

THE BRITISH SOCIETY OF RHEOLOGY

BULLETIN



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CONTENTS

Officers and Members of Council	ii
Editorial	iii
Controlled stress rheometry — early days	22
J. J. Deer	
European Society of Rheology	25
International Symposium on Viscoelastic Fluids	26
Rheology and Water Soluble Polymers	32
Nordic Rheology Society	34
Molecular Spies	35
Commentary: 277th Council Meeting	36
North Midlands Group	38
Recently Published Books	39
Scott Blair Collection	40
Notice of the 54th Annual General Meeting	41
Minutes of the 53rd Annual General Meeting	42
Membership News	45
News of Other Societies	45
Conference Announcements	46

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THE BRITISH SOCIETY OF RHEOLOGY
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 1993/94

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EDITORIAL

As I sit down to write this, my last editorial before handing over to my successor, I look back to four years and sixteen issues ago when I was full of new ideas about how I would develop the Bulletin into a publication to be proud of. Well, while not totally satisfied, I modestly claim some success evidenced by the kind and generally appreciative comments of readers that filter back to me. Aiming to provide what readers want is difficult unless you know what they want, so I had to start from the basis of what I would want in a publication. To me that meant being informative (conference diary, news of new books, commentaries on Council meetings), technically aware (occasional articles on technical subjects), entertaining (competitions, humour, anecdotes) and not being afraid of controversial matter. The competition was an early casualty (too difficult). The technical articles got off to a good start with discussions of rheology in various industries and applications but they have dwindled recently, largely I think because potential authors have discovered that their employers have other priorities. Particularly in the case of academic institutions authors are expected to publish articles in mainstream refereed journals. In recessionary times industrial employers look for value for money from their employees' time and effort. Consequently, I have found it increasingly difficult to bully manuscripts out of authors. In contrast the anecdotes have grown considerably in recent issues, with people offering their reflections upon the early days of rheometry and on the assignment of scientific priority. The history of our science will always be a rich vein of material. Looking forward, one cannot be certain of anything except that the future will be different from the present, and in this connection, someone recently suggested that a series describing rheological activity around the country would be interesting. I leave that for my successor to deal with.

In conclusion, I am proud of my contribution to the Society and have been pleased to serve the membership by producing over 500 pages of hopefully satisfactory material. Editorial work creates rewards in proportion to its frustrations and I am grateful to all those authors who have tolerated my bullying and supplied me with material. I hope that they will continue to help my successor in the same way.

The copy date for the next issue is September 30th 1994.



CONTROLLED STRESS RHEOMETRY — EARLY DAYS

J. J. Deer

The December issue of the Bulletin contained an item by J. E. Roberts concerning Karl Weissenberg that is particularly interesting to me, and I suspect also to my colleagues of the 1960s and 70s at the London University School of Pharmacy.

The acquisition of an R7 Rheogoniometer by the Department of Pharmacy in the mid 1960s encouraged a quite rewarding relationship with Professor Weissenberg leading to several visits to the Farol Research Co. works at Bognor Regis, and many informal, often informative, discussions over the pub lunches provided by Pat Farrow, the Managing Director of the Company.

It was at one such gathering that Karl, when asked how he had come to design the goniometer, replied that while visiting the U. S. A. on one occasion, he had sought the help of his former tutor, Professor Einstein. Einstein advised him to spend time learning technical drawing, in order to be in a position to discuss his ideas with the technical staff. From my own experience in his company, he obviously listened to that advice.

I was introduced to the air bearing modification some time before it was actually fitted to the instrument. At the time, Pat Farrow, giving the prototype spindle a quick turn assured me that it would still be running when we returned from lunch. Of course it was, but as I learned during the development of the controlled stress rheometer, it was only as a result of the inherent 'windmill' effect common to such devices. This is a possible source of error in torque measurement.

The controlled stress instrument began life in 1966 as a modification of the rheogoniometer in the form of the 'Stormer' or the later 'Searle' weight and pulley system. At the behest of the head of department, Professor Shotton, and in consultation with Brian Warburton, I replaced the standard torsion bar with a one metre torsion wire support for the top platen, and a length of cord wound round the spindle, below the air bearing, in order to 'pull' the platen round in response to the force exerted by a small balance to which the free end was attached. This was a simple modification for the benefit of a post graduate student, Brian Barry, whose research project involved the structure of pharmaceutical semi-solids.

Angular (rotational) movement was obviously restricted to just a few degrees, so that the instrument was in fact no more than a 'creep' apparatus. However, with the aid of a multi point 'Kent' recorder we

achieved what I believe must have been the first electrically recorded controlled stress 'creep' response, displayed as a series of dots from the sequentially connected 8 pen system.

The subsequent request that the Farol Co. be asked to quote for a similar, single purpose instrument proved so far beyond the departmental financial resources that the task was passed to me. The only specification provided was the use of an air bearing and a maximum cost of £250, while Farol had estimated £1600. What eventually emerged from the workshop formed the basis of what has now become the Controlled Stress Rheometer.

I built the instrument within the budget but only with the help of Dr John Powell, the then technical director of the West-Wind Turbine Co. of Poole, Dorset. This company manufactured a range of miniature air bearings, one of which incorporated a reaction turbine in its head, or thrust bearing section. It was designed to operate at speeds up to 100,000 rpm. However, when approached, Dr Powell confirmed my theory that the torque against turbine air pressure graph should be effectively linear at speeds approaching zero, and was so attracted by my proposal to design an instrument around that fact, that he made me a personal long term loan of a suitable bearing with which to build a prototype. But I have to say that the idea of using a device designed to operate at such high speeds was not considered a practical proposition by some of my more influential colleagues.

I believe that Warburton was in favour, but was far too preoccupied with his own research to express much of an opinion. In fact, the only really enthusiastic support I received was from S. S. (Bob) Davis who both callibrated the finished instrument, and with some help from Warburton, who I know was in sympathy with the project, carried out a series of practical experiments with it. Bob also wrote most of the paper in which it was described as a "Constant Stress Viscometer", perhaps a questionable claim, because the intrusive angular displacement measuring device, a linear variable displacement transducer, effectively prevented continuous rotation, or shear. Only by removing that component, and with the aid of a stop watch, could we justly claim a controlled stress viscometer. Certainly not a Rheometer, since it was not possible to proceed in an uninterrupted sequence from yield point to continuous shear. That only became possible some four or five years later, following a discussion with Dr Hermannson, of the Lund Institute, Sweden.

In the meantime, the instrument was used for one post graduate research project, under the supervision of Brian Warburton, and also was demonstrated during the 1968 Easter Rheology School, held at the School of Pharmacy. There it received the approval of Karl

Weissenberg. After which it went into store until resurrected for the similar meeting in 1972.

A patent application was made in the name of the School of Pharmacy, for which I signed a disclaimer. This was allowed to lapse, and all rights returned to me when the NRDC failed to interest any commercial manufacturer in the instrument. During the interim period, I was fully engaged in another research project concerning the control of rotary tablet machines.

For the 1972 meeting, I put the task of reassembly in the hands of my assistant, Peter Finlay. Peter had joined my staff during December 1968, straight from school. He subsequently joined me in a not very successful business venture during which, with the cooperation of a small electric motor manufacturer, the gas turbine drive was replaced by a specially wound induction motor. But that is another part of a very long story!

During the 1972 meeting, the instrument caught the attention of Dr Hermannson, who managed to arouse my own interest with a suggestion that I should find a method by which the intrusive angular measuring device could be discarded. As a result, I spent many hours hand operating a 'back geared' lathe, in order to machine a metal cam the radius of which varied linearly. This would produce an electrical output from a variable inductance, non-contacting transducer so positioned as to examine the receding edge of the cam, when attached to a rotating spindle. The output signal thereby became a direct measure of the angle through which the spindle had turned. With the aid of a secondary tachometer system it then became possible to satisfy the continuous deformation and flow condition, and to describe the instrument as a rheometer.

Although now replaced by highly sophisticated electronic equipment, I believe that the angular displacement measuring system was the key to the success of the controlled stress rheometer.

The instrument became a commercial proposition through the interest of an entrepreneur by name of Alan D. Whitehead, who christened it 'The Deer Rheometer' but his interest caused me more problems than benefits. The workshop he promised never materialised, neither did the financial support. But it did introduce me to many interested, and interesting personalities, both within the U. K. and Europe in general.

In that respect, since I have never claimed to be a 'Rheologist' I frequently found myself in very deep water, facing some most eminent scientific minds. I had to learn fast. (There is some difference between rheology and rheometry, for which I do claim some slight expertise!)

However, the totally new concept represented by the results I was able to demonstrate effectively covered any cracks in my abilities, so that most of my rather advanced 'students' were faced with quite similar problems in trying to make sense of visco-elasticity, yield points, and etc.. This was a new concept to most of them, and one that in some manner I had to 'sell' in academic institutions where even the term rheology was unknown.

I am now of course an officially retired geriatric. But there is considerable satisfaction today in the fact that, led by the Carri-Med Company, for whom I am still on the books as consultant, so many instrument manufacturers have joined the controlled stress field.

I feel it is a *big* field, not yet fully appreciated or exploited. But I thank the many people who helped me to do so in the past. In particular Brian Warburton, Bob Davis, Peter Finlay, and of course Howard Barnes who was of more help to me than I think he knew!

This is of necessity an incomplete story. It would take many issues of the Bulletin to discuss the trials and frustrations of the designer/inventor/manufacturer. But your readers may find some interest in it.

EDITORS NOTE. Jack Deer retired after many years as Chief Technician at the London School of Pharmacy. He spent 27 years designing and building apparatus for research and teaching and made his first viscometer in 1951 at a cost of £5. The controlled stress viscometer is described in a paper by Davis, Deer and Warburton in the *Journal of Scientific Instruments* 1968.

A POSSIBLE EUROPEAN SOCIETY OF RHEOLOGY?

At its last Council meeting the British Society of Rheology discussed the possible formation of a European Society, with the object of promoting rheology on a Europe-wide basis, which would complement but not supersede the operations of national societies. Acting primarily as a liaison body it would steer the European Rheology Conference, it would publish a European newsletter and would consider other publications with Europe-wide circulation. It would further the promotion and funding of rheological topics and become involved in educational aspects of rheology. While there is much discussion yet to be done, any members with views should contact the Secretary.

INTERNATIONAL SYMPOSIUM ON VISCOELASTIC FLUIDS TOBAGO, JANUARY 4TH-7TH 1994.

An International Symposium on Viscoelastic Fluids was held in Tobago in January 1994 under the auspices of the Caribbean Congress of Fluid Dynamics, with the encouragement of the British and Mexican Societies of Rheology. The International Union of Theoretical and Applied Mechanics gave a grant to assist the venture and the Mexican Society of Rheology sponsored one invited speaker. The Universities of the two co-chairmen, the St Augustine campus (in Trinidad) of the University of the West Indies and the University of Newcastle upon Tyne (UK), lent their support.

The idea grew out of some correspondence between Dr Harold Ramkissoon and the author of this report, and an organising committee under their joint chairmanship involved Professor Baltasar Mena from Mexico, Professor Dan Joseph from Minnesota and Dr Winston Mellowes from Trinidad. The aims of the symposium were both to provide a forum for the exchange of scientific ideas at an international level and to bring international experts and the local Caribbean rheological community together. That this latter aim was taken seriously by our hosts may be inferred from the presence at the opening ceremony of Mr L. Denoon, Head of the Tobago House of Assembly, and Professor R. Saunders, President of the Caribbean Academy of Sciences. These two distinguished gentlemen showed an impressive grasp of our scientific interests and gave eloquent testimony to the need for scientific endeavour in the Caribbean. In this respect, the symposium did well, with 14 Caribbean participants (from the West Indies and Mexico). The U. K. and the U. S. A. each accounted for a further 7, and the remaining 10 came from Australia, Belgium, Canada, Germany and Spain.

The local rheologists, under the guidance of Harold Ramkissoon, took good care of local arrangements. This involved, among other things, transporting people between hotels, liaising with the Grafton Beach Hotel where the symposium was held and looking after a relaxing social programme. This task was well carried out; Mrs Michelle Khan and Mrs Tara Ramkissoon looked after the registration desk and helped with many minor hitches, while Dr Mellowes dealt with the finances without appearing to enjoy it too much. The Grafton Beach was a pleasant hotel, though not used to scientific meetings — their original idea was to have participants seated round a table like a meeting of a board of directors, which may say something about the hotel's usual clientele.

The small size of the meeting, with 38 participants, four plenary lectures and 22 other presentations over four days, made for an informal

atmosphere and lively discussion. The first plenary lecture was given by Ken Walters who took "Recent developments in non-Newtonian fluid mechanics" as his title and interpreted "recent" to include most of his lifetime. Rheologists are well used to thinking about the different time-scales of processes and the audience had no apparent problem with that definition of "recent". Nhan Phan-Thien surveyed the mechanics of suspensions and particulate solids, with emphasis on computational aspects. There was, among other things, the introduction to the concept of a "farm" of computers organised to work in parallel on a large problem, a theme which a later talk by Peter Henriksen took up. Arthur Lodge's topic was polymer elasticity in experiment and theory, contrasting network theories and mean-field theories with particular reference to elastic recoil. As well as the serious scientific content, Arthur offered us an adaptation of a song from *Patience* which Gilbert and Sullivan fans will appreciate even more than most rheologists. This is reproduced, with permission, as an appendix to this report. Gary Leal reviewed studies of the motion of viscoelastic liquids in extensional and mixed flows. He was particularly concerned with polymer solutions and theoretical (dumbbell) models and in experimental work the main concern was with optical studies. There were varying degrees of optimism among the four invited speakers on the prospects for accurate theoretical prediction of viscoelastic flow phenomena. Certainly there is no doubt that experiment, theory and computation go hand-in-hand in the best of current rheological research.

Space does not allow a comment on each of the contributed talks, which covered such topics as constitutive equations (De Kee, Friedrich), flow through pipes (Kalon, Rahaman) and flow near a corner (Michael Renardy). The rheology of various materials was discussed, including asphalt (Peters), starch (for snack foods) (Hastilow), liquid crystals (Mewis) and electrorheological fluids (Atkin, Bullough and Whittle). There were three talks on flow instability, with discussion of phenomena like the "spurt" effect, "melt fracture" and "sharkskin" by Yuriko Renardy, Arkadii Leonov and Pep Espanol. Sedimentation of irregularly shaped particles was discussed by Raj Huilgol, numerical simulation of blade coating by Evan Mitsoulis. Relations between linear viscoelasticity and molecular weight dependence were considered by Honerkamp (who was concerned with ill-posedness of problems) and del Castillo. Elongational flow featured, not surprisingly, in presentations from two of the organising committee (Mena and the author of this report). The unscheduled star of the programme was Dan Joseph, who contributed in a lively way

during other people's talks and filled a gap caused by cancellations with a talk on low shear rate limits in viscometry. He also showed two videos, on water lubricated pipeline flow and on particle motion in Newtonian and non-Newtonian fluids and concluded the symposium with a masterly summing up. This was so good that I have forgotten it (and so has he — I asked him for the text) but suffice to say that it was very positive in its emphasis and more eloquent than the report which I have produced here.

The social programme included a reception, a boat trip and a dinner, at the end of which we were entertained beside the swimming pool by some local musical talent. These were enlivened by the products of local companies who generously supported the symposium (and I am not referring to Lake Asphalt of Trinidad and Tobago in this connection). The boat trip was particularly memorable, with swimming and snorkelling at Buccoo Reef, which is one of the sights of the island. Those of us who were able to see more of the island, by staying an extra day, were well rewarded. Tobago can be thoroughly recommended as a place to visit — but I mustn't start writing a travel brochure or suggesting that any of the participants had needed more than the scientific content of the meeting to tempt them to attend. The Caribbean Congress of Fluid Dynamics holds its next major congress in 1995 in Venezuela, but for Tobago you should develop an interest in the lubricated transport of viscous material and talk to Dan Joseph or Harold Ramkissoo about their plans for 1996.

Chris Petrie



Arthur Lodge, Baltasar Mena and Nhan Phan-Thien

Appendix:

POLYMERIC PATTERN

If you're anxious now to shine in the polymeric line as a man of vision rare,
 You must get up all the germs of diffuse and snake-like terms and plant
 them everywhere.

You must know the current crazes and discourse in modish phrases of tubes
 with blobs that bind.

The meaning doesn't matter if it's only modern chatter of a strict
 reptative kind.

Then other folk might say,
 If you talk in this topical way,
 "Though his arguments may involve some steps which are obscure to me,
 Yet I can use his equations now, for they're right dimensionally."

Now, the molecules in plastic execute such moves fantastic as they
 diffuse from A to B.

That old models are too spastic, and require changes drastic, is plain
 for all to see.

Although reading Doi and Edwards is enough to drive one bedwards in
 a meditative frame of mind,

Yet their meaning doesn't matter for it's only modern chatter of a near
 reptative kind.

Then an agency might say,
 In a generous-granting way,
 "If this young man expresses himself with such modernity,
 Why, what a very up-and-coming bright young man this young grantee
 must be!"

Could be sung to music from "Patience" by
 W. S. Gilbert and Arthur Sullivan.

Copyright, A S Lodge, August, 1993



Rheologists at work



Rheologists at play



Raj Huilgol and Harold Ramkissoon



Venue for the next Council meeting?

RHEOLOGY AND WATER SOLUBLE POLYMERS

This one-day meeting was held in Newcastle under Lyme in April 1994 and represented the first collaboration between the British Society of Rheology and the Water-borne Polymers Group of the British Association of Chemical Specialities. The aim of the meeting was to introduce participants to rheology and rheological measurements and to give examples of the ways in which they can be helpful in tackling problems in different industries. To achieve this aim the programme was divided into two sections, with the morning devoted to rheology basics and the afternoon to applications.

About 45 participants gathered at the Clayton Lodge Hotel on a sunny spring morning, with the sound of a thrush singing in the trees outside the meeting room. I gave the first talk which was an introduction to rheology and dealt with definitions, flow regimes, flow curves, models, structure, viscoelasticity and thixotropy, but was only able to hint at other delights like normal forces and elongational flow. This was followed by Dr David Cheng who showed the audience the principles of rheological measurements. Using a Chinese saying to warn the audience that his talk would be like galloping a horse through a garden to look at the flowers, he dealt with rotational, capillary and elongational measurements and looked at dynamic measurements, creep, and stress relaxation as well as the fundamentals of measuring geometry and form factors for shear stress and shear rate. The third talk of the morning was by Carole Moules who spoke about the factors to be considered in choosing a rheometer. What are your data requirements? Do you need absolute data or will comparative data suffice? What do you need to measure? What can you afford? Who will use it? What support will they have in-house or need from the manufacturer? In these days of computer controlled rheometers what information is locked up in the software? In this latter connection she made the point that everyone should learn how to do the tests manually before using the computer software. Finally she reviewed a current 'who's who?' of rheometer manufacturers (something I for one found fascinating).

After a drink in the sunshine outside the bar and a chance to inspect the slightly worrying structural cracks in the brickwork of the bedroom block followed by a pleasant lunch, we moved on to the applications section of the programme. Dr. Dieter Schweitzer (Aqualon, Germany) described the use of rheological tests in studying the stiffening of plasters. He showed that the value of G^* changes with time in stages, where there is an initial increase followed by a plateau and a

subsequent sharp increase which corresponds to the setting time. Retarders prolong the plateau and agitation before testing shortens it but neither changes the shape of the curve or the value of G^* in the plateau indicating that there is no change in the structure but that stirring generates more crystal seeds for growth. This behaviour is in contrast to that for cement based materials.

Next came a talk by Peter Bostrom (Berol Nobel, Sweden) on the rheology of associative thickeners in latex paints, which are needed to control the properties important in the application process of paints to the substrate. These thickeners are commonly cellulose ethers, polyacrylics or polyurethanes, and during his talk it emerged that the hiding power of a paint depends on its viscoelastic properties and that spattering (that phenomenon well known to anyone who wears glasses while painting) is worse with a more viscoelastic paint. This talk was followed after tea by Professor Morris (Silsoe College) who discussed the rheology and related properties of natural polymers for food systems. He showed that the nature of the packing between the polymer chains is influenced by the way the sugars bond locally and that various order/disorder transitions can be monitored rheologically. He concluded with an example where such a transition had been postulated for κ -carrageenan gum but had subsequently been shown to be an artefact of the rheological testing system: the material was slipping at the walls of the rheometer.

The day ended with a lively and entertaining talk by Dr. Geoff Price (Unilever Research) which put across the manufacturer's viewpoint on formulating toiletry products like lotions and creams. These are mostly emulsion based products, often highly non-Newtonian, and there may be tens and sometimes as many as a hundred ingredients in the total recipe. He advocated a unit operations approach to their manufacture rather than putting everything through the same universal mixer at once which destroys the carefully contrived structure in the material. By doing separate tasks outside the mixer the structure, which governs the rheology of the product, can be better controlled.

In conclusion, the meeting was a successful one and I felt that, even though there were not many members of our society there, those who did come experienced some other aspects of rheology outside their main specialisms and made some useful contacts. It is always interesting to find that there are similarities in the behaviour of materials which, at first sight, are quite different from the ones to which one may be accustomed. I think there is plenty of scope for further joint meetings of this kind.

Phil Banfill

REPORT ON THE THIRD ANNUAL MEETING OF THE NORDIC RHEOLOGY SOCIETY

The third annual meeting of the Nordic Rheology Society (NRS) took place at the H. C. Orsted Institute in Copenhagen between the 1st and 3rd of June. The conference included a total of twenty nine papers, twelve posters, and several displays of rheological equipment, the contributions mainly being provided by the Nordic countries, although Britain, Germany, Austria and the United States were also represented. The titles and abstracts of the papers appearing in the transactions will appear in *Rheology Abstracts* in due course.

Thanks to excellent instructions provided in the conference literature it was easy to reach the Institute, and most people arrived in good time for the 1 o'clock start on the 1st of June. The meeting was opened by a short welcome speech from Soren Hvidt, the conference chairman, after which it was the first session entitled 'Instrumentation and Applications'. This was followed by my big moment, the poster session. A total of twelve posters were presented during which a 'welcome beer' was served to all 100+ participants. All posters received plenty of interest and the session lasted for well over an hour. Several kegs of beer were drained which effectively finished off the first day.

Thursday's meeting started at the earlier time of 9 a. m. but thanks to the efficiency of the Danish bus service I crossed Copenhagen in a very short time and arrived at the meeting with time to spare. The morning was devoted to two sessions on this year's special subject of food rheology with a coffee break arranged mid morning to allow time for the test equipment that was on show to be examined and for the conference chairman to make the first of several 'Swedish jokes'! Just before lunch the NRS rheology award was presented and the day's work was concluded by the presentation of nine papers on the subject of general rheology.

The conference dinner took place that evening at a restaurant at the edge of Copenhagen surrounded by a deer sanctuary, which resulted in us being able to see our dinner trotting around the park before we ate it! The food was wonderful, the wine flowed freely and the after dinner speeches (including several more 'Swedish jokes') were very amusing — when they were translated correctly! Further amusement was had with the pudding, a lemon mousse, which was used by several of the members present to demonstrate rheological testing techniques — particularly frequency scans!

Judging by the number of late arrivals for the last day of the conference it was apparent that everyone had enjoyed themselves the

evening before. The conference finished at 12. 20 and there was thus only time for two sessions, both on food rheology, before the meeting was closed.

Personally I found the event most enjoyable and useful both from the point of view of the questions which were asked of my work and the papers that were presented by others. I should like to thank the NRS and Soren Hvidt in particular for organising the event, and the B. S. R. for providing me with a travel grant which allowed me to attend.

Benjamin Evans

MOLECULAR SPIES

An item under the heading "Molecular spies make light work" appeared in a recent issue of Chemistry in Britain and may be of interest to readers. A research team led by Dr Ben-Amotz at Purdue University, U.S.A., has devised a series of tracer molecules, typically large dye molecules which can be used to probe remote areas such as within micron sized machinery or inside living cells. They use Raman spectroscopy, which involves shining laser light at the tracer molecules and studying the frequency spectrum of the light scattered from it, to observe the rate of rotation of the dye molecule in the flow field. Since the rate of rotation is related to the viscosity of the liquid in which the dye is dispersed the spectrum gives indirect information about the viscosity of the liquid. The system has been used to measure a range of viscosities from about 0.1 to 1000 centipoise (10^{-4} to 1 Pascal.sec). On the face of it, merely to measure bulk viscosity is a fairly trivial application even though it has possibilities for on-line measurement, but think of some of the possibilities the system could offer for probing the behaviour of non-Newtonian liquids in complex geometries. Simply focusing the laser on a discrete zone of the flow would enable the viscosity under the local shear rate conditions to be measured and checked against the flow curves obtained by viscometry. This could be used to optimise mixing and the design of reactors in chemical engineering. Then there is the possibility of measuring oil viscosities inside internal combustion engines. I think this is a development worth watching.

Phil Banfill

Haake (UK) present their high quality range of viscometers and rheometers

HAAKE

RS 100

A state of the art controlled Stress Rheometer to determine viscosity over a wide range of shear rates and elasticity using creep and oscillation techniques.



VT 500

This robust but precise viscometer is ideally suited for Viscosity measurement in demanding Quality Control environments. The instrument may be stand alone or computerised.



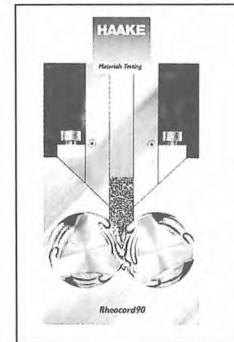
RV 20

A high quality speed-controlled Rheometer for research and development viscosity applications. There are measuring geometries to cover a wide range of shear rates and temperatures.



RC 90

This specialist torque rheometer is designed to meet the challenging requirements of polymer processability testing using a variety of mixers, extruders and accessories.



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COMMENTARY: B. S. R. COUNCIL MEETS IN THE LAKES

The 277th B. S. R. Council meeting was held on the shores of Lake Windermere in the Lake District on the 16th June 1994. The Langdale Chase Hotel was the immediate venue and it has commanding views of the Lake and is set in beautiful gardens that sweep down to the water.

This meeting represented a significant turning point in the structure of the B. S. R. committee and this report will concentrate more on the people sitting round the table, rather than the details of the issues in hand. Our President, Ralph Oliver, steps down from the post in September as at this point his two year term of office comes to an end. During his period in the chair Ralph has of course applied his own style to the meetings. His 'no nonsense' approach means that business has been carried out in a brisk and efficient manner. Perhaps the most significant development that Ralph has guided us through is the issue of the nature of the B. S. R. connections with Europe. It is clear that all the committee were enthusiastic about developing connections, and Ralph cleverly steered us into a balanced position. The B. S. R. would maintain its current position within the U. K. and a way would be devised to form a European Rheology Federation which did not endanger the now well established strengths of the B. S. R..

Carole Moules also steps down as Secretary of the Society. Carole is of course mega efficient and she has managed to keep an at times not very efficient Council on their toes. She has put an immense amount of work into the Society and we are all very grateful for her endeavours. She is of course not afraid to speak her mind and at this meeting she again put forward her views that the B. S. R. should be more involved with training rheologists and also acting as an accrediting body for rheological competence.

Roy Carter is our recently appointed treasurer and he is busy checking on our financial affairs. The Society at present has a healthy balance which has been built up over the past years mainly through income from *Rheology Abstracts*. With rapidly changing technology in this area he and others have been firing warning shots across the bows of the Society that this useful revenue can not be expected to continue indefinitely. Roy is also our man on the Scott Blair Library Committee and he reported that all was ship shape with the Library. He did however find that Aberystwyth was an awful long way from his home!

Geoff Brownsey has given sterling service in the past by keeping *Rheology Abstracts* going to a very high standard. Rumour has it that he may now be prepared to take over as Secretary! Geoff is a pragmatic chap and can be relied upon to give sensible advice to the Society. He is also very aware that the Society should spend its money prudently.

Phil Banfill has of course kept the Bulletin on the straight and narrow for a number of years. He has done a very professional job and

we should all be most grateful for his great effort. Also many thanks to his family who have filled thousands of envelopes over the years.

Peter Anderson has kept the financial books in order and I am sure passed the monies of the Society over to Roy in good shape. My own dealings with Peter over the last two Cambridge Conferences has taught me that Peter is very careful and precise. One of Peter's great achievements on the financial side has been to formally rid us of the dreaded VAT.

Doug Houston now leaves the B. S. R. Council. He has recently been appointed to a chair at Loughborough and these and other duties mean that he will step down from keeping the membership files in order. Doug has done a fine job and runs a very tidy ship.

Unfortunately both Peter Townsend and Gerry Meeten were unable to attend the meeting, but there was one new face at the table. Our new President elect, Professor Howard Barnes was present, reacquainting himself with the ways of the Society. Howard will bring a new approach to the Society and we left the meeting confident that the British Society of Rheology will remain in good and caring hands.

Nick Hudson's involvement with the B. S. R. goes back a number of years and many will know him from his conference organising efficiency. The 50th anniversary meeting at Edinburgh stands out as a great success and since then the Ferguson/Hudson duo have organised workshops at Ross Priory and more recently an interesting extensional flow conference at St. Andrews. At this meeting a number of well known rheologist golfers were seen treading the hallowed turf of the 18th, presumably either discussing stretching flows or golf. I am not sure which of the two subjects is more challenging, both are difficult!

My own experience of the last four years serving on Council has been that the B. S. R. represents one of the last few Scientific Clubs run by enthusiasts for the benefit of enthusiasts. Clearly the Society will have to respond to the changing world, however, I personally hope that some of the friendly intimate style of the Society can be maintained. Rheology is a wonderfully diverse subject that can be thought of as a core subject which has relevance to a multitude of related topics. Both the core and the connections remain as fascinating now as they did ten, twenty, thirty years or a hundred years ago. Long live rheology and the Society!

Malcolm Mackley

Editor's Note: In case readers gain the impression that little business was done at the meeting which Malcolm describes above, it is worth mentioning that we discussed forthcoming meetings, awards, honorary memberships, the application of the Swiss Group of Rheology to join the International Committee of Rheology, new members for Council and a number of other routine matters.

NORTH MIDLANDS GROUP

Editor's Note

With the blessing of Council, Dr Geoff Tattersall started a local group of people interested in rheology in 1991. Unfortunately it has had to cease operations and his report on the activities of the group, presented to Council last year, is reproduced below. Naturally we regret this turn of events but perhaps, as Geoff implies, it is just another sign of the times.

CLOSING REPORT

Rheology is a subject involved in and with several disciplines and industries and it has always been the hope of the Society to encourage cross fertilisation, right from the days of the original Rheologists' Club. As life in general has become more complicated that objective has become more difficult to achieve on a national scale, so it was thought that establishment of groups holding informal meetings locally, and with no charge, might do something to redress the balance. The experiment has been tried in the North Midlands area, centred on Sheffield.

In summer 1991, I wrote to over 40 members whose addresses are within about an hour's journey of Sheffield and from the 20% response was able to start a group with an initial membership list of 7 which eventually grew to 14 as a result of contacts. Five meetings have been held and all have been successful in that they were enjoyed and felt to be useful by those present, but the pattern of attendance has been disappointing.

A sixth meeting was planned for 12th May 1993 but from a circulation of 12 (i.e. excluding the intended speaker and me) only three replies were received and all were negative, so there was no alternative but to, cancel the meeting. The attendance records for the five meetings show an average attendance of 5 (range 4-7) with an average attendance per member of 13%. Two people have not attended any meeting and 5 have attended only one. It seems to me that the group is not viable and it is certainly not achieving the objective for which it was founded, so there is little point in continuing.

I think that the failure of this experiment raises important points that should be considered by the Society as a whole and by every individual member. Is it thought a waste of time to move outside one's narrow speciality, even for a few hours a year, and is there no possibility that ideas in another area might be relevant and helpful? Is the individual now so hideously hidebound by the 'system' that he cannot escape for a while to seek a broader view?

It is easy to be nostalgic and even cantankerous when one has achieved the status of holding a bus pass, but there does seem to me to be something wrong.

G. H. Tattersall

RECENTLY PUBLISHED BOOKS

Information on recent books is given here for the benefit of members, but the Society cannot answer enquiries about the availability of particular titles. Place orders for books with publishers through booksellers and agents.

Organic coatings science and technology, Vol. 2 Applications, properties and performance. Z.W.Wicks, F.N.Jones, S.P.Pappas, Chichester: John Wiley and Sons 1994, pp xix + 383, £70.00, ISBN 0 471 59893 3.

This book continues volume 1 and deals with flow, adhesion, pigment dispersions, pigment volume relationships, application methods and mechanical and other properties of films, as well as specific areas of their use, such as for coatings on metals, wood etc.

Tribology in the USA and the former Soviet Union: studies and applications. V.A.Belyi, K.C.Ludema, N.K.Myshkin, New York: Allerton Press, 1994, pp v + 455, \$60.00, ISBN 0 89864 065 2.

This book attempts to harmonise the viewpoints of scientists from the two countries and consists of a series of chapters contributed by different authors, grouped into sections entitled General problems of tribology, Fundamentals of friction and wear, Tribotechnical materials science, Friction under various conditions, Tribology and diagnostics, Terminology.

Bubbles, drops and particles in non-Newtonian fluids. R.P.Chhabra, Ann Arbor: CRC Press, 1993.

Title only available.

British Standards Institution B.S. 2782 Methods of testing plastics Part 7 Rheological properties. Method 730B *Determination of the viscosity of polymers in the liquid, emulsified or dispersed state, using a rotational viscometer working at a defined shear rate.* (ISO 3219:1993)

This standard describes the procedure for and method of analysing the results of flow curves obtained in coaxial cylinders and cone-and-plate viscometers.

SCOTT BLAIR COLLECTION

The following recent acquisitions have been added to the Scott Blair Collection. We are grateful to Dr M. W. Jones for donating ten books, J. J. Benbow (four) and the British Society of Rheology (three items from the archives).

A consolidated catalogue is being prepared, and in addition it will be possible to gain access to the catalogue through the JANET computer network.

Astarita, G., *Principles of non-Newtonian Fluid Mechanics*. G. Astarita, G. Marrucci, London: Mc Graw-Hill 1974.

Chorlton, F., *Viscoelastic properties of polymers*. 3rd edition New York: Wiley 1980.

Jong, W. F. de, *General crystallography: a brief compendium*. San Francisco: Freeman 1959.

Lane, C. T. *Superfluid physics*. London: McGraw-Hill 1962.

McCloy, D. *Control of fluid power: analysis and design*. D. McCloy and H. R. Martin. 2nd edition rev. ed. Chichester: Halsted 1980.

Ouder, J., *Physics and chemistry of surfaces*. London: Blackie 1975.

The physics of liquid and solid helium; edited by K. H. Bennemann, J. B. Ketterson. New York: Wiley 1976-78.

Townsend, A. A., *The structure of turbulent shear flow*. 2nd edition Cambridge: C. U. P. 1976.

Ubbelohde, A. R., *Melting and crystal structure*. Oxford: Clarendon 1953.

Kinloch, A. J., *Fracture behaviour of Polymers*. A. J. Kinloch and R. J. Young. London: Applied Science 1983.

Kolsky, H., *Stress waves in solids*. Oxford: Clarendon 1953.

Love, A. E. H., *Theoretical mechanics*. 2nd edition Cambridge: C. U. P. 1906.

Williams, D. J., *Polymer Science and engineering*. Englewood Cliffs, N. J.: Prentice-Hall 1971.

Swainger, K. H., *Potential theory extended to higher order tensors*. Offprint from the Eighth International Congress on Theoretical and Applied Mechanics. Istanbul, August 1952.

Symposium on Viscosity and Rheology. Proceedings . . . Reprinted from the *Journal of the Institute of Petroleum* Vol. 31 No. 260 August 1945.

Weissenberg, K., *Die mechanik deformierbarer Körper*. Berlin: Akademie der Wissenschaften 1931.

NOTICE OF THE 54TH ANNUAL GENERAL MEETING

The 54th Annual General Meeting of the British Society of Rheology will be held on September 22nd 1994 at The National Motorcycle Museum, West Midlands starting at 2. 00 p. m..

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

- a) The election of Officers and Council Members for 1994-95.
- b) The 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.

Nominations to date are as follows:

President:	Dr H. A. Barnes
Honorary Secretary:	Dr G. J. Brownsey
Honorary Treasurer:	Mr R. E. Carter
Membership Secretary:	Dr N. E. Hudson
Bulletin Editor:	Mr P. C. Anderson
Abstracts Editor:	Dr G. H. Meeten

Ordinary Members of Council:	Dr P. F. G. Banfill
	Mrs C. A. Moules

There are four vacancies resulting from the retirement of Dr M. R. Mackley and Professor P. Townsend who are not eligible for re-election, and the resignation of Professor D. J. Hourston and Dr N. D. Waters. Professor R. Davis has been nominated and other nominations for Council or for any of the Offices are invited. Nominations should be sent to the Secretary or may be made at the meeting (see rule 5[b]).

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

C. A. Moules
Honorary Secretary

MINUTES OF THE 53RD A. G. M.
HELD AT ROBINSON COLLEGE, CAMBRIDGE
SEPTEMBER 23RD 1993

PRESENT:

Dr D. R. Oliver	President , in the chair
Mr P. C. Anderson	Hon. Treasurer
Mrs C. A. Moules	Hon. Secretary

There were 18 further members present including the President of the German Society.

1 APOLOGIES FOR ABSENCE

Received from Professor Townsend and Mr Schimanski.

2 MINUTES OF THE 52ND A. G. M..

These had been published in the Bulletin Vol. 36 (2). After correcting Dr Waters' name there were no queries and the minutes were duly signed by the President.

3 MATTERS ARISING

There were no matters arising

4 REPORTS OF THE OFFICERS

4.1 President

The President read his report which was to be published in Bulletin Vol. 36. (3), September 1993.

4.2 TREASURER

Mr Anderson presented the accounts which would be published in Bulletin Vol. 36 (4). The year showed that once again income exceeded expenditure by approximately £4,000 There were no questions on the accounts and Dr Hudson proposed, Dr Cheng seconded that the accounts be accepted. Agreed unanimously. At the same time the auditors, Alfred Simmons & Co. were retained.

Mr Anderson concluded his four year period as Hon. Treasurer which had seen two firsts, namely the registration for VAT at the time of the Golden Jubilee Meeting and the introduction of credit card facilities. The B. S. R. had recently deregistered for VAT. He felt that there was no need for change at present. Mrs Moules said that the outcome of the debate on the Future Role of the Society could have an effect on budgetary plans.

Dr Petrie asked how frequent was the use of credit cards. Mr Anderson replied that the benefit was in the service to members especially those from overseas who found it a much easier way to pay.

Dr Oliver commented on the need to maintain a high cash level, stating that it was the aim of the Council to bid for the International

Congress on Rheology in 2000 which could lead initially to high outlays. Dr Oliver then went on to thank Mr Anderson for his efforts during his term in office.

4. 3 HON. SECRETARY

Mrs Moules read her report which covered the events of last year in a newsletter style to inform the members of the behind the scenes events of the past year. A copy would appear in Bulletin Vol. 36 (4). Dr Cheng asked if there was to be a write up of the Working Party dealing with Transparency in Rheometry and Computer Software. He felt that the conclusion that the round robin exercise had produced satisfactory results should be recorded. Mrs Moules said she would contact Professor Barnes and ask him to send a copy for publishing in the Bulletin.

4. 4 MEMBERSHIP SECRETARY

Dr Hourston presented his report which would appear in Bulletin Vol. 36 (4). The highlight of the year was the production of the Membership List which would need to be updated in approximately 2 years. The membership payment records were up to date and he had an 80% success rate in collecting subscriptions last year. He would endeavour to improve on this aspect in the coming year. He noted that there was a slight upturn in the membership with about 600 members including 62 in 1992/93 with 18 resignations.

4. 5 BULLETIN EDITOR

Dr Banfill said he seldom received any response to the Bulletin which he assumed meant that it was fulfilling its purpose. Volume 36 had approximately 130 pages with advertising bringing in valuable income. He continued his policy to include a mix of technical articles, reports of scientific meetings and Council business. Dr Heyes commented that he very much looked forward to receiving the Bulletin which he described as a good read.

4. 6 ABSTRACTS EDITOR

Dr Brownsey said that progress was slow but steady with on average 250 abstracts/issue. Over the year the number of abstractors had risen from 15 to 25. He anticipated that as academia cut back its budget that the more obscure journals would not be bought by the institutions and hence the number of abstractors from this sector might fall. He thanked Elsevier for their support during his term of office. He reminded members that they should be sending abstracts of their papers directly to the Abstracts Editor.

Dr Evans endorsed Dr Brownsey's comments concerning an adequate dredge of journals, saying that banner headlines were needed. He

asked members to remind their colleagues and friends to send abstracts of their papers. Dr Brownsey said that pleas go out very frequently but basically people are lazy and the response to pleas is poor. Dr Oliver advocated a little arm twisting for more abstractors reminding the membership that some years ago all abstractors used to read papers and personally write the abstracts whereas now the abstract is generally a photocopy of the author's original. Dr Chai stated that he did not know about the list of abstractors. Dr Cheng asked for the Authors Index to be resurrected and the postal code of U. K. authors added. Dr Brownsey said he would pass on these comments to the incoming Abstracts Editor.

5.ELECTION OF OFFICERS

Mrs Moules briefly stated the changes due to take place in accordance with the constitutional period in office for Officers and Members of Council. She stated that she had received no nominations.

Dr Oliver pointed out the proposed nominations from Council as published in the last Bulletin Vol. 36 (2). He asked if there were any nominations from the floor. None were forthcoming. He asked the meeting to vote *en bloc* for the nominees shown. There was unanimous agreement and the following people were elected to the posts:—

PRESIDENT	Dr D. R. Oliver
HON. TREASURER:	Mr R. E. Carter
HON. SECRETARY:	Mrs C. A. Moules
MEMBERSHIP SEC.:	Dr D. J. Hourston
BULLETIN EDITOR:	Dr P. F. G. Banfill
ABSTRACTS EDITOR:	Dr G. H. Meeten
MEMBERS OF COUNCIL:	Mr P. Anderson
	Dr G. J. Brownsey
	Dr N. E. R. Hudson
	Dr M. R. Mackley
	Prof. P. Townsend
	Dr N. D. Waters

6. ANY OTHER BUSINESS

Francis Butler from the Engineering Department of University College, Dublin asked if a joint meeting in Dublin in 1994 could be organised on the subject of Food Rheology. Dr Oliver said he would discuss the matter with him after the A. G. M. and put it to Council at the next meeting.

There being no further business the meeting closed at 19.35 hours.

Carole Moules
Hon. Secretary

MEMBERSHIP NEWS

The following applications for membership were approved at the Council Meeting, June 16th, 1994.

Mr Robert Claridge,
Rheometric Scientific Ltd.,
Surrey Business Park,
Epsom,
Surrey KT17 1JF.
(feta ABCDEFGHIJKLMNO)

Mrs Gillian L. Clissold,
Dept. of Mathematics,
University College of Wales,
Aberystwyth,
Dyfed SY23 3BZ.
(fetsa DFGJ)

Mr Simon John Crook,
Dept. of Chemical Engineering,
University of Cambridge,
Pembroke St.,
Cambridge.
(feta L)

Dr John Meadows,
Science, Health & Medical Studies,
North Easr Wales Institute,
Connah's Quay,
Clwyd CH5 4BR.
(fesaDFGL),

Dr Sonia Michiels,
Smith & Nephew Group Research,
York Science Park,
Heslington,
York YO1 5DF>
(petsa DO)

Dr Claude Verdier,
Laboratoire de Rhéologie,
B. P. 53 Domaine Universitaire,
38044 Grenoble Cedex 09,
France.
(fetsa DJLNO)

P. G. Vandor has resigned.

Dr P. F. G. Banfill has been appointed Professor in the Department of Building Engineering and Surveying, Heriot-Watt University.

NEWS OF OTHER SOCIETIES

The Swiss Group of Rheology is a subgroup of the Swiss Polymer Group and has about fifty members. Similar to other national groups of rheologically interested people, members must also be members of the parent body. The Group recently applied to the International Committee of Rheology for admission and has said that it would be willing to host an international congress in due course.

CONFERENCE ANNOUNCEMENTS
 YOUNG RHEOLOGISTS' DAY AND A. G. M.
 SEPTEMBER 22ND, 1994
 NATIONAL MOTORCYCLE MUSEUM, WEST MIDLANDS

This meeting will be held in the Crow's Nest Suite at the National Motor Cycle Museum in the West Midlands and will include the Annual General Meeting. The talks will be given by those who have received travel or study grants and by the holder of the Society's Scott Blair Scholarship. There will be an award for the best presentation, as judged by a panel.

PROGRAMME

10.00-10.30 Registration and coffe.

LECTURES-SESSION ONE

10.30-11.00 Paul Doody (National Starch) — Scott Blair Scholar 1993/95. Title to be advised.

11.00-11.20 Tsung-Yu Chen (Imperial College) *A Micro-Structural Study on the Rheological Behaviour of Electro-Rheological Fluid in a DC Electric Field.*

11.20-11.40 James Greener (Mars Confectionery, Slough) *Rheology in Confectionary Production.*

11.40-12.00 Maria Aranzazu Odriozola (University of Strathclyde) *The Linear Rheological Behaviour of PS/PI Star Co-Polymer Melts.*

12.00-12.20 Ruifeng Liang (University of Cambridge) *Planar Entry Flow and Die Swell of Molten Polyethylene: Experimental and Numerical*

12.40-13.30 LUNCH

13.30-14.00 Short tour of Museum for participants/B. S. R. Council Meeting.

LECTURES-SESSION TWO

15.00-15.30 Stefan De Smedt (University of Ghent) — Scott Blair Biorheology Scholar 1993/95. *The Use of Rheology to Elucidate the Permeability of Hydrogels in Pharmaceutical Research.*

15.30-15.50 Bas Smeulders (University of Cambridge) *Multi-Pass Rheometry.*

15.50-16.10 Mark Whiskens (University of Birmingham) *The Analysis of Melt Flow at Low Shear Rates for an Injection Moulding Mix.*

16.10-16.30 Anne McGinness (University of Birmingham) *Evaluation of Shear and Elongational Flow Fields on Powder Dispersion in Fat.*

16.30 TEA

16.45-17.00 Awards Presentation.

YOUNG RHEOLOGISTS' DAY
SEPTEMBER 22ND, 1994

REGISTRATION FORM

DELEGATE NAME

Title Initials

First Name (if preferred)

Surname

.....

COMPANY

ADDRESS

TEL:..... FAX:.....

FEES:-

BSR Member =£45.00

☐

Non Member =£55.00

☐

Student =£30.00

☐

I/We enclose the sum of £.....for the items ticked above

Signed Date

RETURN TO:

C. A. Moules, CAMTEL Ltd., 5 Carrington House, 37 Upper King St., Royston,
Herts SG 8 9AZ.

Tel.: 0763-244280 Fax: 0763-244298

SPECIAL REQUIREMENTS—please inform the organiser if you have special needs
e. g. dietary or others.

This form may be photocopied.

SCHOOL OF INDUSTRIAL RHEOLOGY

TORQUAY, OCTOBER 24-27TH, 1994

Space considerations preclude giving full details of this short course. Participants will hear talks and get full course notes from experts on the following topics:

Basic rheology, measurement techniques, mathematical modelling, steady and dynamic shear, extensional rheology, wetting and adhesion, and the rheological behaviour and industrial applications of polymers, foods, pharmaceuticals, pastes, slurries, household products and coatings. In addition, participants will perform a number of practical experiments with current instruments provided by several manufacturers. They will all perform experiments on using a low viscosity oil to check instrument calibration and zero, using a time independent material to check the gap effect, checking for wall slip and using a time dependent material. In addition they may choose from a menu including creep measurements, relaxation times, oscillatory shear, normal force measurement, capillary rheometers, extensional effects, texture analysers and on-line viscometry.

There will be a programme of social events outside of the classroom sessions. The course fee will be £650 + VAT = £763.75 and accommodation for three nights (dinner, bed and breakfast) will be £165 + VAT = £193.88.

For further information contact CAMTEL Ltd, 5 Carrington House, 37 Upper King Street, Royston, Herts SG8 9AZ, telephone 0763 244280.

COATING AND COATINGS FOR ALL

The mechanics of thin films of fluids is more than a legitimate subject of interest within the sphere of Rheology. The reasons are simple and straightforward. In the first place manufactured goods all end up with some kind of surface coating applied. Secondly that coating will have one or more particular purposes from advertising and protecting to waterproofing and zinc galvanising. Industries which are faced with the challenge of producing high quality coated goods at higher and higher production rates always run up against the laws of the physics of fluids. The fluids themselves are not pure, being either solutions or suspensions with strange rheological properties.

The more one looks at the process end of rheology in the coating, printing and thin film applications industries, from 'Cellophane' to 'perspex' and papers to textile fibres via fluxing and waxing electrical boards and printed circuits and painting, the more one can see the vast areas of work that needs to be done and present knowledge that needs to be applied.

The Oil and Colour Chemists Association, (General Secretary; Chris Pacey-Day, previously of the IChemE) is anxious to raise the standing of this highly interdisciplinary activity and to that end will be supporting the first of a series of European Coating Symposia starting in Leeds, September 1995, to be followed by a second in Strasbourg in 1997 and a third in Scotland in 1999, where, no doubt we could paint out auld year's night whilst enrobing a new century.

Coating technology is required by so many industries that the only response by research and teaching bodies must lie in a true interdisciplinary approach to the overall process. From formulation of the coating to the final finished product via pigment, colour and coating rollers this can only be approached in a true rheological interdisciplinary spirit if industries are going to obtain the correct overall picture.

Given the increasing European interest in coating technology, it is quite appropriate to launch this series of symposia which will be aimed at reflecting the established interdisciplinary areas in the U. K., drawing on both applications and applied methods across the board. This will hopefully lead to new initiatives in research due to the identification of current problems and their resolution.

The First European Symposium will be held at Leeds in September 1995, with the theme title "The Mechanics of Thin Film Coatings" . . . see you there?

Roger Burley

THE MECHANICS OF THIN FILM COATINGS FIRST EUROPEAN COATING SYMPOSIUM

LEEDS, U. K.

SEPTEMBER 19TH-22ND, 1995

Potential authors are invited to submit a title and abstract for either a paper or a poster presentation in any of the following areas:

Experimental and numerical methods

Rheology

Stability

Coating fundamentals

Industrial applications and novel coating processes

Please submit abstracts before December 21st 1994 to The Secretary, European Coating Symposium '95, Department of Chemical Engineering, University of Leeds, Leeds LS2 9JT.

WARREN SPRING LABORATORY COURSES

The work of the former Warren Spring Laboratory in organising courses in rheology and related matters is continuing at AEA Technology, Harwell, Oxfordshire. A Slurry Handling Course will be run on October 12-13th, 1994. The Foundation Course in Rheology will be run on November 1st-2nd, 1994. An on-line slurry instrumentation seminar, which will include viscosity measurement, will be run on February 15th, 1995. For further information on all these events contact Mrs Margaret McCulloch at Harwell, telephone 0235 432820.

CONFERENCE DIARY

DATE	PLACE	DETAILS
4-9/9/94	Seville Spain.	'4th European Conference on Rheology', contact: Prof. C. Gallegos, Departamento de Ingenieria Quimica, Universidad de Sevilla, (Edificio de Quimica), 41071 Sevilla, Spain.
12-16/9/94	Leuven Belgium	Short course: 'Rheological Measurements: Applications to polymers, suspensions and processing', contact: Prof Paula Moldenaers, Dept. of Chemical Engineering, Katholieke Universiteit Leuven, Leuven, Belgium, Tel.: 32-16-28-66-11 ext. 2359, Fax: 32-16-22-15-22.

21-23/9/94	Cambridge, U. K.	'8th European Conference on Mixing' contact: Conference Section (MIX8) I Chem E, 165-171 Railway Terrace, Rugby, Warwickshire CV21 3HQ.
22/9/94	West Midlands U. K.	Young Rheologists' day, contact: Mrs C. A. Moules, Camtel Sciences, 27 Alexander Road, Stotfold, Hitchin, Herts SG5 4NA.
26-29/9/94	Kyoto, Japan	'First Asia-Oceanian Rheology Conference' Society of Rheology, Japan, contact: Professor Kunihiro Osaki, Institute for Chemical Research, Kyoto University, Uji, Kyoto 611, JAPAN Fax: +81-774-331247.
29/9/94	London U. K.	'Grouts and Grouting', contact: Society of Chemical Industry, 14/15 Belgrave Square, London SW1X 8PS.
2-6/10/94	Philadelphia U. S. A.	'66th Annual Meeting, Society of Rheology', contact: N. Wagner, Dept. of Chemical Engineering, University of Delaware, Newark, DE 19716, U. S. A..
17-19/10/94	Lake Vyrnwy Wales	'Settling in non-Newtonian Fluids II', contact: Mrs E. Shouaib, Dept. of Computer Science, University College Swansea, Singleton Park, Swansea SA2 8PP.
10-12/10/94	Sofia Bulgaria	'7th International Conference on Mechanics and Technology of Composite Materials', contact: Dr Y. Yanakiev, Central Lab. of Physico-Chemical Mechanics, Acad. G. Bonchev Str. Bl. 1, 1113, Sofia, Bulgaria.
12-13/10/94	Harwell U. K.	'Slurry Handling Course', contact: Mrs M. McCulloch, AEA Technology, Harwell, Oxfordshire.
24-27/10/94	Torquay U. K.	'School of Industrial Rheology', contact: Camtel Sciences, 5 Carrington House, 37 Upper King Street, Royston, Herts, SG8 9AZ, U. K..
27/10/94	London U. K.	'Measurement of fundamental properties of bituminous materials, contact: Society of Chemical Industry, 14/15 Belgrave Square, London SW1X 8PS.
1-2/11/94	Harwell U. K.	'Foundation Course in Rheology', contact: Mrs M. McCulloch, AEA Technology, Harwell, Oxfordshire.

Travel grants are available to help students attend any of these meetings.

6-10/11/94	Yokohama, Japan	'International Adhesion Symposium' Contact: H. Mizumachi, University of Tokyo, Chemistry of Materials, Yayoi 1-1-1, Bunkyo-ko, Tokyo 113, Japan.
15/2/94	Harwell U. K.	'On-Line Slurry Instrumentation Seminar, contact: Mrs M. McCulloch, AEA Technology, Harwell, Oxfordshire.
29-31/3/95	Bristol U. K.	'Concentrated dispersions', contact: Dr A. Lips, Unilever Research, Colworth Laboratory, Sharnbrook, Bedford MK44 1LQ.
4-7/4/95	Lancaster U. K.	'Multi-phase materials prepared by emulsion polymerisation', contact: Ms L. Edwards, Conference Officer, Bailrigg, Lancaster LA1 4YT.
19-22/4/95	Rossett, Wales	'Ninth International Workshop on numerical Methods in non-Newtonian Flows' contact: Dr T. N. Phillips, Dept. of Mathematics, University of Wales, Aberystwyth SY23 3BZ.
4-7/9/95	Aberystwyth Wales	'Polymer Melt Rheology,' contact: Prof. K. Walters, Dept. of Mathematics, University of Wales, Aberystwyth SY23 3BZ.
6-8/9/95	Paris France	'Gels', Contact Dr J. W. Goodwin, School of Chemistry, University of Bristol, Cantocks Close, Bristol BS8 1TS.
19-22/9/95	Leeds, U. K.	'First European Coating Symposium', contact: Dept. of Chemical Engineering University of Leeds, Leeds LS2 9JT.
1995	Caracas, Venezuela.	'3rd Caribbean Conference on Fluid Dynamics', contact: Dr H. Ramkisson, University of the West Indies, Dept. of Mathematics, St. Augustine, Republic of Trinidad and Tobago.
18-23/8/96	Québec City, Canada.	'XIth International Congress on Rheology' Canadian Rheology Group/Groupe Canadien de Rhéologie contact: Prof. D. DeKee, Dept. of Chemical Engineering, University of Sherbrooke, Sherbrooke, Québec J1K 2R1. Canada.

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