequency and amplitude for any number of phases. This provides raw viscosity and elasticity values which are subtracted from each test sample. Fig. 6 shows how air, the surface of water and the bulk of water compare against reference values collected in air.

It should be noted that:-

- a) an oscillatory test run in air will produce values relating only to the instrument's own properties i.e. calibration against zero interfacial properties.

- b) a test conducted at the surface of 'pure' water assumes a zero interfacial elasticity and negligible interfacial viscosity. If the ring is placed in the bulk of the water the viscosity increases as the bulk is more viscous and there appears to be negative elasticity due to added inertia.
- c) a test to compare liquid / liquid behaviour should use the interface between the two 'pure' phases as a reference.

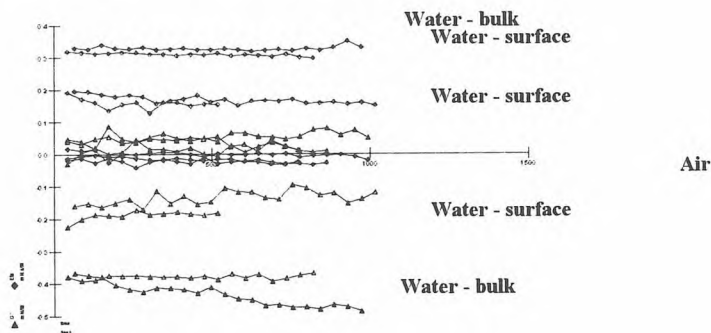


Fig. 6 Time Sweep for Air and Water (surface) & (bulk)

The interfacial rheometer has an automatic procedure to collect reference data which are stored in a library from which the operator selects the appropriate phase for each test. It should be noted that reference data must also specify the measuring geometry as this affects such factors as moment of inertia etc.

6 Potential Application Areas

During the stabilisation of emulsion droplets by interfacial films, the initial process of emulsion formation creates a very large new interface. Multiple coalescence, which destroys the emulsion, can occur if the new interface is not protected in a short time. The final equilibrium state of the interfacial film dictates how well the emulsion will last.

Similarly stabilising of foams needs the same protection and it therefore goes without saying that if demulsification and defoaming is the application then protection is not required.

Elastic (solid-like) films have long been associated with the stability of emulsions and foams.

Industry -

Large polymer molecules occur at the liquid/liquid interfaces in the formation of oil-in-water emulsions used in such industries as pharmaceuticals, agrochemicals, paint, paper coating and food.

Multiple emulsions, using adsorbed polymers as stabilisers, are effective in the preparation of microcapsules.

Foam stability relies on correct control of the liquid/gas interface and is relevant to processes such as baking, cosmetics, brewing, metal recovery and prevention of river pollution to name but a few.

Flexible rubber and plastic products also rely on foam stability knowledge for optimisation of quality control.

Biology - medicine, bio-physics - in Health & Disease

Human & Animal body fluids - blood, mucus, saliva, serum, synovial fluid, etc.

6.1 Preliminary Experimental Results

6.1.1 The Behaviour of 'stable' Foam Surfactants

Two surfactants from different suppliers and used for foam stability had previously shown no differences when measuring both static and dynamic surface tension. However they behaved differently in the process.

When measured in simple shear at the interface with air there was a noticeable difference between the two samples diluted as required and measured immediately and after 3 days. Surfactant 1 showed rapid increase in the elastic component during the first 15-20 min before slowly falling away and after one hour the equilibrium condition had not been reached. After 3 days the same diluted sample was measured over 30 min and showed a much changed profile with G' 's considerably lower but increasing. Surfactant 2 had a much lower and slowly decaying G' 's when first tested and gave the same result three days later, Fig 7. Surprisingly the manufacturer of Surfactant 1 claims that the product is stable!

The loss modulus (viscous component) of Surfactant 2 was lower than Surfactant 1 and practically time independent and repeatable after 3 days. Surfactant 1 reached a maximum within a few minutes and slowly decreased to reach a near equilibrium state. After 3 days G'' 's was lower but appeared to be increasing to the equilibrium, Fig. 8.

Further tests are in place to study foaming and defoaming agents in more detail and compare with surface tension data.

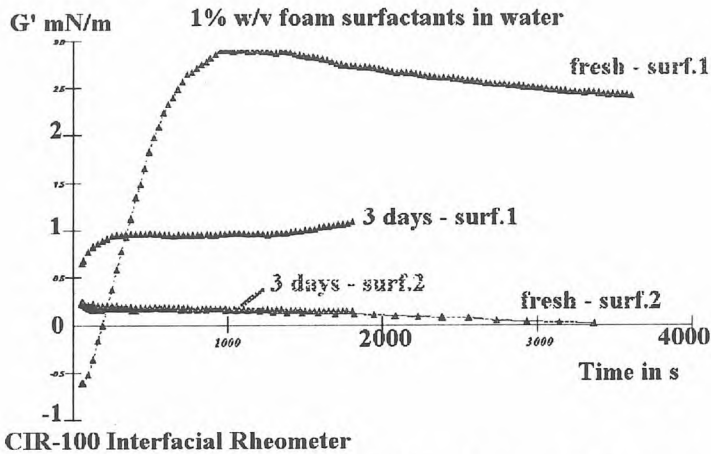


Fig. 7 Surface Elastic Modulus of 2 Foam Surfactants

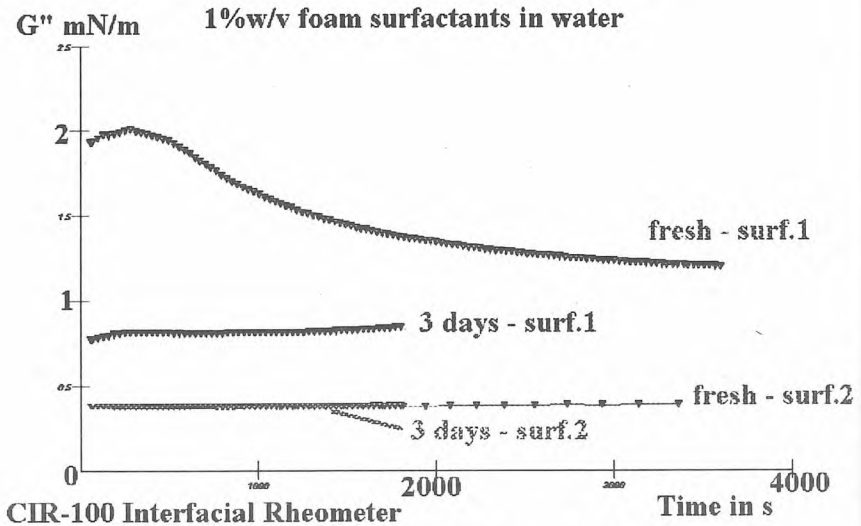


Fig. 8 Surface Loss Modulus of 2 Foam Surfactants

6.1.2. Monitoring of Foam - growth and decay

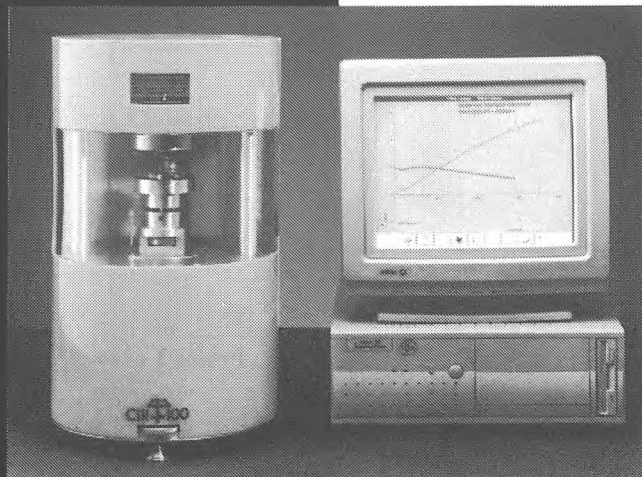
The quantification of the growth and breaking of a foam are of vital importance in understanding the properties and hence formulation and quality control of foam properties. We all expect bubbles to last in our bath and where would Guinness be without its head? However in other circumstances foam can be an unwanted parameter.

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Preliminary results from 3 foam tablets (different suppliers) were obtained by lowering the du Noüy ring into the bulk of the foam produced by dissolving each tablet in similar amounts of water. The resultant η 's curves from a time sweep monitored the strengths and lifetimes of each of the three foams. Surface viscosity clearly reflected the behaviour of each foam as visually observed and showed differences between the samples, Fig. 9. Foam 1 was tested over 300 sec but as the foam showed no sign of breakdown the test was restarted hence the two curves for Foam 1 covering ~ 600 s. After some time the foam reached a constant value for 40-50 sec and then decreased in line with the period of the foam liquefying. Foam 2 grew for a short period, levelled out and broke after ~120s. Foam 3 hardly foamed at all, turning into liquid almost immediately.

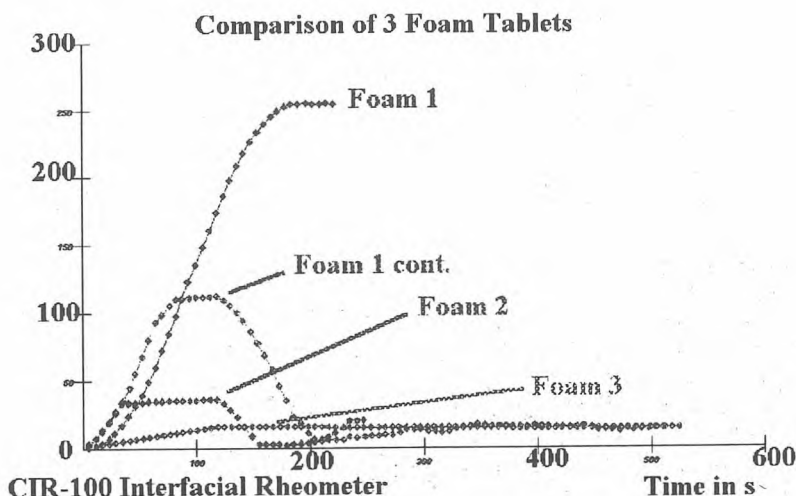


Fig. 9 The Growth and Decay of Foam

6.1.3 Effects of Additives on Carboxymethylcellulose (CMC)

Interfacial rheological measurements on carboxymethylcellulose, a common component in artificial saliva formulations, to see the effect of changes in pH, ionic strength and detergents, were conducted by Smith et al² in 1992. Surface Tension tests were also carried out on the same samples for comparison. In all cases the tension initially decreased rapidly followed by a period of slower decline but the rigidity modulus, G'_s , behaved differently depending on the environment and additive.

Similar tests have been conducted with this interfacial rheometer and the same Processor Tensiometer with additives of salt, sugar and salt + vinegar (without the fish and chips!). The results of the tests on the CIR-100 show that the additives do not rank in the same order as the results from the tensiometer, Figs 10-12. These results confirm that there are differences when measuring forces in shear as opposed to the forces of interfacial tension.

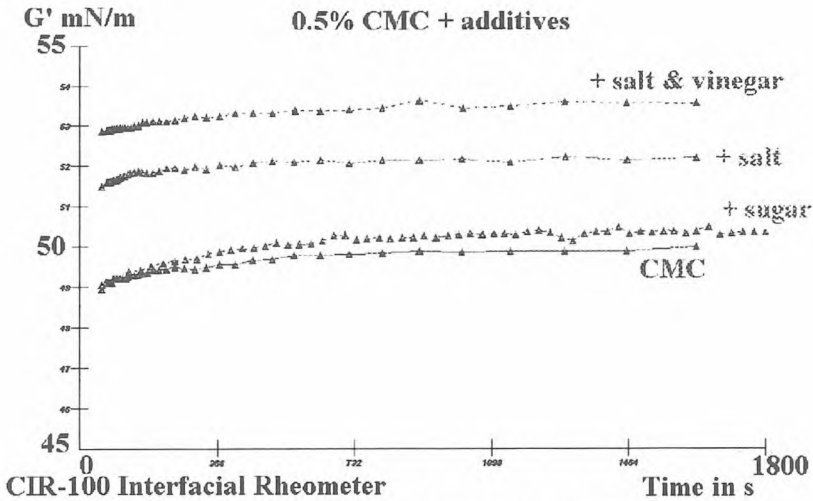


Fig. 10 G'_s of 0.5% CMCellulose in distilled H_2O (1996)

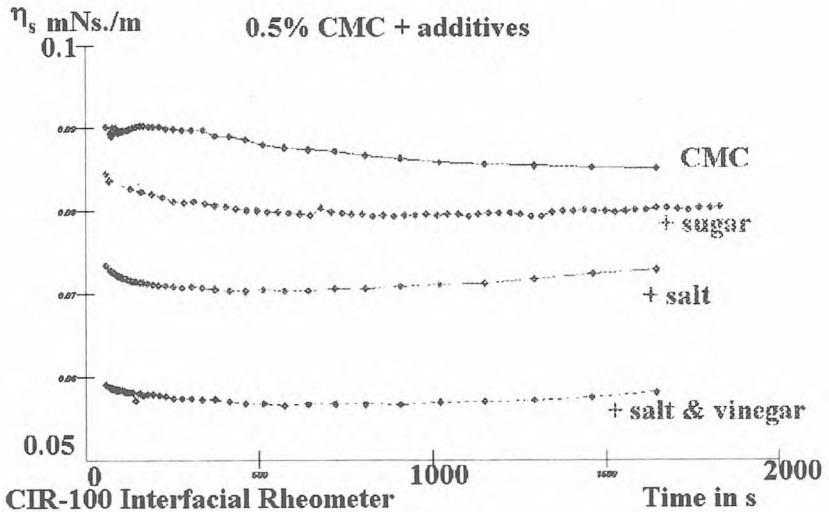


Fig. 11 η'_s of 0.5% CMCellulose in distilled H_2O (1996)

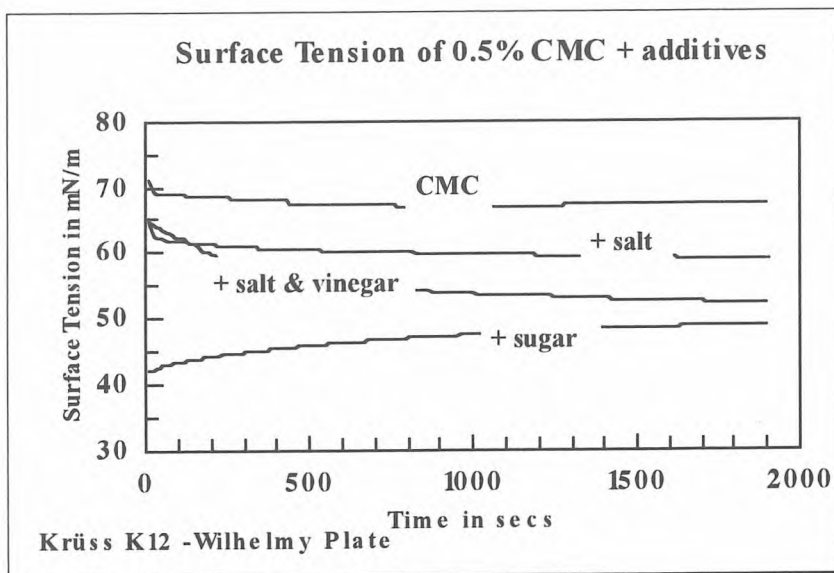


Fig. 12 σ of 0.5% CMCellulose in distilled H₂O (1996)

7 Conclusion

With the increase in technology, the recently developed interfacial rheometer has provided additional information about the interface which was not apparent from interfacial tension data.

Current application areas which are being studied include anti-foam formulations, stability of emulsions, effect of additives on gums and molecular interactions between lung surfactants, stabilisers and pluronics.

Note, in the book edited by Collyer³, a chapter is devoted to Surface Rheology.

8 References

1. Vermaak, J.S., Mays, C.W., & Kullman-Wilsdorf, D., Surface Science, 12(2): 128-133, (1968)
2. Smith, S.R., Warburton, B., Moules, C.A. & Challacombe, S., Gums and Stabilisers for the Food Industry 6: Oxford, New York and Tokyo, (IRL) Oxford University Press 501-506 (1992)
3. Collyer, A., Techniques in Rheological Measurement, Chapman & Hall, 1st Edition 1993, 2nd in preparation

EUROPEAN NEWS

LETTER FROM THEIR PRESIDENT TO THE MEMBERS OF THE NORDIC RHEOLOGY SOCIETY

This year has been a very active period for the board of the Nordic Rheology Society (NRS).

First a revision of the charter of the society has been completed. The revised charter will be discussed and voted on at the General Business Meeting of the NRS Rheology Conference in Stavanger, June 12-14.

Secondly the British Society of Rheology and other European societies have been working very actively on the creation of a European Society of Rheology. The national societies of rheology and not individuals should be members of the European Society.

Two advantages could be mentioned. The formation of a European Society would give our members a better chance to get to know rheologists from all over Europe and a European Society would have the resources to produce a Newsletter of much higher quality, than now.

The proposal was discussed at several board meetings of the Nordic Rheology Society. Considerable scepticism was expressed by the board members. No great need for such an umbrella organisation was seen, and fear of creating a bureaucratic mastodon was another point which was brought up against the idea of forming a European Society of Rheology. The conclusion was that the board decided to recommend the members to vote against membership of the European Society of Rheology at the present time. The matter will be discussed at the General Business meeting in Stavanger, where the members of the Nordic Rheology Society must take a decision.

It has been decided that the next NRS Rheology Conference (1997) will be in Iceland with Dr Olafur Wallewik as conference chairman. The 1998 conference will be in Sweden, probably in Lund.

It was also decided that the Nordic Rheology Society should submit a proposal to host the International Conference on Rheology in the year 2000. However, it turns out that both the British and German Societies intend to submit proposals, leaving us with only a small chance of being selected by the ICR delegates in Quebec. I am presently negotiating with the British in an attempt to find a compromise solution.

Prof. Ole Kramer
København Universitet.

The Nordic Rheology Society

The 5th Annual Meeting of the Nordic Rheology Society was held in Stavanger on Wednesday 12th to Friday 14th June 1996.

Three invited lectures were scheduled on:

"The Influence of Rheology - Structure Relationships on Processing and Stability of Food Suspensions", Eric Windhab;
"On the HPHT Rheology and Hydraulics of Synthetic-Based Drilling Fluids", Mario Zamora;
"A Coating Technology Topic", Volker Ribitsch.

In addition there were scheduled to be a further 24 papers presented, grouped into six sessions entitled:

General Industrial Rheology and Instrumentation
Food Rheology
Non-Newtonian Fluid Mechanics
Petroleum Technology
Coating and Suspension
Polymers and Polymeric Liquids

CONFERENCE ANNOUNCEMENT

THE SECOND INTERNATIONAL CONFERENCE ON 'THE DYNAMICS OF POLYMERIC LIQUIDS'

This Conference will take place at the Hotel Residenza, Capri from May 7th - 10th, 1997.

Further details may be obtained from:

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University of Wales,
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Bitumen surface chemistry and emulsions Rheology

Nynäs Petroleum requires two specialists, one in bitumen surface chemistry and emulsions, the other in rheology.

Both positions are based in Nynas' new research and development centre - Group Competence Centre (GCC).

GCC is located close to Stockholm in Sweden. GCC reports to the Technical Director.

The bitumen surface specialist is to be responsible for further developing the knowledge behind Nynas' emulsion based Cold Paving Technology programme. Responsibilities will also include other R&D projects within GCC as well as specialist technical support for the Business Areas within the Nynas Group. R&D projects will involve close contacts with external research institutes and universities, mainly in Europe.

Scope of the work includes fundamental aspects of emulsification, adhesion, breaking of emulsions as well as an understanding of how the final products are applied and their function in the final road application. The position is a key one within an extensive network consisting internally of GCC and the three Bitumen Business Areas, and externally of chemical suppliers, research institutes, universities and customers.

The ideal candidate will have a university degree or equivalent and more than five years of applied research experience in industrial emulsions, such as paints, surfactant chemicals, foods, bitumen emulsions, pharmaceuticals and so on. The applicant must be capable of communicating scientific and technical information internally and externally.

Nynas' company language is English. To applicants for this position, knowledge of other languages, particularly French, German and Spanish, will be an advantage.

The rheology specialist will be responsible for enhancing Nynas' knowledge of rheology mainly relating to the mechanical performance of bitumen. The work will include other R&D project work as well as specialist technical support for the Business Areas within the Nynas Group. R&D projects will involve close contacts with external research institutes, other companies and universities in Europe, the USA and South America.

Scope of the work includes fundamental aspects of rheological performance and testing as well as an understanding of how our products are applied and their function in the final road or industrial application.

The ideal candidate will have a university degree or equivalent and be interested in applied research relating to the mechanical performance of bitumen and/or polymers. The applicant must also be capable of communicating scientific and technical information internally and externally.

Nynas' company language is English. To applicants for this position, knowledge of other languages, particularly French and German, will be an advantage.

Applications with CV should reach AB Nynäs Petroleum, Human Resources, P.O. Box 10700, 121 29 Stockholm, Sweden, by no later than 22 August 1996.

For further information, please contact:

Martin Carlson, Technical Director, phone +46-8-6021291 or +46-8-520 65053.

Per Redelius, Research Specialist, phone +46-8-520 65370
Berndt Nilsson, Human Resources, phone +46-8-6021293

RHEOLOGY ABSTRACT NEWS

The first issue of Rheology Abstracts Volume 39, recently distributed to members, is associated with several changes, described below.

The foremost is that after a long and useful period with Elsevier as publishers, Rheology Abstracts is now once again published by the British Society of Rheology. Many thanks to Elsevier and its staff for the past collaboration, and in particular for their help in the transitional process.

A second change is that two of the Society's Officers are now involved in the production of Rheology Abstracts.

The Publication Manager is the present Membership Secretary, Dr N.E. Hudson. Please address matters to Nick Hudson which pertain to the printing, production and distribution of Rheology Abstracts and the sister publication, this Bulletin of the British Society of Rheology.

The current Honorary Editor is Dr G.H. Meeten, who will continue the collation and editing of material sent by the Abstractors, as previously. Matters which relate to the abstracts should be addressed to the Honorary Editor. Please note that Abstractors are still required; Gerry Meeten would be delighted to hear from potential abstractors. The addresses of both Officers can be found in the inside front cover of either the Bulletin or the Abstracts.

Another item of note is that the Abstracts are now indexed by their Abstract Number, rather than by the page, as previously. This step has been taken to facilitate electronic versions of Rheology Abstracts which are planned for the future.

With the invaluable and tireless input from its Abstractors, Rheology Abstracts is now set for moderate growth, in both size and scope. Please address queries or suggestions about Rheology Abstracts to either Nick Hudson or to me, as appropriate. Feedback of any kind, from BSR members or other readers of Rheology Abstracts, is appreciated.

G.H. Meeten
Hon. Editor

CONFERENCE ANNOUNCEMENT

Second BSR Young Rheologists' Day

Wednesday, 4th September 1996
at the

De Vere Hotel, Coventry, CV1 5RP

Following the success of the last Young Rheologists' Day in 1994, the Society intends to hold a second meeting devoted to short presentations on all aspects of Rheology and invites contributions from research students, industrialists, and other young rheologists. We anticipate that talks will be given by recipients of travel or study grants and by holders of the BSR's Scott Blair Scholarships. There will be awards for the best presentations, as judged by a panel.

The BSR's Annual General Meeting will also held during the day at 3 pm.

To encourage participation, the BSR Council has decided that there will be no charge for attending this meeting. A free buffet lunch will also be provided. Travel grants may also be applied for from the organiser.

For those people wishing to present a paper at the Young Rheologists Day, please send the title and a short summary of the paper **ASAP** to:
Paul Doody, National Starch & Chemical, Galvin Road, Slough, SL1 4DF.

Booking Form (may be photocopied if preferred)

Please return as soon as is possible

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CONFERENCE DIARY

DATE	PLACE	DETAILS
4-9/8/1996	Seoul, Korea	'36th IUPAC Int. Symposium on Macromolecules' Contact: Dr Kwang Ung Kim, Div. of Polymers, Korea Institute of Science and Technology, Seoul 130-650, Korea. Fax: 822 957 6105
18-23/8/96	Quebec City, Canada	'XIIth International Congress on Rheology' , Canadian Rheology Group / Groupe Canadien de Rhéologie, Chairman: Prof. D.DeKee, Dept of Chemical Engineering, University of Sherbrooke, Sherbrooke, Québec, J1K 2R1. Canada Congress Secretary: Dr M. Dumoulin, National Research Council - Canada Industrial Materials Institute, 75, de Mortagne, Boucherville (Québec), Canada, J4B 6Y4 Fax: 1-514-641-5103
4-5/9/96	Coventry, UK	Annual BSR Meeting and AGM 'Young Rheologists Day' & 'Controlled Stress Rheometry' Contact: Dr Paul Doody, National Starch & Chemical Ltd, Galvin Rd., Slough, Berkshire, SL1 4DF Tel: 01753-533494 Fax: 01753-577704 email: paul.doody@nssgb.co.uk
9-11/9/96	Aberystwyth, Wales	'4th International Conference on Flow Processes in Composite Materials (FPCM '96)' Contact: Dr R.S.Jones, Dept of Mathematics, University of Wales, Penglais, Aberystwyth, Dyfed, SY23 3BZ, UK Tel: +44(0)1970-622762 Fax: +44(0)1970-622777
17-18/9/96	Cirencester, UK	BOHLIN Instruments Limited 'Rheology User Group Meeting, 1996' Contact: Trevor Gregory, Bohlin Instruments Ltd., Unit 6, Corinium Centre, Cirencester, Glou., GL7 1YJ, UK Tel: +44 (0) 1285 644407 Fax: +44 (0) 1285 644314
29/9-4/10/1996	Karacharovo Russia	Vinogradov Society of Rheology, '18th Symposium on Rheology' Contact: Prof V.G.Kulichikhin, A.V.Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences, 29 Leninsky Pr., Moscow 117912, Russia. Tel: (095) 955-4388 Fax: 7-(095)-230-22-24

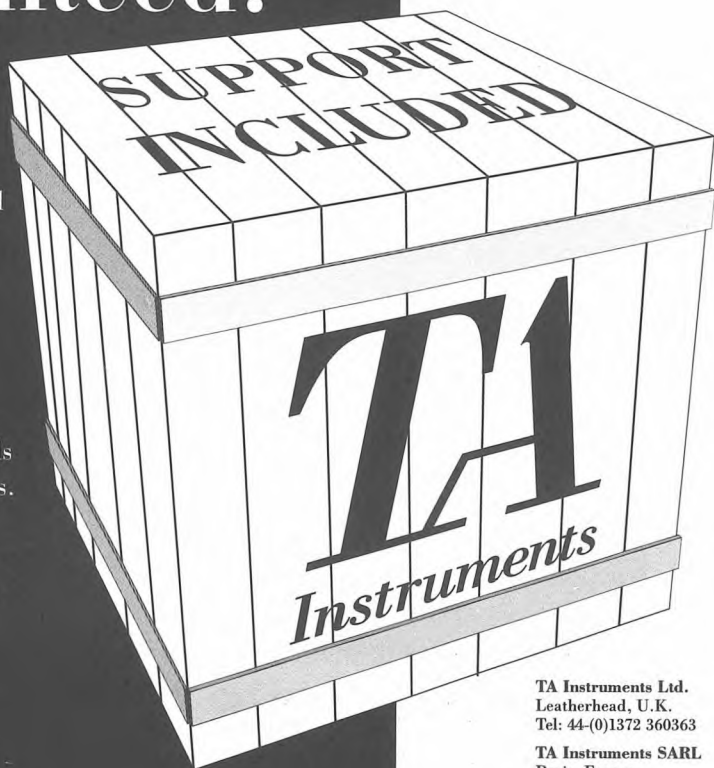
Travel grants are available to help students attend any of these meetings.
Applications to the BSR Secretary supported by a letter from supervisor.

DATE	PLACE	DETAILS
28-30/10/96	Metz, France	Joint Meeting of French and German Rheologists 31 ^{ème} Colloque Annuel du GFR, ' Rheology and Structure ' Contact: Prof R.Gressely, L.P.L.1., Groupe RhéoPhysique des Colloïdes, 1, Bd Arago, F-57078, Metz Cedex 03, France. Fax: (33) 87 31 58 01 E-mail: makh@ipc.univ-metz.fr or Dr M.Kröger, Technische Universität Berlin, Institut für Theoretische Physik, Hardenbergstr. 36, Sekt. PN 107, D-10623, Berlin, Germany Tel: 49 30 314 25225 Fax: 49 30 314 21130 E-mail: mk@polly.physik.TU-Berlin.de
11-14/11/96	Chicago, USA	'American Institute of Chemical Engineers Annual Meeting and Polymer Processing Society Meeting for the Americas First Joint Topical Conference on ' Processing, Structure and Properties of Polymeric Materials ' Contact: Prof. I. Manas-Zloczower, Case Western Reserve University, Dept of Macromolecular Science, Kent Hale Smith Building, Cleveland, OH 44106. USA. Tel: (216) 368-3596 Fax: (216) 368-4202 E-Mail: ixm@po.cwru.edu
16-20/2/1997	Galveston, TX, USA	' 68th Annual Meeting of the Society of Rheology. '
16-20/3/1997	Zurich, Switzerland	' 1st Int. Symposium on Food Rheology and Structure. ' Contact: Congress Secretary, Applied Rheology, Vincent Verlag, 30062, Hannover, Germany. Fax: +49 511 9910399
7-10/5/1997	Capri, Italy	The Second International Conference on ' The Dynamics of Polymeric Liquids ' Hotel Residenza, Capri. Contact: Prof. K.Walters, Dept of Mathematics, University of Wales, Aberystwyth, Ceredigion, SY23 3BZ, UK Tel: +44(0) 1970 622750 Fax: +44(0) 1970 622777
27-31/7/1997	Melbourne, Australia	' Second Pacific Rim Conference on Rheology ' Conference Organiser: David V. Boger, Univ of Melbourne. Conference Secretary: Leong Yeow, Univ of Melbourne. Technical Programme: Carlos Tiu, Monash University. Local Arrangements: Sati Bhattacharya, RMIT. Contact: Christine Collis, Dept of Chemical Engineering, The University of Melbourne, Parkville, Victoria 3052, Australia. Tel: 61 3 9344 7440 Fax: 61 3 9344 4153 E-mail: prcr2@unimelb.edu.au
19-23/10/1997	Columbus, OH, USA	' 69th Annual Meeting of the Society of Rheology. '

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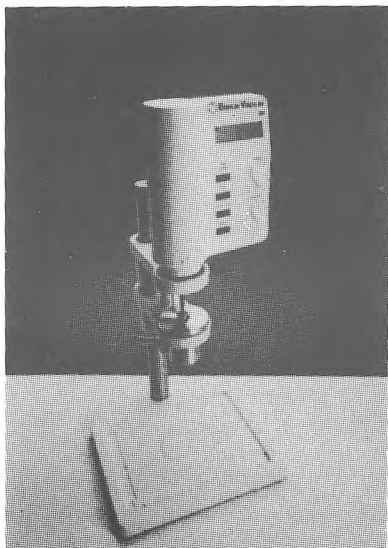
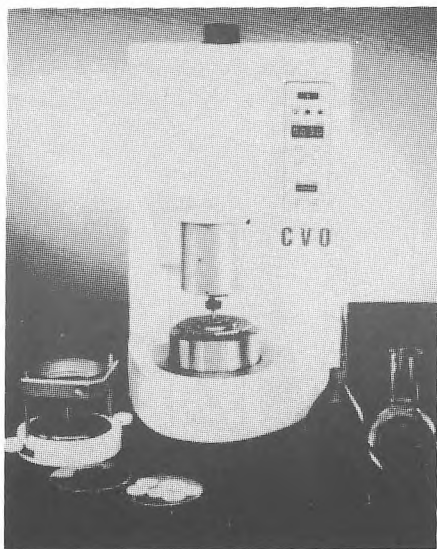


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COURSE DIARY

DATE	PLACE	DETAILS
3-5/7/96	Bristol Univ., UK	'Rheology for Technologists' Course organised by the Bristol Colloid Centre. Contact: Mrs M. Knights, Bristol Colloid Centre. School of Chemistry, University of Bristol, Bristol, BS8 1TS Tel & Fax: 0117-929-8388 E-mail: bcc@bristol.ac.uk
5-9/8/96	Minneapolis Minnesota, USA	21st Annual Short Course on 'Rheological Measurements: Applications to Polymers, Suspensions and Processing.' Directed by Christopher W. Macosko. Contact: Susan Burke, Professional Development and Conference Services, University of Minnesota, 204 Nolte Center, 315 Pillsbury Drive S.E., Minneapolis, MN 55455-0139 Tel: (612) 625-3530, Fax: (612) 626-1632 E-mail: sburke@mail.cee.umn.edu
26/9/96 24/10/96 28/11/96	Cirencester, UK	One Day Rheology Workshops at BOHLIN INSTRUMENTS LIMITED 'Paint Rheology' 'Pharmaceuticals Rheology' 'Polymer Rheology' Contact: Trevor Gregory, Bohlin Instruments Ltd., Unit 6, Corinium Centre, Cirencester, Glou., GL7 1YJ, UK Tel: +44 (0) 1285 644407 Fax: +44 (0) 1285 644314
21-25/10/96	Hinckley, UK	School of Industrial Rheology - SIR '96 this year offers an optional Starter Day which can be taken on its own or added to the 4 day course below. Optional 'Back to Basics' day SIR '96 Venue: Hinckley Island Hotel, Hinckley. Sponsored by TA Instruments , Leatherhead, Surrey. Contact: Nicola Moules, Camtel Ltd , 5 Carrington House, 37 Upper King St., Royston, Herts, SG8 9AZ. Tel: 01763-244280 Fax: 01763-244298
21/10/96 22-25/10/96		
21-24/10/96	Strasbourg, France	'European School in Colloid Science' Organised by the Bristol Colloid Centre. Contact: Mrs M. Knights, Bristol Colloid Centre. School of Chemistry, University of Bristol, Bristol, BS8 1TS Tel & Fax: 0117-929-8388 E-mail: bcc@bristol.ac.uk

DATE

PLACE

DETAILS

4-8/11/96

Univ of Strathclyde,
ScotlandOne Week Course: '**Process Rheology.**'Contact: Prof J. Ferguson or Dr N.E.Hudson,
Dept of Pure & Applied Chemistry,
University of Strathclyde,
295 Cathedral St., Glasgow, G1 1XL.

Tel: +44 (0) 141 552 4400 X 2161/2 Fax: +44 (0) 141 552 5664

E-mail: j.ferguson or n.e.hudson@strath.ac.uk

BOOK REVIEW

The Thermodynamics of Rheology - Third Edition, by H. H. Hull

Published by H. H. Hull - Sponsored by The Society of Plastics Engineers.

This highly idiosyncratic book presents the author's treatment of rheology, as the title suggests, in terms of thermodynamics. As a result it is an alternative view of rheology, from a chemical and engineering viewpoint, that will appeal to those groups of rheologists who have despaired of understanding the more esoteric forms of constitutive equations so beloved of mathematicians. For those who have also despaired of understanding thermodynamics, it will be a comfort to know that the first 40% of the book deals with those principles of thermodynamics necessary to understand the remainder. Equations of state, the first and second laws of thermodynamics, entropy, thermodynamic functions, and models of systems in balance, are all covered. The remainder of the book considers the thermodynamics of elastic deformation, viscoelastic fluids, rheology in general, and chemical thermodynamics.

This reviewer had the uncomfortable feeling that the author was more at home with thermodynamics than with rheology. As the author admits, not all the concepts and conventions used are generally accepted. Key concepts reviewed at the end of the book include the suggestion that energy of elastic deformation has two components, one entropic and one not entropic; that rheological measurements made at one temperature are "unrealistic"; that enthalpy and internal free energy are free energies.....and so on.

As the author comments at the end, the book presents a radically different viewpoint of both thermodynamics and rheology. He clearly feels that the thermodynamics of rheology is a subject that can develop, although it is an area that has been neglected.

The problem with taking such a single-minded approach to rheology is that many of the concepts of "normal" rheology have been ignored. Extensional viscosity and the phenomenon of filament formation during extension are regarded as a good test for elasticity. This implies an ignorance of recent developments in extensional flow. Recent flow visualisation studies on melt fracture have been ignored in favour of very early work by Bagley (1956) and Tordella (1957).

The book was published by the author and composed using a home computer. As a result, it has the appearance of a set of lecture notes, an effect enhanced by the anecdotal style of writing. Figures have been scanned onto the page from other publications, giving the book an amateurish appearance. This is a pity since the book is well worth buying, if only to see rheology from a different point of view.

Jim Ferguson

MEMBERSHIP NEWS

The following applications for membership were approved at the Council meeting on June 6th, 1996.

Dr W. Canet,
Departamento Cimicia y
Tecnologia Productos Vegetales
Instituto del Frio, C.S.I.C.,
Ciudad Universitaria,
E - 28040 Madrid,
Spain
(fetsa L)

Dr A. Ericsson,
ABB High Voltage Cables AB,
Aud. TU,
Box 546,
S-371 23 Karlskrona,
Sweden
(feta CDG)

Mr M.F. Griffin,
SEAT,
Edinburgh Building,
University of Sunderland,
Chester Road,
Sunderland, SR1 3SD
(fesa GHIK)

Mr L.G. Hamilton,
Development Dept.,
D98 Laboratory,
Boots Contract Manufacturing,
Nottingham,
NG2 3AA
(fea DFGJ)

Mr W.P. Harvey,
Kalon Group plc,
Huddersfield Road,
Birstall,
West Yorkshire,

(peta BFGHK)

Dr M.A. Hulsen,
Lab. for Aero & Hydrodynamics,
Delft University of Technology,
Rotterdamseweg 145,
2628 AL Delft,
The Netherlands
(fets D)

Prof. J.C. Hyun,
Dept of Chemical Engineering,
Korea University,
Anam-Dong, Sunbuk-ku,
Seoul 136-701,
Korea
(fetsa BD)

Prof M.W. Johnson,
University of Wisconsin,
1415 Johnson Drive,
Madison,
WI 53706, USA
(ftsa CEJN)

Mr Chuanxian Li,
Centre for Oil Storage & Transp.
University of Petroleum,
Shandong, Dongying 257062,
The People's Republic of China
(fetsa DFGJO)

Dr F. Madsen,
Dept of Anal. & Pharm. Chemistry
The Royal Danish School of Pharm
Universitetsparken 2,
DK - 2100, Copenhagen, Denmark
(fetsa DFM)

Dr J. Muñoz,
Dept de Ingeniería Química,
Universidad de Sevilla,
c/ P Garcia González s/n,
41012 Seville, Spain

(fetsa FGLO)

Mr M. Nisbet,
SmithKline Beecham
Consumer Healthcare,
St George's Avenue,
Weybridge, Surrey,
KT13 0DE
(pesa FGO)

Dr J.G.L. Pluyter,
National Starch & Chemical Co,
10 Findeme Avenue,
Bridgewater,
NJ 08807
USA
(fetsa CDFGO)

Mr M. Riedlin,
Dept of Aeronautical, Mechanical
& Manufacturing Engineering,
Newton Building,
The University of Salford,
Salford, M5 4WT
(feta G)

Dr R. Rychwalski,
Dept of Polymeric Materials,
Chalmers Univ. of Technology,
S-412 96 Göteborg,
Sweden

(fetsa BCI)

Mr C. Sanders,
Stiefel Laboratories,
Whitebrook Park,
68 Lower Cookham Road,
Maidenhead, Berkshire,
SL6 8XY
(peta FG)

Miss N. Turner,
Civil & Building Eng. Dept.,
Loughborough Univ. of Technology,
Loughborough,
Leicestershire
(feta GHKO)

The following cease to be members under rule 4(d):

Dr R.S. Bailey, Mr A.M. Bellamy, Dr S. Blackburn, Prof. M.A. Da Silva,
Mr I.N. Forsdyke, Mr G. Gow, Mr R. Greenwood, Mr J.A. Handforth,
Mr P.N. Heyworth, Mr P.K. Jenness, Dr Ruifen Liang, Mr D.K. Majumdar,
Dr P. Matricardi, Dr C. O'Donnell, Dr A.V. Ramamurthy, Dr A. Senouci,
Dr J.M. Steuten, Mr J.C. Winterwerp.

With these changes, the membership stands at 602.

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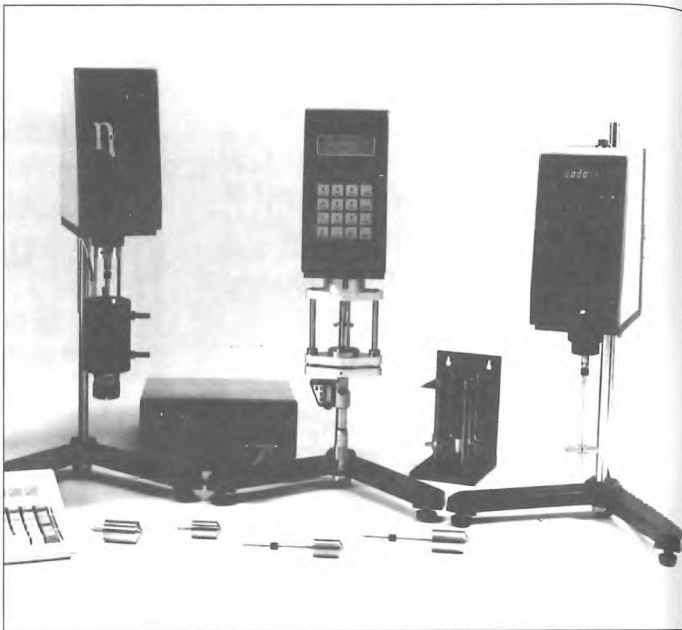
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