

THE BRITISH SOCIETY OF RHEOLOGY

BULLETIN



October 1996

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THE BRITISH SOCIETY OF RHEOLOGY

OFFICERS AND MEMBERS OF COUNCIL. 1996/97

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COMMENTARY ON COUNCIL MEETING AND AGM, SEPT 4th 1996

P.C. Anderson, Bulletin Editor

It has always been Council's policy to hold its AGM as a part of a Conference, to help in attracting an audience big enough to form a quorum. It has also been the practice to hold one of our regular quarterly Council meetings at the same time, before the AGM in order to be sure that we are properly prepared for it. It has however always been difficult to find a decent amount of time to hold this meeting, particularly during a one day conference. It would not be acceptable to hold it whilst technical papers are being presented as some Council members would wish to attend. It therefore often happens that the only time available is to hold the Council meeting over lunch and this is what was resorted to on this occasion. 10 members of Council had a quick buffet lunch in a corner of the conference room, whilst the other conference attenders retired to the dining room. As we looked out onto Coventry Cathedral, Gerry reminisced about his childhood memories of hearing wartime bombers overflying his home on their way to Coventry and other targets and how they sounded different when they returned lighter. I hadn't thought of him as old enough to remember the war.

Apologies were received from Russell and Tom, and also Peter Townsend, our incoming President, who would be present later at the AGM. We attempted to quickly correct the minutes of the previous Council meeting and deal with the matters arising. Discussion of future conferences took a bit longer than intended, so we then had to rush a bit through the presentations of the Council Officers' reports for the AGM. Howard proudly announced that we had won the vote in Quebec to host the next International Rheology Congress which will be in the year 2000 in Cambridge. An Executive committee under the chairmanship of Ken Walters will be soon be up and running to organise this important conference. A float for running expenses was approved.

Mike confirmed that although there had been some technical problems in getting the accounts prepared and audited, the Society's finances were in a very healthy state. Council were very appreciative of the efforts of Gerry and Nick in handling the transfer of the publishing of Rheology Abstracts from Elsevier to the BSR. This had resulted in a substantial increase in our income and would also enable us to make a number of improvements. The design of the new cover for the Bulletin was approved. You will see the results in the new year. By this time the returning conferees were battering down the doors, so we hurriedly approved the new members put forward by Nick and agreed the venue for the December Council, before returning to the afternoon session of the Young Rheologists Day.

At the conclusion of the conference, we proceeded to the business of the AGM, for which fortunately there was just a quorum. The minutes of last year's meeting were accepted and the Officers' reports were presented, starting with the outgoing President, Howard Barnes. These reports are reprinted in full elsewhere in this Bulletin. Howard was very pleased to be able to report on a number of important developments during his tenure. Under his Chairmanship of a formation committee, The European Society of Rheology had now formally been founded with 12 founder Societies or Groups. We had also won the vote in Quebec to host the next International Rheology Congress in 2000, narrowly beating the bid from the Korean Society.

The Hon. Secretary, Geoff reported on the work of a number of Council's subcommittees and their rôle in the future of the Society, before thanking his fellow councillors for all their efforts. Treasurer Mike apologised for the absence of audited accounts, but reported on the healthy state of the Society's bank accounts. A proposal to change our rules for the preparation and examination of annual accounts, and take advantage of new Charity laws which came into force from March 1st, 1996, was put to the meeting. When appropriate in future, we could chose to have our accounts scrutinised by external examination instead of being formally audited, in years when our income did not exceed £100,000. The BSR wished to take advantage of the new rules, as it would save on auditing costs. The proposal was approved.

Membership Secretary Nick, managed to convince the meeting that the virtually constant membership numbers was actually a healthy state of affairs, as we were able to replace, each year, the more than 10% that we lost due to changes of interest or other reasons. He also explained the additional rôle that he had taken on as Publications Manager, handling the subscriptions for, the printing of and the distribution of our two publications. Your Bulletin Editor reported that he had succeeded in producing another four issues and thanked his contributors whilst appealing for the continued supply of material for publication. So come on all you potential authors out there, lets hear from you, in your own name or under a pseudonym (Watson et al?). Abstracts Editor Gerry reported on a successful transition from Elsevier to in-house publishing. This freed us from some constraints, and he was hoping to expand the number of pages per issue, previously limited to 400pp per year. He reiterated the annual plea for more abstractors to come forward. In reply to a question, he projected a subscription income of some £28,000 p.a. against a production cost of some £8,000 p.a., significantly adding to the Society's income.

The meeting then proceeded to the election of Officers and Council members. There were no additional nominations for any of the positions, so all were elected unopposed and unanimously. The only change from last year's Council was Peter Townsend as President, Howard having completed his allotted term of two years. Secretary Geoff thanked Howard on behalf of Council and the members for his work for the Society. Howard welcomed Peter to the post, wished him luck and handed over the chain of office. There being no other business, Peter was able to close the meeting within minutes of taking over the Chair.

LETTERS TO THE EDITOR

Dear Editor,

Some of the early classic papers on Rheology (for example by Ostwald) were published in German. Does anyone know of good translations (into English) of any of these? It occurs to me that a collection of such translations would be a useful thing for the library to hold, or perhaps even publish. I have often found that there is much more in an old paper than is suggested by modern summaries, but it would be helpful to be sure that my understanding is accurate.

Yours sincerely,

Dr Martin J. Pitt

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Rheological Techniques - A Chance for a Bargain

Rheological Techniques by R.W.Whorlow, 2nd Edition, (Ellis Horwood, 1992, 460pp., £79.95) is about to go out of print. The author is, however, able to provide copies at the greatly reduced price of £15 (including postage and packing in the U.K.) for a very limited period. This is a chance to own your own copy instead of relying on the copy which someone else always seems to have borrowed from the library! However, orders, with cheques, must be received by November 16th at the latest by:

Dick Whorlow,
3, Pittville Crescent Lane,
Cheltenham, Glos. GL52 2RA.
Tel: 01242 23250963

OFFICERS' REPORTS TO THE 55th AGM OF THE BSR

4th September, 1996, De Vere Hotel, Coventry

PRESIDENT'S REPORT

This AGM brings my two-year term of office to an end. While, during that time, the Society has moved on at its usual pace, a number of important things have happened around it in the field of organised rheology. First we have seen the introduction of the IChemE's Applied Rheology Subject Group, then allied to this, the formation of the Industrial Rheology Working Party of the European Federation of Chemical Engineers. These last two groups are in addition to the existing Non-Newtonian Club which is also linked with the IChemE. Then at the end of June I organised the formation meeting of the European Society of Rheology (ESR) at Cambridge, which was the culmination of a task I took over from the last BSR President. The formation of all these bodies shows that the interest in rheology is alive and well, but it also shows that the BSR will have to come to terms with these new ways of doing things in the future. The Council has also sensed that the BSR might have to change to better serve its members and to this end it has organised a working party and plans a special in-depth study of the Society and its role.

Rather late in the day it was decided that having the next International Rheology Congress in the UK would be a good idea, especially as it would coincide with the Society's Diamond Jubilee and the year 2000! To this end I hurriedly put together a written application based on Cambridge as a venue, and with the help of the ESR in the organisation. I drew up a suggested list of people to sit on various committees, and contacted most of them, and thereafter had to apologise to one member for using his name without asking, and my apologies to any others in that position. This one-page proposal was sent - just in time - to all the national delegates. We were just ahead of the Korean Society in the subsequent postal vote, and both of us were well ahead of the Chinese Society. In the case of a close vote, it had already been decided by the International Committee that oral presentations should be made at the national delegate committee meeting at the then forthcoming International Congress in Quebec. Hence on the evening of August 20th, the Korean delegate and I addressed the national delegates in the penthouse conference suite of the Quebec Hilton, with its beautiful panoramic view of the old city. The outcome was that we came first with 11 votes, while the Korean Society got the support of 8 national delegates.

My best wishes go to those who will now have to live up to the promises I made for a wonderful "Rheology 2000" Congress in Cambridge.

In handing over to the incoming president, I wish him well and sincerely hope that the Society will be able to adapt to its changing environment and thrive as an organisation that gives its members what they need in a professional way, while still maintaining the well-loved informal club atmosphere that has always marked it. Thank you all for your support.

Professor Howard A. Barnes, D.Sc, FICChemE, FIM, CEng.
Unilever Research,
Port Sunlight Laboratory.

HON. SECRETARY'S REPORT

As you are no doubt aware, Council meets only four times a year and I suppose our meetings in some way reflect the pressures that we are all under. It is a fact of life that it is becoming increasingly difficult for Council members to attend all our meetings. As a consequence, significantly more time is taken up by meetings of sub-committee or working parties. Some of these are quite large, such as the Scott-Blair Working Party, involving our archivist, John Benbow, Tony Evans, Merwyn Jones, Russell Davies and library staff at the University of Wales Aberystwyth. It is hoped that very soon, the accessibility of our catalogue of rheological texts will be by electronic means as well as the well established hard copy. Following on, there is activity, albeit it slow at the moment, on our web page which is soon expected to go public. Of more immediate impact to our membership will be the redesigned front cover of our Bulletin, which involved a working party of one person (thanks to Carole).

Of greater significance to fellow rheologists was the creation of a European Society of Rheology, which this Council was actively involved in through the fine efforts of our President and founding Chairman of the ESR, Howard Barnes. A working party was also set up to look at our meetings, the Second Young Rheologists Day being but one example with others planned for September 1997, "New Frontiers in Rheology" and we have also been successful in our request to hold the International Rheology Congress in the year 2000.

After many years with Pergamon Press and subsequently Elsevier, Rheology Abstracts is now published by the Society. This logistic task has been undertaken successfully and the Council's thanks and appreciation go to Nick Hudson, Gerry Meeten and Elsevier for making the transition go as smoothly as it has. By taking on this enhanced role of preparing and publishing our own publications, it has led Council to decide that it should generate another executive post, that of Publications Officer. This more pro-active approach by Council has been considered expedient as we look to the "Future Role of the Society", a working party having recently been set up by Council to re-address its role, supporting the desires and expectations of its membership.

So, as you can see, Council is actively involved in many areas in support of the objectives of the Society. Some of our expenditure has gone in awards and thus is but one aspect that Council hopes to develop, made possible by our anticipated healthy financial position.

In conclusion, may I thank all my fellow Council members for the support given to me and the Society. Special mention must, of course, go to our retiring President, Howard Barnes, who has steered well over the past two years.

Geoff Brownsey
Institute of Food Research, Norwich

TREASURER'S REPORT

The Treasurer reported that 1994/95 accounts were still with the auditors, having been tripped up at the last moment due some anomalies in the data provided by the previous treasurer. He was confident that the problem was minor and did not significantly affect the financial position of the Society. The draft accounts had shown a total expenditure of £13,897 against an income of £15,061 (figures very similar to those of the previous year). The total assets amounted to £40,971, up £1,163 from the previous year. In addition there was £10,545 in the Scott Blair Legacy fund. The preparation of the accounts for 1995/96 was nearly complete but some data was still needed so that they are a little behind schedule and could not be presented to the AGM. The Treasurer proffered his apologies and assured the meeting that the Society had achieved a substantial excess of income over expenditure this year, mainly due to producing Rheology Abstracts in-house.

The balances in the various bank accounts currently totalled about £67,000 plus £11,000 in the Scott Blair Legacy fund.

The background to the proposal to change our rules for the preparation and examination of annual accounts was explained. This arose from a change in the Charity Commissioners' rules governing the accounts of charities which came into force from March 1st, 1966. This meant that in future Charities needed only to have their accounts scrutinised by external examination instead of being formally audited, provided their income did not exceed £100,000 p.a. An annual report would still need to be prepared and submitted to the Charity Commissioners. The BSR proposed to take advantage of the new rules, if the AGM approved, as it would save on auditing costs.

Mike Webster
Dept of Maths & Computer Science,
University College Swansea

MEMBERSHIP SECRETARY'S REPORT

Preamble

I have now completed my second year in the position, and hope that I have maintained the standards set by my predecessor. An *addenda and corrigenda* sheet to the membership list has been issued; a new membership list will be published next Summer (1997). You will hear from the Abstracts Editor that the Rheology Abstracts are now printed at the University of Strathclyde, in addition to the Bulletin. I have the responsibility of Publications Manager, which involves overseeing the work of an administrative assistant who invoices customers, sends out reminders, handles the correspondence, deals with the printers, and posts out the two journals.

As you will see, our membership has risen slightly over the year. Most of the departures have been of people for whom we no longer have a current address, and who have not paid their subscription for at least a year. Hopefully, this will be the last year for a serious cull (none of our members has BSE), and we should now start to increase our membership significantly. Please keep recruiting!! We still give some of the best value for money in a Scientific Society.

Statistics

Membership Information , 1995-1996

	Total	New members	Resignations, etc
Total membership	605 (601)	74 (35)	69 (45)
UK	407 (413)	30 (22)	
Overseas	198 (193)	44 (13)	

() indicates the 1994-1995 figures.

Nick Hudson

Dept of Pure & Applied Chemistry,
University of Strathclyde, Glasgow

RHEOLOGY ABSTRACTS EDITOR'S REPORT

As from January 1996, Rheology Abstracts is published by the British Society of Rheology, instead of Elsevier. I pay tribute here to our present Membership Secretary, Dr Nick Hudson, who engineered and oversaw the transition. As previously published by Elsevier the annual page budget was 400. This restricted the annual number of published abstracts to about 900. We now have the opportunity to expand our page and number output, and a small expansion has taken place this year, with more planned for 1997.

Such expansion requires more abstracts to be delivered to the Editor. In previous articles in the Bulletin this year I have pleaded for more Honorary Abstractors. I am now pleased to report a modest increment in the number of Abstractors, who are abstracting from fields previously not well covered.

In other Bulletin articles I have described the work of the Editor and the Abstracting team, and asked the membership for their views and comments on Rheology Abstracts. The survey did not reveal great dissatisfaction, and personal communication generally has been favourable, allowing me to assume that members are generally content with the publication. RA in its present paper form is being considered for electronic dissemination; the survey here showed neither great enthusiasm nor great dismay. It is clear that the paper and electronic versions need to coexist for some time ahead.

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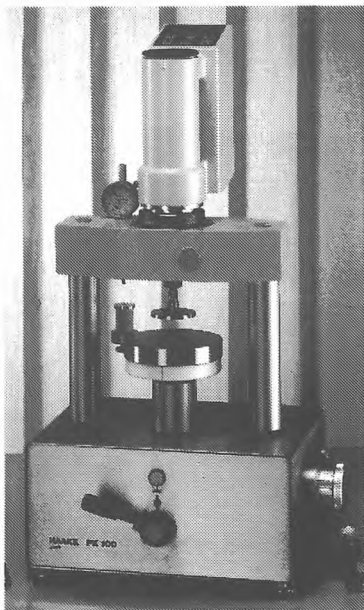
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I reiterate the need for more abstractors in the world where both rheology and publication are expanding. Three simple steps are required:

1. Contact the Hon. Ed. regarding what journal(s) you can abstract from.
2. When (1) is agreed, look at the journal(s) regularly and find abstracts.
3. Photocopy the abstract page onto A4 paper and send it to the Hon. Ed.

Even a dozen abstracts a year are well worth the effort. Your name will be gratefully registered in the RA's list of Abstractors, and you will have the satisfaction of service for your Society and for Rheology.

Gerry Meeten, Hon. Ed. Rheology Abstracts
Schlumberger Cambridge Research

BULLETIN EDITOR'S REPORT

I have now completed my second year as Bulletin Editor with the issue of Vol. 39 No 2. The four issues contained a total of 156 pages and earned advertising revenue of some £4250. I have tried to speed up the appearance of each issue and this has been helped by switching the printing to the University of Strathclyde. My thanks to Nick Hudson, now elevated with the additional title of Publications manager. However each issue was still appearing well after its cover date, with number 4 (December) only getting to members in about February. It is intended to rectify this and get the four numbers of a Volume out within the same calendar year, by issuing a special number before the end of this year containing reports from the meetings during the Cambridge workshop on 'Dynamics in Complex Fluids'. This will also bring the numbering of the Bulletin and the Abstracts into line. In this coming year there will be a new look to the Bulletin, with the introduction of a coloured cover. We will continue to try to include more European news, now that the ESR is off the ground.

May I thank all the contributors to the Bulletin over the past year and I look forward to your further support next year; without you and your letters and reports there would be no Bulletin.

Peter Anderson

PROFILE OF THE SOCIETY'S NEW PRESIDENT

Peter Townsend

Peter, like the outgoing President, Howard Barnes, is a product of the Aberystwyth School. Both were amongst some of the first research students of Ken Walters and in fact worked together in the late 60's on aspects of pulsatile flow. There was that dreadful day when they tried to pump cow's blood around Howard's apparatus. Quite a mess. Fortunately Peter's job was to simulate the flow on a computer so he retired quickly to the infinitely safer and cleaner computer room.

Peter was born in industrial South Wales, received a conventional Grammar School education before taking a degree in Applied Mathematics at Aberystwyth. He then left to join the Patent Office as an examiner of computer patents. This was a fairly 'cushy number', for patents were few and far between at that time. After a year he was back at Aberystwyth pursuing a research degree. He remembers the rather sceptical looks on his boss's face on leaving the Patent Office when he claimed to be going to work on liquids 'with memories'.

Three happy years at Aberystwyth led on to a mathematics lectureship in Reading where he was to benefit greatly from working closely with Bill Morton, one of the UK's leading numerical analysts. In 1971 he moved back to South Wales to a post in Computer Science in Swansea University, an institution with quite a pedigree in rheology. Over the years he has moved up the University hierarchy to a position where he is now a Professor and full-time Pro-Vice-Chancellor responsible for the overall administration of the University.

He still retains a significant involvement in research, working with Mike Webster on computer simulations of various rheological flows, with an emphasis these days on real industrial applications. Current work includes an investigation of polymer coating processes and some applications in food processing. The link with Aberystwyth is as strong as ever through the Institute of Non-Newtonian Fluid Mechanics, a venture which brings together the team at Swansea with that of Ken Walters at Aberystwyth.

Peter feels that the field of rheological research has so much to offer. It still has so many challenging and fascinating problems. He says that rheology has allowed him to travel the world. He particularly treasures a year working in Madison, Wisconsin with two of the greats - Arthur Lodge and Bob Bird. He values also the many friends he has made in the field over the years.

For the future, he looks forward with some trepidation to guiding the Society as President. He appeals to the membership to take as active a part as they can in the Society, and is confident that with the help of a strong and conscientious Council, much will be achieved over the next two years.

EUROPEAN SOCIETY OF RHEOLOGY (ESR)

It is my pleasure to inform you of the formation of the European Society of Rheology (ESR) on June 27, 1996.

The Chairman of the Foundation Committee and President of the British Society of Rheology, Prof. H.A.Barnes, opened the formation meeting in the Cavendish Laboratory, University of Cambridge, at 5.15 pm on Thursday June 27, 1996, with delegates of six European Rheology Groups being present.

Prof. Barnes read out the consenting letters of approval of the following Rheology Groups (in chronological order), which are the founding members of the ESR:

1. Germany
2. Spain
3. The Netherlands
4. Austria
5. France
6. The Vinogradov Society of Rheology
7. Switzerland
8. Bulgaria
9. Belgium
10. Slovenia
11. Italy
12. Britain

He then nominated for officers of the ESR:

President:	Prof. K. Walters FRS, Aberystwyth
Immediate Past President:	Prof. J.M. Piau, Grenoble
Secretary:	Prof. M.H. Wagner, Stuttgart
Treasurer:	Prof. J.Mewis, Leuven

The British Society of Rheology had endorsed this list. There were no other nominations. The officers of the ESR as proposed above were accepted unanimously.

As Secretary of the ESR, Prof. Wagner took the opportunity to thank the Chairman of the Foundation Committee, Prof. H.A.Barnes, personally for his efforts in creating the ESR.

The officers of the ESR will meet in the near future to discuss the policy of the ESR and to prepare a meeting of the Delegates of the Rheology Groups.

Looking forward to a bright future for European rheology through close collaboration of all scientists active in the field.

Prof. Manfred Wagner,
Secretary, ESR

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

XIIth INTERNATIONAL CONGRESS ON RHEOLOGY

I was fortunate to be able to attend the Twelfth International Congress on Rheology which took place in Quebec City, Canada, from the 18th - 23rd August, this summer.

There were over 650 participants attending the Congress, from 36 countries, 22 of these people were from the United Kingdom. The proceedings of the Congress included 4 plenary papers, 7 keynote papers and 451 contributed papers. Of these contributed papers, 289 were given as oral presentations and the remaining 162 were presented as posters in one of the three poster sessions.

Due to the large number of papers being presented, there were 6 parallel oral presentation sessions. This made it difficult for anyone to attend all of the presentations they wished to and since there was no 'transfer' time allowed for between presentations there were always people moving in and out of rooms during the first and last few minutes of any paper. Fortunately I found that the sessions that were of most interest to myself did not clash with each other. These being the two Constitutive Equations sessions, the two Fluid Mechanics sessions and the three Flow modelling sessions.

Of the presentations I saw there are a few that stick in my mind, not just because of my interest in that particular field but also due to the interesting and entertaining way in which they were delivered. I found the first plenary paper of the congress, entitled 'Rheological Properties of Multiphase Polymeric Systems: Facts and Challenges' presented by Pierre J. Carreau particularly interesting. A review was given of the rheological behaviour of multiphase systems and it started the congress off nicely. The paper entitled 'An Experimental Study of Cavity Flow of Viscoelastic Fluids' by P. Pakdel, S.H Spiegelberg and G.H.McKinley, in which the stability of the flow of Boger fluids was investigated for cavities of varying aspect ratio, was particularly enlightening. There were some interesting flow visualisation slides and a stability condition that relates the aspect ratio to a critical Weissenberg number was determined. 'Finite Volume Computational Methods for 3D Viscoelastic Flows' by R.I. Tanner, N. Phan-Thien and S-C Xue considered solving a 3D flow problem using a finite volume method as opposed to the popular finite element method. The use of finite element methods for three-dimensional calculations leads to a large matrix and hence computer systems with large amounts of memory are required to solve these problems, therefore a method which is much more computer efficient is sought. The method developed was shown to give promising solutions of complicated problems with singularities and did not require large amounts of memory, thus enabling large problems to be solved on small computer systems.

In the paper 'Numerical Simulations of Complex Flows of Polymer Melts by an Unstructured Control Volume Method' by X. Huang, N. Phan-Thien and R.I.Tanner I was introduced to control volume methods in which an unstructured mesh is used. The method was used to solve the problem of fully developed channel flow between two parallel plates containing a cylinder fixed at the centreline. It was found that using an unstructured algorithm allowed solutions to be obtained at much higher Deborah numbers than have been successfully reached using a finite element method. I was given my first taste of the field of Biorheology by the keynote paper entitled 'Biorheology: A Survey of Recent Developments' presented by H.L. Goldsmith in which he presented a brief history of investigations into blood and its flow properties.

The social programme of events organised for the delegates was extensive with only one free evening. The welcome reception after registration on Sunday afternoon was held in the Panorama room on the 23rd floor of the Quebec Hilton and as the name suggests it offered spectacular views over much of the Quebec City region. Due to the Hilton's close proximity to the old part of the city there was a good view of the walled city and the impressive Chateau Frontenac. On Wednesday afternoon there was a whale watching excursion on the St. Lawrence River. Although we did see whales I got the impression that the majority of people were disappointed that we saw so little of them, just the top of their backs as they came up to breathe every 15 minutes or so. It is only during the mating season that they are seen diving out of the water and flapping their tails, as the males try to impress the females. Anyone who did not manage to see any whales should have attended the presentation given by David Binding on Thursday morning where he kindly showed a map of his home country so no one would have to go home having not seen W(h)ales. The banquet, which took place on Thursday evening at the Quebec Hilton, was in the form of a Mediaeval night with entertainment between each course and was very enjoyable.

The International Committee on Rheology met at the congress to decide the venue for the next International Congress on Rheology, and I am sure that all readers will be pleased to hear that the British Society of Rheology will be hosting the XIIIth International Congress on Rheology in Cambridge. This will be in the millennium year, the year 2000, which coincides with the 60th anniversary of the British Society of Rheology.

It only remains for me to thank the British Society of Rheology for their financial assistance which enabled me to attend a most enjoyable International Congress. I found the presentations that I attended most informative and it was nice to see the faces of people whose papers and books I have read. I am sure that attending the congress will prove to be very valuable in my future studies towards my Ph.D.

Jason Hughes, School of Mathematics and Statistics, Univ. of Plymouth

CONFERENCE REPORTS

Second BSR Young Rheologists' Day De Vere Hotel, Coventry 4 September 1996

The Second Young Rheologists' Day was held in Coventry on Wednesday, 4th September, 1996 at the De Vere Hotel. There were eight presenters who took part and gave interesting talks on an extremely wide variety of subjects - from horse blood to ceramic pastes. The overall standard of presentations was very high and the judges for the day (Prof Howard Barnes, Dr Gerry Meeten, and Steve Robinson - all BSR Council Members) found that their task (to select the best overall presentation and runner-up) was not an easy one.

In the end, the prize was awarded to Rulande Rutgers of the Dept. of Chemical Engineering at the University of Cambridge. Rulande professionally presented a fascinating account of the surface instabilities seen during extrusion of LLDPE through a slit die, work which she is undertaking as part of her PhD under the watchful eye of Malcolm Mackley. The runner-up was also from Cambridge (indeed from the same department!). Robert de Roeck (despite technical difficulties with a 35mm slide projector!) gave a very good presentation on his attempt to quantitatively analyse the rheological properties of equine blood. Congratulations must, of course, go to the Winner and Runner-up but must also be extended to all of those who took part for the high standards achieved.

Holmes and Watson were not seen in attendance but would have perhaps noted that, once again, the fabled industrialists were absent from the actual presentations - this story will run and run!

Paul Doody
National Starch & Chemical Ltd., Slough

Second BSR Young Rheologists' Day

Programme

Comparison of Steady Shear and Oscillatory Rheology of a Carboxylated Acrylic Latex

RM Crum, LM Oldfield, and D Eagland
Pharmaceutical Chemistry, University of Bradford

The Rheology and Microstructure of Equine Blood

R de Roeck and MR Mackley
Dept of Chemical Engineering, University of Cambridge

The Effect of Absolute Pressure on the Yield Stress and Shear Stress Behaviour of Ceramic Pastes

X Huang and DR Oliver
IRC in Materials for High Performance Applications,
University of Birmingham

Steady Shear and Oscillatory Shear End Effects in a Concentric Cylinder Geometry

IP Hughes
School of Mathematics and Statistics, University of Plymouth

Rheological and Viscosity-Average Molecular Weight Studies of Hyaluronan

S Karim, MB Brown, S Ingham, GP Martin, and C Marriot
Dept of Pharmacy, King's College, London

Surface Instabilities during Extrusion of LLDPE

RPG Rutgers, MR Mackley, and D Gilbert[†]
Dept of Chemical Engineering, University of Cambridge
[†]BP Chemicals, Meyrin

Synthesis and Dynamic Rheological Behaviour of Polybutadiene Star Polymers

CH Adams, LR Hutchings[†], PF Klein, TCB McLeish and RW Richards[†]
IRC in Polymer Science and Technology - University of Leeds
[†]IRC - University of Durham

Comparison of Steady Shear and Oscillatory Rheology of a Carboxylated Acrylic Latex

RM Crum, LM Oldfield and E Eagland

Pharmaceutical Chemistry, University of Bradford, Bradford, BD7 1DP

Abstract

Steady shear viscosities, as a function of shear rate, together with the oscillatory rheologies as a function of frequency, are presented for two high volume fraction acrylic lattices of similar size but very different fluidities, RAF 111 and RAF 122.

The steady shear behaviour of the two lattices, as a function of shear rate was examined. The latex of relatively low viscosity, RAF 122, shows linear visco-elastic behaviour over the whole range of frequencies examined. The latex of higher viscosity, RAF 111, shows much more complex behaviour, only behaving in a linear viscoelastic manner over a limited frequency range, and exhibiting, dependent on amplitude of the oscillation, non-linear behaviour at the lowest frequencies studied.

The dynamic viscosity and the storage modulus of the two lattices, as a function of the applied shear, whilst in oscillation, was examined.

Both lattices showed time dependent yield behaviour in the measurement of their steady shear viscosities, although of very different magnitudes, suggesting the existence of structures in the resting dispersions.

It appears that a linear correlation exists between the time taken for flow to occur in the steady shear mode and the elastic component derived from the oscillatory mode measurements. The plotted behaviour of this property suggest that perhaps two structures, of differing stabilities exist in the system. A plot of the stress, corresponding to the same values of shear rates used, against the response time, also suggest two regions of stability. The value of stress when rapid change occurs, appears to correlate with the change in behaviour observed in the storage modulus.

The Rheology and Microstructure of Equine Blood

Robert M de Roeck and Dr M R Mackley

Department of Chemical Engineering, University of Cambridge,
Cambridge CB2 3RA

Abstract

The long term aim of the current study is to determine a quantitative mechanistic model of structure formation in whole blood that can be used to predict rheological behaviour under complex flow. The model must reflect the shear thinning, visco-elastic, and thixotropic characteristics exhibited in the blood system. The material presented reflects a number of preliminary investigations that have been undertaken by the author with this aim. Equine blood is the chosen system for investigation due to its strong aggregating tendency.

Rheological experiments have been performed on a Rheometrics RDSII dynamic strain rheometer. Results have demonstrated shear thinning behaviour under steady flow, and the visco-elastic nature of blood under oscillatory flow, confirming the findings of previous authors (e.g. Thurston 1970, Chien 1975). They have further shown pronounced thixotropic effects when subject to particular shear conditions.

Microscopic observations of blood under controlled shear conditions were performed using the Linkam Cambridge Shear System. High resolution images were produced, providing opportunity for an in depth analysis of the dynamics of aggregation. It was observed that numerous structured phases could be induced as a function of both steady and oscillatory flow conditions.

It is hoped in the future to make correlations between the rheological findings and the observed microstructure. Proposals include a systematic investigation of the factors controlling the structure formation in blood, and the determination of the dynamic processes involved. It is then proposed that these findings will serve as foundations for future modelling.

The Effect of Absolute Pressure on the Yield Stress and Shear Stress Behaviour of Ceramic Pastes

Xiaobing Huang and Donald Ralph Oliver

The IRC in Materials for High Performance Applications and School of Chemical Engineering, University of Birmingham, Edgbaston B15 2TT

Abstract

The influence of absolute pressure on the yield stress s_0 and shear stress t'_0 of ceramic pastes has been investigated using a ram-type extruder testing machine and 27 dies with various diameter and lengths. Three kinds of pastes, mainly Alumina-based with different binders, have been tested using ram speeds of 5 mm/min, 10 mm/min and 20 mm/min, which provide a range of different extrudate velocities. The experimental results confirm the conclusions of earlier work by Oliver and Whiskens using a novel form of apparatus, which shows that the yield stress s_0 shows little change with increasing absolute pressure (or even decreases). The present work shows that shear stress t'_0 rises rapidly at low pressure but when the absolute pressure exceeds a certain value, which may vary from different pastes, t'_0 becomes constant. The system pressure applied is up to 16 MPa. In order to examine the effect of fibre loading on the processing behaviour, glass fibre has been added to the pastes with fractions from 5 to 30% by volume. It has been found that addition of fibre can change the value of both s_0 and t'_0 . The trends of variation of t'_0 with the absolute pressure are similar to that of monolithic pastes, whereas s_0 is no longer independent of absolute pressure. The present work may be suitable as a tool for the further research of monolithic pastes and in the design of composite pastes.

Steady Shear and Oscillatory Shear End Effects in a Concentric Cylinder Geometry

JP Hughes

School of Mathematics and Statistics, University of Plymouth, Plymouth,
Devon PL4 8AA

Abstract

The shear viscosity and complex viscosity prediction of a fluid using a commercially available rheometer with a concentric cylinder geometry is obtained from infinite cylinder length theory. End effects are therefore not taken into account. In order to reduce the end effect on viscosity predictions the inner cylinder of this geometry is recessed so that air is trapped between the lower end of the cylinder and the fluid surface.

This paper is concerned with a theoretical prediction of the end effect of a recessed concentric cylinder geometry on viscosity measurements of Newtonian and inelastic power law fluids in steady shear experiments. The numerical calculations for these fluids are carried out using the POLYFLOW finite element package taking into account fluid inertia effects. A perturbation analysis is considered for Newtonian fluids for low Reynolds number flows and the results agree with those obtained using the POLYFLOW package. The theory shows that end effects on steady shear viscosity predictions can be significant but are negligible for narrow gap concentric cylinders. This paper also considers the theoretical prediction of the end effect of a recessed concentric cylinder geometry on complex viscosity measurements of a general linear visco-elastic fluid in oscillatory shear experiments taking into account fluid inertia effects.

Rheological and Viscosity-Average Molecular Weight Studies of Hyaluronan.

S Karim, MB Brown, S Ingham, GP Martin and C Marriott.
Department of Pharmacy, King's College, London SW3 6LX

Abstract

Hyaluronan (HA) is a high molecular weight polysaccharide prevalent within the extracellular matrix of mammalian connective tissue, especially the skin. The biopolymer, which at certain concentrations possesses gel-like properties, is associated with numerous physical and biological functions. Currently, HA formulations are being developed for several transdermal drug delivery/targeting applications including the alleviation of osteoarthritic pain, treatment of actinic keratosis and basal cell carcinoma. The availability of improved instrumentation combined with the more traditional methods, now enables the production of accurate rheological data. Consequently, regulatory authorities are beginning to place considerable emphasis on the rheological evaluation of gel formulations, particularly with reference to product specifications and stability.

The aim of this study was to evaluate and characterise the rheological parameters of HA gels derived from various sources. G' and G'' values were determined by a non-destructive dynamic rheological test using the Carri-Med CSL rheometer. In addition, capillary viscometry provided intrinsic viscosities for dilute HA solutions from which corresponding viscosity-average molecular weights were calculated and compared using the Mark-Houwink equation.

For each source of Hyaluronan, G' and G'' was found to be a function of HA concentration. At 2.5% w/w, G' and G'' was dependent not only upon the molecular weight but also on the source of HA, possibly due to purity considerations. Further tests showed that the rheological properties of the gel varied as a function of pH and temperature. Lowering pH increased G' , while higher temperatures decreased gel stability thus reducing G' . In some cases, discrepancies were observed with respect to the experimentally obtained molecular weights to those claimed by the supplier and could be explained by the use of inappropriate values for K and a in the Mark-Houwink equation.

Surface Instabilities during Extrusion of Linear Low Density Polyethylene

RPG Rutgers, M R Mackley, and D Gilbert (BP Chemicals, Meyrin)
Department of Chemical Engineering, University of Cambridge

Abstract

This study concerns the extrusion behaviour of a film blowing grade of linear low density polyethylene. LLDPE shows a variety of instabilities with increasing production rate. The purpose of the study is the understanding of the mechanism underlying the onset of the first instability to occur with increasing flow rate, which affects only the surface of the extrudate. The ultimate objective is the product optimisation such as to eliminate or delay the onset of the instability.

The onset and progress of the surface instability is studied as a function of process conditions using a Betol 25mm screw extruder, equipped with an abrupt entry slit die allowing rheo-optical measurements. The stainless steel slit die is 1 mm wide, 8 mm long and 15 mm deep. We show the qualitative characteristics of the surface instability obtained via scanning electron microscopy (SEM) and quantitative surface roughness data obtained with a stylus profilometer, as a function of flow rate and melt temperature. Flow induced birefringence measurements provide a measure of the level of stress in the die exit region under stable and unstable flow conditions. The fringes at the exit show large concentrations of stress as a result of the extensional stresses involved in the transition from a constrained flow at the die wall to a no friction condition at the free surface of the extrudate.

It is found that the instability causes a wave-like pattern on the extrudate with an amplitude of order 10 mm. The extrudate has experienced stretching and relaxation before the frost-line is reached, which could result in the observed rounded appearance of the wave pattern. The severity of the instability increases with increasing exit stress level. When surface instabilities occur, no time dependence of the stress field is observed inside the die at the wall. It is suggested that the extrudate surface distortion is a result of elongational stress concentrations at the exit of the die, which result in random crack formation along with width of the exit. Because LLDPE has a weak melt strength, it may not withstand the elongational stresses that are particularly high at the surface of the extrudate due to die swell. This could explain why LLDPE is much more susceptible to surface instabilities than LDPE which does not show this effect.

Synthesis and Dynamic Rheological Behaviour of Polybutadiene Star Polymers

CH Adams², LR Hutchings¹, PG Klein²

T C B McLeish² and R W Richards¹

IRC Polymer Science and Technology,

¹University of Durham DH1 3LE, UK

²University of Leeds LS2 9JT, UK

Abstract

Polybutadiene star polymers, of nominal functionality 3, 4, 8, and 12, all with arm lengths of approximately $30,000 \text{ g mol}^{-1}$, have been synthesised using chlorosilane coupling agents. Dynamic mechanical studies have been carried out using parallel plate rheometry at various temperatures, and the data frequency-temperature shifted to produce master curves. Fits to the Ball-McLeish constraint release theory indicate an effective entanglement molecular weight somewhat higher than the literature value for a linear polymer. This has been interpreted by considering a dilution of constraints effect caused by the Rouse diffusion of the terminal section of the star arm, leading to a predicted modified entanglement molecular weight similar to that found experimentally. Evidence for the Rouse - like behaviour of the terminal section has been obtained from deuterium NMR spectra of a selectively deuterated sample. The presence of small amounts of residual linear chains is shown to cause a further dilution of entanglements. An extension of the theoretical fits to include the high frequency Rouse mode spectrum show a divergence between theory and experiment which is indicative of the onset of the glass transition.

4th Italian Rheological Application Seminar
12th - 15th June, 1996
Moon Valley Hotel, Sorrento, Italy

The delegates assembled for what was about to be a very worthwhile meeting on the evening of Wednesday, 12th June. The Moon Valley Hotel was located high above the Southern Italian coastal town of Sorrento and offered an excellent panoramic view across the bay below. My short car journey from the airport to the Hotel was "typically Italian". As we drove through Pompeii I felt a degree of empathy for the poor souls that had perished on that site many years earlier (79 AD, if I remember correctly - O level Latin was such a long time ago!)

It was obvious from the programme of presentations that a great deal of time and thought had gone into the organisation of the meeting. A four man scientific committee and a five man organisational committee were responsible for what we were about to be offered.

I was aware that the Italian Society of Rheology was due for a shake up and discussed this matter with Prof. Romano Lapasin of Trieste University. It was in fact their intention to discuss the matter during the week, with a view to strengthening the Society to ensure it's future. The proposed European Society was also discussed informally and a general agreement reached as to it's conception and relevance.

34 presentations were offered over the three day "meeting proper". A good mix of industrial applications and academic studies were supported by an impressive poster display. Of the presentations, all but two were delivered in Italian, as you might expect. I gave one of the remaining two presentations and sat spellbound before the second English offering. Fortunately, as with all good presentations of this type, much rheological data supported the text and this enabled the less cosmopolitan members of the audience, such as myself, to keep up with the proceedings.

I wasn't able to attend the "course dinner", but I understand it was held in a local pizza restaurant. An unassuming little place sitting a mere 1800 patrons at any one time!! I'm sure there was much discussion as to the flow/deformation properties of the cheese, etc.

Delegates drifted in and out during the week, such were the temptations of the resort, so I'm not able to give an accurate attendance figure. Suffice it to say that the quality of the presentations and the reaction from the numerous delegates at the meeting certainly suggests a very healthy future for rheology in Italy.

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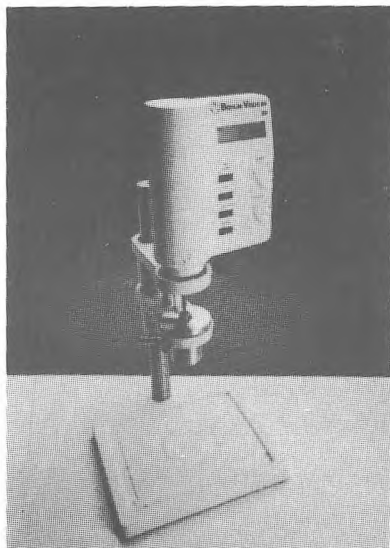
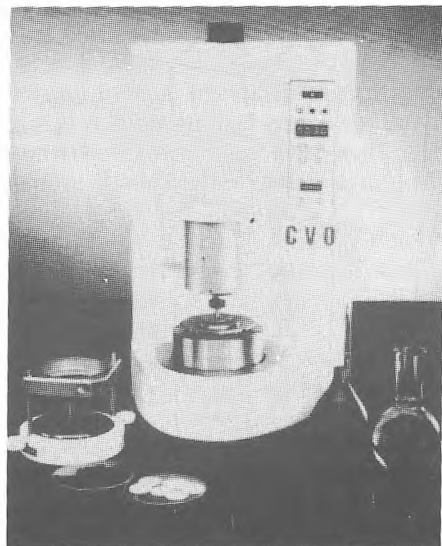
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THE BSR COLLECTIONS AT SHEFFIELD

Tony Evans

Secretary, BSR Scott Blair Collection Working Group.

On 18th July 1996, I visited the Sheffield University Main Library, where Mr Lawrence Aspden was kind enough to show me round. Unfortunately the previous Archivist, Mr Peter Carnell, died in February 1996 and Mr Aspden has recently been appointed as his successor.

We first went into the caged area of Level Two of the stack to inspect the Tattersall Collection. This consists of approximately 14 books, 30 bound theses and say 5 shelf feet of assorted documents, mainly relevant to freshly mixed concrete pastes. Unfortunately Mr Aspden has not had any contact with Dr Tattersall and so is unsure of progress, if any, on the collection. Some 400+ numbered offprints have been placed in new boxes, and there is an edge-punched card index to some, if not all, of them which is probably Dr Tattersall's. No other cataloguing of the Collection appears to have taken place, so no access is permitted at present.

Once a full catalogue has been compiled, Mr Aspden suggested that the Tattersall papers should be available just like any of their other Special Collections: accessible to personal callers by arrangement for inspection on the premises. Borrowing would not normally be allowed.

We then went up to Level Three of the stack, which is accessible to users without the need for special arrangements. The Society's reference collection of Rheology Abstracts is to be found at ABS 530-5. Volumes 1 to 33 (1958 to 1990) have been bound, and were all on the shelf. At present they are not marked in any way to indicate their status, though Mr Aspden will arrange for bookplates to be added to indicate that they should not be disposed of without consulting the Society.

The reference collection of Bulletins is also on level three, located at B530-5. They are unbound and the loose parts are in three boxes. The first contains volumes 12 to 19 (1969 to 1976), though parts 14(3) and 18(3) are missing. The other two boxes contain volumes 20 to 34 (1977 to 1991) which appear to be complete. Again there is no marking or notice to suggest that they are of special significance.

It is clear that the Society's collections are in safe hands and in good condition. The Abstracts reference set is fine, though the Bulletins could be improved. Mr Aspden welcomed the suggestion that we might supply the missing numbers, and would be able to arrange for the complete run to be bound, though we would have to cover the cost of this. With the present financial constraints on the Universities he does not envisage rapid progress with cataloguing the Tattersall collection. However he did indicate that he might be able to arrange for this to be carried out soon if some financial assistance could be provided.

For completeness I should mention that the more recent issues of Rheology Abstracts and the Bulletin are to be found in St George's Library, (about half a mile away) which I did not visit.

The main Library is only a short walk from the supertram stop called University.

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CONFERENCE DIARY

DATE	PLACE	DETAILS
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
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 Colloides, 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
29/10/96	Guildford, UK	'Sludge 6' Environmental Biotechnology Group + RSC + IChemE University of Surrey, Guildford, UK Contact: Val Horsfield, Tel: 01483 259239, Fax: 01483 259510
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
26 - 27/11/96	London, UK	'Colloidal Characterization and its Applications in Formulation' Colloid and Surface Chemistry Group + Royal Pharm. Soc. Contact: Dr J. Clements, Royal Pharmaceutical Society, 1 Lambeth High Street, London SE1 7JN Tel: 0171 735 9141, Fax: 0171 735 7629

DATE	PLACE	DETAILS
16/12/96	London, UK	'Advances in Characterization of Particulate Colloidal Dispersions' Colloid and Surface Chemistry Group + RSC Contact: Prof. R.A. Williams. Tel: 01209 714866 Fax: 01209 612941 Email: williams@csm.ex.ac.uk
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.'
Sept 2000	Cambridge, UK	'XIIIth International Congress on Rheology'

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

COURSE DIARY

DATE	PLACE	DETAILS
24/10/96 28/11/96	Cirencester, UK	One Day Rheology Workshops at BOHLIN INSTRUMENTS LIMITED '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 21/10/96 22-25/10/96	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
21-24/10/96	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
4-8/11/96	Univ of Strathclyde, Scotland	One 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



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Dow Chemicals Co.,
PO Box 515,
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Prof. R. Keunings,
Unite de Mécanique App. (Euler),
Univ. Catholique de Louvain,
Av. G Lemaitre 4,
B-1348 Louvain-la-Neuve,
Belgium
(fetsa BDG)

Dr L. Korugic,
Dept. of Metallurgy & Materials,
University of Malta,
Msida MSD 06,
Malta

Dr J.A.S. Montoya,
Biotech & Bioengineering Dept.,
Cinvestav-Ipn,
Av. Ipn No 2508,
Col. San Pedro Zacatenco,
07360 Mexico D.F.
(fetsa FLM)

Prof. R.A. Pethrick,
Dept of Pure & App. Chemistry,
University of Strathclyde,
295 Cathedral Street,
Glasgow, G1 1XL
(petsa BCDNO)

Prof. V.N. Pokrovskii,
Dept of Physics,
University of Malta,,
Msida MSD 06,
Malta
(fts D)

Prof. E.G.R. Ramirez,
Biotech & Bioeng. Dept.,
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(fetsa DGJ)

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 UMR 5514, INSA Batiment 113,
 20 Avenue Einstein,
 69621 Villeurbanne Cedex,
 France
 (pesa DFGJ)

The following resignations have been received:

Dr L. Grunberg, Dr A.F. Miles, Mr D.E. Morgan, Mr C. O'Driscoll,
 Mr W.F.O. Pollett

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

Dr D.J. Bloomfield, Mr T.W. Dobbie, Mr W. Kleinjans, Mr R.T.J. Marshall,
 Dr R.K. Palmer, Mr C.J. Parkinson, Mr R.A. Richmond, Dr J.H. Stark.

With these changes, the membership stands at 601.

Classification of abbreviations for Members' Rheological Interests

- | | | | |
|---|--|---|-----------------------------|
| f | Member's main interest is rheology (ie. full-time) | | |
| p | rheology is secondary interest (ie. part-time) | | |
| e | approach is experimental | t | approach is theoretical |
| s | area of work is pure science | a | area of work is technology |
| A | metals | I | glasses, ceramics |
| B | composites | J | oils, greases |
| C | solid polymers | K | building and road materials |
| D | molten or dissolved polymers | L | foodstuffs |
| E | natural fibres | M | biological materials |
| F | liquid-liquid systems | N | theoretical models |
| G | liquid-solid systems | O | other systems |
| H | particulate systems | | |

Subscriptions. A Short Note from the Membership Secretary.

Subscriptions for the year 1996/7 are now due. Many of you have paid in advance, and I would request that those who have opted to pay by standing order check that this has been done. The remaining members have a choice of paying by cheque (£15) or credit card (£10). If paying by cheque, please ensure that any charges are paid beforehand. For example, transfer by Fundsflow attracts a charge of £2, so this should be added to the amount paid. It is obviously an advantage to pay for a number of years in advance, paying a one off charge, and ensuring a hedge against a rise in subscriptions.



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