
THE BRITISH SOCIETY OF RHEOLOGY



BSR BULLETIN
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EDITORIAL

I hope that many of you managed to attend the ICR 2000 at Cambridge earlier this year. This edition of the Bulletin contains snapshots of the event, but a much more extensive description will appear in the next edition of the Bulletin – a European issue.

Paul Doody

SUBMISSIONS TO THE BULLETIN

Submissions to the Bulletin may be made by any practical means – post, email, disk, fax, pigeon, donkey, et cetera but electronically is preferred (saves typing...). Most packages supported (Word, WordPerfect, ASCII, RTF, PDF) but always provide a contact name, address, eMail, or telephone number in case of problems.

Copy dates are now fixed at 15 December, 15 April, and 15 August. This should allow me to publish in January, May, and September and, as always, all contributions gratefully received.

Late copy can sometimes be accommodated however the facilities of the BSR and ESR web sites may also be appropriate. Please contact the Editor for details.

COVER ILLUSTRATION

Gelled particle suspensions with particle shapes ranging from spherical and ellipsoidal to cylindrical were prepared from a mixture of the two polysaccharides, gellan and k-carrageenan. Suspension morphologies were visualised using phase contrast microscopy. The cover illustration shows the morphology of suspension B and suspension C with ellipsoidal and cylindrical particles respectively. Taken from the paper “The rheology of gelled biopolymer particle suspensions with anisotropic morphology” by B. Wolf et al. (Unilever Research Colworth, Bedford, UK), published as *Proceedings of the XIIIth ICR, Cambridge, UK (2000)* 4-324 to 4-326.

I'd like to remind everyone that suggestions for Black & White or colour pictures (preferably of a rheological nature!) are welcomed by myself (Bulletin Editor) or Nick Hudson (Abstracts Editor). Suggestions are always welcome!

BSR NEWS

CITATION FOR THE GOLD MEDAL AWARD OF THE BSR ROGER TANNER

Roger Tanner originates from Somerset in the West of England. He started his engineering career as an apprentice at the Bristol Aircraft Company but soon moved into the academic world, obtaining first a Bachelor's degree at Bristol, a Masters at Berkeley and a PhD in Manchester. He has taught at the Universities of Manchester, Brown and Grenoble. Since 1975 he has been the PN Russell Professor of Mechanical Engineering at the University of Sydney, including a spell as Pro-Vice-Chancellor for research. His outstanding work has attracted numerous honours, including election as a Fellow of the Australian Academy of Technological Sciences and Engineering and later as a Fellow of the Australian Academy of Science. Between 1993-1997, he was Foreign Secretary to the Australian Academy of Science. He was also the recipient of the first award of the Australian Society of Rheology Medallion. In 1999, he was awarded the AGM Michell Medal by the College of Mechanical Engineers. This is the premier award made each year by the College to a person for outstanding excellence in the science or practice of mechanical engineering and contributions to the profession.

Professor Tanner's contributions to Rheology have been extensive and on a broad front. His research covers the mechanical properties of materials and he is a world authority on polymer rheology. He was one of the very early pioneers of computational rheology, and has become a giant of this field. This work continues today with the development of ever more sophisticated algorithms. He is the author of three books, including 'Engineering Rheology' OUP, and over two hundred research publications. His important work on the characterisation of materials and, particularly the development of new constitutive models for polymeric materials, has found great favour with his peers, and is much referenced in the literature. This is exemplified by the model known as the 'Phan-Thien/Tanner model', more commonly referred to as simply the PTT model.

There is much more that one could say, but, unfortunately, time does not permit mention of a whole host of other contributions to the science of

rheology. Suffice to say that there can be few in this audience who have not encountered or benefited from the work of Roger Tanner.



Roger Tanner gives the Gold Medal Lecture at the XIIIth International Congress on Rheology, Cambridge, 21st August 2000.

Ladies and gentlemen, the British Society guards its Gold Medal Award with great care and pride. In the long history of the Society, the award has only been made on just ten previous occasions. As President of the British Society of Rheology, it gives me great pleasure to present the first BSR Gold Medal of the new Millennium to a most worthy recipient, Roger Tanner.

Richard Buscall



Roger Tanner receives the Gold Medal from the BSR President, Richard Buscall, at the XIIIth International Congress on Rheology, Cambridge, 21st August 2000.

CITATION FOR THE ANNUAL AWARD OF THE BSR THOMAS C.B. MCLEISH

The BSR annual award is awarded to Thomas Charles Buckland McLeish, Professor of polymer physics at the University of Leeds for his work on molecular theories of polymer melts. In particular it is given in recognition of his contribution in developing rheological models for the flow of branched polymers.

A longstanding mystery in polymer physics has been to understand why polymers with the same chemical structure and similar molecular weights but different branching structure can have widely differing

rheological properties. For example, low and high-density polyethylene have the same chemical structure yet have very different rheological properties. This is by no means an academic question, as modern metallocene catalysts provide a means to control the degree of branching during synthesis.

In order to solve this mystery it is necessary to bridge the gap between the microscale molecular structure and the macroscale of polymer processing flows. Traditionally these two worlds have been treated separately, with rheological constitutive equations being derived from continuum mechanics rather than polymer physics. However, the complexity of the microstructure in an entangled melt of polymer molecules makes this a daunting task.

The foundations for a molecular theory were laid down in the tube theory ideas of De Gennes and Doi and Edwards. They recognised that in an entangled system of linear polymers, the other polymers constrain the lateral motion of a polymer to a tube along its length. The polymer can move freely inside this tube in process called reptation.

Professor McLeish's contribution to this subject dates right back to his Ph.D. work at the University of Cambridge under the supervision of Professor Robin Ball (last year's annual awardee). As part of his thesis on "Molecular models of polymeric flows" he extended the tube theory ideas to more complex branched molecules (McLeish 1988a). Since the tube around the polymer must divide at a branch point, the branch point acts as a "brake" on the reptation motion.

After completing his Ph.D. in 1987 he stayed on in the Cavendish Laboratory as an ICI research fellow, and became a fellow at Emmanuel College. During this time, he continued to develop the theory of branched entangled polymers (Ball and McLeish 1989) in a series of studies of molecular architectures of increasing complexity (McLeish 1988b).

In 1989, he was appointed to lectureship in Physics at the University of Sheffield. During this time, he continued to work on high-shear rheology of polymer melts and on complex architectures, as well as many other topics in polymer physics and also electrorheological fluids and superconductors.

In 1993, he became Professor of Polymer Physics at the University of Leeds, where he now runs a research group of fifty people. He has extensive collaborations with the polymer industry in the UK and worldwide, and is currently running a major research project on microscale polymer processing involving six universities and seven companies. This year he was awarded an EPSRC Senior Research Fellowship, awarded to established academic scientists and engineers of international repute.

He was one of the organisers of a six month workshop on “Complex Fluids” at the Isaac Newton Institute in Cambridge in 1996. This workshop brought together many of the world’s top rheologists to work together, unhindered by administrative and teaching responsibilities. During this time, two important collaborations were begun that have born much fruit over recent years. Together with Scott Milner he developed methods to predict the linear rheology of polymer melts from a knowledge of just the molecular architecture (Milner and McLeish 1997).

He also began work with Ron Larson on a constitutive model for a melt of simple branched molecules, the pom-pom molecule, consisting of two star polymers joined together. This was perhaps the most important outcome of the workshop and the resulting paper, (McLeish and Larson 1998) was awarded the 1999 Publication Award from Society of Rheology.

By capturing the essential molecular physics of branched polymers, the pom-pom is able to explain why branched polymers strain-harden in extension, while linear polymers do not. This model has attracted a great deal of interest for its ability to capture the rheological behaviour of low-density polyethylene in shear and elongational flows simultaneously (Inkson et al. 1999).

For those wanting to learn more about this work, Tom has given an excellent introduction in the Rheology Bulletin (McLeish 2000). For a more detailed review see McLeish and Milner (1999).

References:

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McLeish, TCB, Milner ST (1999) "Entangled Dynamics and Melt Flows of Branched Polymers", *Advances in Polymer Science*, 143, 195-256.

McLeish, TCB (2000) "The Hitch-Hiker's Guide to Polymer Rheology" *Rheology Bulletin*, 43(1), 8-15.

Richard Buscall



Tom McLeish receives the BSR Annual Award from the President, Richard Buscall

BSR AWARDS

The Annual Award

The Council has recently reviewed its Annual Award. The award was established in 1978 and initially its scope was deliberately set as wide as possible. It was to be “made to an individual or a group of individuals or an institution for significant or promising contribution(s) and/or services to the advancement of rheology in any of its many aspects”. By 1991 the emphasis had been clarified and the award was “designed to reflect either contributions made over a prolonged period or used in appreciation of a particular contribution to the field including a single published paper. Council particularly welcomes nominations of younger members whose contributions are judged to be of especial merit or promise.” Looking back on the recipients over the years it is very heartening to see the range of contributions that have been recognised and these have confirmed the award’s wide international reputation. In particular, those who were comparatively early in their scientific careers have maintained the promise which contributed to their recognition.

Council’s review confirmed the role of the Annual Award as an award focussing on the scientific merit of the recipient(s) as stated in the quotation above dating from 1991. However, it agreed to establish an additional award in recognition of extensive or prolonged distinguished service, as described below. A note on the Annual Award was published in BSR Bulletin 36(1), 1993, 7-9.

The Distinguished Service Award

The Distinguished Service Award is a new award and will be made by the Council in recognition of a major contribution to the life of the Society, for example through prolonged and active Council membership and office holding, organisation of special events including conferences, or other meritorious activity. It is not expected that awards will be made more often than every few years.

Phil Banfill

OFFICERS' REPORTS FROM THE AGM

HONORARY SECRETARY'S REPORT FOR 60TH AGM

This, the Society's Diamond Jubilee year has been one of steady progress and consolidation following the implementation of the decisions of the EGM in December 1998.

Beginning with the Society's *raison d'être*, this year has seen several successful scientific meetings. In December there was a half-day meeting associated with the opening of the re-housed Scot Blair Collection in the University of Wales, Aberystwyth. Approximately 35 people heard talks by Robin Ball and John Melrose, who were presented with the Annual Award for their work on the computational rheology of suspensions, and Howard Barnes, who spoke about the life and scientific work of George Scott Blair, whose bequest enables us to maintain the Collection. Sir Sam Edwards then declared the re-housed Collection open. In April the Society supported the Institute for Non-Newtonian Fluid Mechanics with its annual meeting entitled "Inverse problems in rheology and emerging techniques in materials characterisation". About 40 people heard a range of papers and participated in fruitful discussions. Clearly the highlight of the year and of the international rheological calendar was the August occurrence of the Thirteenth International Congress, held in Cambridge and organised by the Society in collaboration with the European Society of Rheology. With over 700 people there was no doubt that it was a scientific and social success and all credit must go to the organising committee and David Binding in particular who worked very hard as Congress Administrator. The year ended with the present meeting on rheological aspects of surfactant based systems. The programme of future meetings is fully planned for the next couple of years. There will be a meeting on food and general rheology in Plymouth in April 2001, a meeting on the theme of colloids and soft matter in Manchester in August-September 2001 and we are developing a joint meeting with the Spanish, Portuguese and Italian societies on engineering rheology, to be held in Malaga in April 2002.

In this 60th year of the Society, another milestone passed was that of the 300th Council Meeting, held in June in London. A quick count around

the table suggested that those present at that meeting could muster only a small proportion of that total between them.

This year we have awarded the Gold Medal to Roger Tanner, presented at the ICR in Cambridge, the 1999 Annual Award to Robin Ball and John Melrose, as noted above and the 2000 Annual Award to Tom McLeish, the presentation of which will be done at the present meeting. We have been able to make a small number of travel grants to students this year. We supported Karen Lee, Cambridge, to attend the American Institute of Chemical Engineering conference in Dallas, Richard Blackwell, Leeds, to attend the Materials Research Society Spring Meeting in California, and Yogesh Joshi, India, to attend the ICR in Cambridge. As always, we are keen to receive more applications from students.

I would like to conclude by thanking all the Officers and Council Members who have worked hard for the Society this year, particularly mentioning John Gearing and Tom Dovey who have decided to stand down at this AGM. Richard Buscall's term as President finishes with the present AGM and I would like to pay tribute to his efficient and good humoured chairing of our Council meetings and other events. It has been a pleasure to work with him and I now look forward to working with his successor, Eirian Jones. I would like to say thank you to three other people, who are not members of Council but also do a great job on our behalf: Chris Petrie who looks after the Society's web page, John Benbow who acts as our archivist and Ken Walters who is custodian of the Scott Blair Collection.

PFG Banfill

17 September 2000

HONORARY MEMBERSHIP SECRETARY'S REPORT FOR 60TH AGM

Members may recall that several major changes to membership conditions were agreed at the EGM of September 1998. These changes included the introduction of a separate £15 charge for Abstracts and the ending the £5 concession for payments made by standing order. In 1999 Council also decided that the Society should no longer accept standing order payments and that members should be invoiced each year. This

decision was made due to declining membership fee receipts, and also because an increasing number of standing order payments were arriving with no information about the sender. This position was not felt by Council to be acceptable, as it was difficult to tell which members had actually paid their fees. The membership year 1999/2000 was the first year in which all of these changes came into effect.

The membership in September 1999 was 616, however, no current addresses were available for 33 of these members. As agreed by Council the remaining 583 members were all invoiced for membership in October 1999. A reminder invoice was issued in January 2000, as required by the constitution, and a further reminder was issued with Bulletin 42/3. Appeals were also printed in the Bulletin for help in tracing members for whom we had no current address, with some success. By September 2000 replies had been received on behalf of 305 of the 583 members invoiced (52%). Of those not responding 21 were honorary members who pay no fees and a further 17 members were found to have moved on to unknown addresses. This leaves 240 members (41%) who have not responded to the invoices, although at least 64 of these members have made a standing order payment. Although attempts will need to be made at the end of this year to recover the outstanding fees, Council expected that it would take some time for members to adjust to the new system.

During this membership year 27 members have resigned and sadly 7 have passed away. However membership numbers have remained basically unchanged as 34 new members have been elected. A significant number of the new applicants have used the application form now available on the Society web page, and thanks are due to web master Chris Petrie for making this possible. As a result of the changes throughout this year the membership list as of 14th September 2000 shows 584 members of which 17 have no current addresses.

Finally I would like to thank my colleagues on Council for their assistance over the last year. Due to an enforced change of employment I am unable to continue with the post of membership secretary but I would like to take this opportunity to wish my successor well.

T Dovey

17 September 2000

HONORARY BULLETIN EDITOR'S REPORT FOR 60TH AGM

Editions published – Volume 42 and Volume 43 were both issued in 1999/2000 – the first year under the new 3-edition regime. Odd-numbered editions include the Newsletter of the ESR.

I have tried to increase the number of conference reports included in the Bulletin (9) and have taken to re-introducing book reviews when received.

I would love to include more correspondence from members in the letters section and would welcome any contributions.

Publication dates are still delayed but are gradually coming back on track although it is important to note that the details in the Diary section are generally amended to reflect actual publishing date rather than cover date...

Reasons for the delay are numerous but active steps have been, and are being taken to eliminate delays and to improve the service to members.

Advertising revenue – Advertising revenue remains strong with an average of £1300 per edition and I am pleased to report that we have had a couple of new advertisers in the year. The Publications Manager will report on production and distribution costs.

Future plans – A review of the ICR2000 event will appear in the next European edition and I hope to include more scientific papers along the same lines as Tom McLeish's recent Hitchhiking odyssey.

The overall design of the Bulletin has, I hope, continued to meet with Members' approval – I hope to continually improve the layout and content through what will be my fourth and final year as Editor (...subject to re-election, of course!)

Paul Doody

September 2000

HONORARY ABSTRACTS EDITOR'S REPORT FOR 60TH AGM

Since the last AGM, the following editions of Rheology Abstracts have been published: Vol 42 Nos 3&4; Vol 43 No 1. Vol 43 Nos 2&3 is to be published early next month, and Vol 43 No 4 is expected in the New Year. A survey of various scientific databases indicates that the number of papers having a significant rheological content is still on the increase, at over 5000 per year. We are now publishing details of about 4000 of these, thanks to the help of a small, but hardworking group of abstractors.

I am now entering my final year as Honorary Editor, and am actively seeking a successor. It is a time consuming but very fulfilling position. One also keeps very much up to date with developments across the spectrum of rheology.

Nick Hudson

September 2000

PUBLICATION MANAGER'S REPORT FOR 60TH AGM

The peak subscription level for Rheology Abstracts was 251 in the mid 1980s. When Elsevier handed back the publication rights to the BSR, in late 1995, this had fallen to 108. We have now stabilised the take up to around 80, including some new subscribers. It is hoped to put the Abstracts on line in the near future, once access rights and facilities are in place. During the year, the CDROM containing all back issues of the Abstracts (Volumes 1 to 42) has been issued, and sales are progressing steadily.

A CDROM of the Proceedings of the XIIIth International Congress on Rheology has been produced, in addition to the hard copy (4 volume set). Both are on sale by the Society, and they have attracted much interest.

The Print Unit at the University of Strathclyde, where the Bulletin and Abstracts are produced, have invested in new equipment and staff, and are able to turn round work faster and to a higher quality. They have even produced posters for the Society to display at Meetings.

Nick Hudson

September 2000

CONFERENCE REPORTS

REPORT ON THE XIIITH INTERNATIONAL CONGRESS ON RHEOLOGY, CAMBRIDGE, 20-25TH AUGUST 2000

It was a great pleasure for me to attend the XIIIth International Congress on Rheology held at Cambridge. Since it was the first international conference I attended, I was excited to meet various stalwarts in rheology. It was indeed a pleasurable experience itself to meet various rheologists in person, to listen to their lectures and to discuss various aspects of ongoing work with them.

Because of the busy conference schedule (seven parallel sessions) it was difficult to choose between some lectures to be held at the same time. One of the features of this congress as compared to previous rheology congress was the various papers on the micro structural modeling. Current trend seems to be in the area of the modeling various microstructural changes in the polymer molecule for predicting their rheological response. The corresponding session in the conference was just a preview of forthcoming advances in area of microstructural modeling in coming years. The session on the newly developing area like granular flow was interesting and indeed increased scope of the present congress. Personally I found some of the lectures and discussions thereafter to be extremely beneficiary to my Ph.D. thesis.

There were several facets of the conference other the scientific part of it, which I found to be fascinating. The first of them is the place where it was held. Cambridge may not be a tourist place for a common person, but one is forced to admire its beauty in its own way. It certainly has a place of Mecca or Rome in the hearts of those people, whose religion is science or education. The next admirable aspect of the conference was obviously the management of the British Society of Rheology. I understand that all the student and professor volunteers might have missed some of the important sessions and discussions and hence I would like to thank them on behalf of all the conference delegates and also congratulate them for coming up with such a successful and well organized event. Further I must mention one unique experience. After I joined my department roughly a week after the conference. I found a thick parcel from BSR waiting for me. When I opened the parcel, I found

my own notebook that was misplaced in the conference. The notebook was accompanied by a note from Prof. Walters, saying that it was found in the conference. This was really very touching experience and I thank organizers for giving a personal touch to such a large event.

Finally I would like to thank the British Society of Rheology for granting me the partial aid towards the travelling and other costs for attending the conference.

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REPORT ON THE COURSE “PROCESS RHEOLOGY”, 6-11TH NOVEMBER 2000

I would like to express my appreciation and my sincere gratitude for everybody who contributed in organizing the course “Process Rheology” (6th to 11th November, 2000).

The laboratories were well supplied and prepared. The wide variety of rheometers were available, in addition, other relevant equipments were available as well such as extruders, mixers and viscometers. The instructors were really very high qualified and were established in their topics. They were willing to answer any question.

The topics were very related and practical in different fields, it gives us a clear understanding of actual application in rheology.

It was a very interesting opportunity, we had the chance to deal with different topics as the basics of rheometry, capillary, coaxial, cone and plate, parallel plate rheometers and on-line viscometry which measure the viscosity of liquids on-line, during their manufacture has many advantages such as time and effort are saved in obtaining the current viscosity, a control function can be introduced and a continuous monitor of viscosity build up- is available for batch-mixing operations.

The processing of pharmaceuticals, biological fluids, gels and foods including the importance of rheology in various areas of research and

development such as microstructure component interactions stability, manufacture and transfer involving mixing, stirring, milling, extrusion and pumping, quality control of recipients manufacturing process and final product including removal from container patient acceptance bioavailability. The rheology of fluid and semisolid dispersions, such as practical emulsions, suspensions and polymeric or micellar solutions, form the basis of many pharmaceutical, cosmetic, food, agrochemical and paint formulations, these complex dispersions are subjected to a wide range of stresses, strains and strain rates during their processing, transport, storage and use.

Industrial processes-suspensions of deformable particles and the relationship between the rheology of a liquid and its formulation and processing: in which way can we influence the flow properties by manipulating the variables at our disposal to produce what we think is desirable. The factors at our disposal originate from processing, like the particle size distribution, through to small formulation changes such as polymer additives.

Industrial processes-extrusion and extruders including polymer processing-screw extruder. The main operational regions of a screw extrusion are feed zone, compression zone and co extrusion. The processing procedures which are used depend on the nature of the polymeric material such as thermoplastics polymers and thermo set polymers such as injection moulding which is widely used and provides a method for the fabrication of a wide variety of objects and vacuum moulding which is used to produce large mouldings and involves the combined use of heat and vacuum to form the final object.

Non-Newtonian fluid in elongation and numerical simulation by construction of suitable constitutive models which have been considered for viscosity of non-newtonian liquids and found that the cross, power-law and sisko models covered most behaviour, theoretical CFD within a non-Newtonian setting.

Once again, I am deeply grateful to you and BSR for their help.

Haifa El-Sadi

CONCRETE RHEOLOGISTS IN FRANCE

OCTOBER 2000

How do you carry out a round robin test on a material which has a life of at most a couple of hours and is made from materials which are different in every country? I recently helped a group of concrete rheologists tackle the problem in the only logical way. We brought five rheometers together at a laboratory that had sufficient capacity to produce enough fresh concrete for them each to test it simultaneously.

By way of background, the obvious instrument to test freshly mixed concrete, a concentrated suspension of particles up to 20mm diameter in water conforming to the Bingham model, is a coaxial cylinders viscometer. However, applying some basic geometrical rules such as the gap width needing to be 10 times the particle size, a radius ratio of 1.2 or less, and a height to radius ratio of 1, suggests that the test samples need to be 2.5m^3 (ie about 6 tonnes). The biggest rheometer in existence which comes anywhere near this size is one used by Cemagref in France for testing mountain debris materials. All other practical rheometers for fresh concrete are based on measuring the torque exerted in small scale mixers at a range of rotation speeds and applying the Metzner-Otto principle of assuming that a mean effective shear rate exists which is proportional to speed. The first such instrument was devised by Tattersall with derivatives subsequently developed by other workers, but some conflicts have emerged in the data, and these need to be resolved in order to make further progress.

Accordingly a round robin testing campaign was organised by the American Concrete Institute Committee 236A and held in Nantes, France, in October 2000. Five rheometers from four countries came together with workers from eight different countries for a week of testing. After some teething problems twelve concretes were successfully produced and delivered to the laboratory for simultaneous testing. After each test all the apparatus was rigorously cleaned ready for the next one.

For the programme to be capable of rigorous analysis, the National Institutes of Science and Technology, who were supervising the tests, required careful sampling and analysis of the concrete to check its homogeneity, backed up by adherence to a consistent procedure. So, for

example, ten samples were collected from the mixer's discharge conveyor belt for analysis, the concrete was delivered by fork lift truck to the laboratory and we descended on it like a swarm of bees to transfer material to our rheometers. When everyone was ready a bugle call signalled the time to start all the tests.

The results will require some analysis before the report can be finalised but immediately obvious was the close numerical agreement between two of the instruments with a third one giving significantly higher yield value and plastic viscosity. That immediately gives us some food for thought.

The week was very pleasant and some good humoured chat was exchanged while we waited for the concrete to be delivered, as well as having some short presentations on the various instruments and their principles of operation. The social side was not neglected, with Francois de Larrard, our host, entertaining us to an evening of live jazz at his home, and an evening dinner cruise sponsored by the Laboratoire Central des Ponts et Chaussées on the river Erdre.

We ended the week looking forward to Part 2 of the programme to be carried out in the USA in 2001.

Professor P F G Banfill

December 2000

BSR ANNOUNCEMENTS

<http://www.bsr.org.uk/> and <http://www.rheology.org.uk/>

THE INSTITUTE OF NON-NEWTONIAN FLUID MECHANICS

THE BRITISH SOCIETY OF RHEOLOGY

INDUSTRIAL FOOD PROCESSING: EXPERIMENTS AND NUMERICAL SIMULATION

**A CONFERENCE TO BE HELD AT THE UNIVERSITY OF
PLYMOUTH, UK**

9th – 11th APRIL 2001



Local Organising Committee

Prof. T. E. R. Jones
Dr P. W. James
Dr J. M. Davies
Dr C. Brennan
Dr J. Summerscales

Scientific Committee

Dr. P. Sadd (RHM)
Mr G. Tucker (CCFRA)
Prof. M. F. Webster (University of Swansea)
Dr. P. R. Williams (University of Swansea)
Dr P. W. James (University of Plymouth)
Prof. T. E. R. Jones (University of Plymouth)

PROGRAMME

Monday 9th April

12.00 – 1400 Registration and Buffet Lunch

RHEOLOGICAL CHALLENGES

14.15 H A BARNES

"An overview of food rheology"

14.40 I D ROBERTS

"Industrial perspectives on rheological problems in food processing"

15.05 A S BURBIDGE

"Modelling the rheology of highly concentrated food systems"

15.30 – 16.00 Tea & Coffee

SQUEEZE FILM FLOW

16.00 D R OLIVER

"The compression of foods between circular parallel discs"

16.25 N M YATES, M BARIGOU, P J FRYER & S MOORE

"Squeeze flow rheometry of semi-solid food materials"

18.15 Bus leaves Copthorne Hotel for National Marine Aquarium and Evening Meal

Tuesday 10th April

FLOW MODELLING

9.00 P SADD

"Technical challenges in dough mixing"

9.25 D M BINDING & M R COUCH

"On the peeling of doughs from solid surfaces"

9.50 M F WEBSTER, A BALOCH, D DING & K S SUJATHA

"On the modelling of dough mixing flows"

10.15 T AVALOSSE, B ALSTEENS & Y RUBIN

"Numerical analysis for the design of a food mixer"

10.40 – 11.15 Tea & Coffee

HEAT AND FLOW MODELLING

11.15 A R DAVIES

"Some case studies in the mathematical modelling of food"

11.40 C DUCHANOY & T JONGEN

"Detailed modelling of liquid/solid flows with applications to food processing"

12.05 U BOLMSTED

"Heat transfer and flow behaviour modelling in heat exchangers"

12.30 – 13.45 Lunch

IN-CONTAINER PROCESSING

13.45 G TUCKER

"Using the rheology of foods to optimise thermal processing"

14.10 M VANDENBERGHE

"Agitation in axially rotated cans"

14.35 J HUGHES, T E R JONES & P W JAMES

"Simulations of in-container mixing processes in axial and end over end rotations"

15.00 – 15.30

Tea & Coffee

FOOD BIOPOLYMERS AND RHEOLOGY

15.30 C J CARRIERE & G E INGLETT

"Constitutive analysis of the non-linear rheological behaviour of cellulosic fibre gels"

15.55 G BROWNSEY

"Food Rheology -A view from the bulk to the interface"

16.20 G BRENNAN

"Rennet coagulation and curd rheology of milk products with fibre additions"

18.45 Bus leaves Copthorne Hotel for Conference Dinner (sponsored by T.A. Instruments Ltd) at St Mellion Golf and Country Club.

Wednesday 11th April

RHEOMETRY

9.00 C F SHOEMAKER

"Rheological characterization of food dispersions with an on-line rheometer"

9.25 P R WILLIAMS, R LI WILLIAMS, R JONES, A AI-HUSSANY & S RAVJI

"New rheometry for sol-gel characterisation-mechanical measurements and fractal characteristics"

9.50 C O'DONNELL

"Evaluation of process viscometry systems for food process applications"

10.15 C SERVAIS

"The food rheologist's need for new rheometry"

10.40 – 11.15

Tea & Coffee

FOOD PRODUCT RHEOLOGY

11.15 M LESER

"Rheology of cubic phase systems"

11.40 C GALLEGOS, C VALENCIA, M C SANCHEZ & A CIRUELOS

"Rheology and processing of tomato products"

12.05 I M AFONSO, L MELO & J M MAIA

" Rheological and thermal behaviour of stirred yoghurt during manufacturing"

12.30 – 13.45

Lunch

END OF CONFERENCE

**INDUSTRIAL FOOD PROCESSING:
EXPERIMENTS AND NUMERICAL SIMULATIONS**

**REGISTRATION FORM
(This form may be photocopied)**

**I wish to attend the Conference at the University of Plymouth
from 9th – 11th April, 2001.**

The cost of the conference will be £340 payable by February 1st 2001. The fee includes accommodation at the Copthorne Hotel, located very close to the conference venue. Accompanying persons may share rooms free of charge but meals taken must be paid for separately. The fee also includes all meals, a visit to the National Marine Aquarium and the conference dinner.

Payment of the Registration fee may be made by one of the following methods.

By cheque made payable to the University of Plymouth.

By telegraphic transfer, with costs being paid by the remitter, to Midland Bank, City Centre Branch, Plymouth, U.K., to the credit of account No 61485946 (Bank Code 40-36-22). Please quote reference conf. 81291.

Further information may be obtained from Professor T.E.R. Jones, Department of Mathematics and Statistics, University of Plymouth, Drake Circus, Plymouth, PL4 8AA, UK

(Tel: 01752 232735, email: ejones@plymouth.ac.uk).

Signed _____

Name _____

Address _____

Please return this form and cheque (if applicable) to:

**Professor T. E. R. Jones
Department of Mathematics and Statistics
University of Plymouth
Drake Circus
Plymouth PL4 8AA
Devon, UK**

OTHER ANNOUNCEMENTS
3RD PACIFIC RIM CONFERENCE ON RHEOLOGY
VANCOUVER, BC, CANADA, JULY 8-13 , 2001

After two successful events in Kyoto, Japan, and Melbourne, Australia, the Pacific Rim Conference on Rheology is moving to Vancouver for its 3rd meeting. This will take place at the Westin Bayshore Hotel (downtown Vancouver) in July 8-13, 2001. The Conference is sponsored by the Canadian Rheology Group and it is aimed in continuing the tradition of the international conferences on rheology.

TOPICS

Applied Polymer Rheology with Applications to Polymer Processing
Rheology and Thermodynamics of Polymer Blends and Composites
Extensional Polymer Melt and Solution Rheology
Rheology of Metallocene Polyolefins
Flow Instabilities: Melt Fracture-Wall Slip and Related Phenomena
New Experimental Rheological Techniques
Modeling of Polymer Flows and Numerical Simulations
Rheology of Complex Fluids
Rheology of Suspensions, Emulsions and Colloids
Biorheology

INVITED SPEAKERS

Roger Tanner - History of Rheology
Vlassopoulos D - Rheology and Thermodynamics of Polymer Blends
Munsteadt H - Extensional Melt Rheology
Denn MM - Melt Fracture and Wall Slip Instabilities
Goldsmith - Biorheology
Watanabe H - Rheology of Complex Fluids
D. Boger - Suspensions
Lee SJ - Polymer Processing
Hasegawa T - Polymer Solutions

CONFERENCE COMMITTEE

Prof John M Dealy (McGill University)
Prof Jeffrey Giacomin (University of Wisconsin)
Prof Savvas G Hatzikiriakos (The University of British Columbia)

Prof David James (The University of Toronto)
Prof. Daniel Klingenberg (University Of Wisconsin)
Prof. Gareth McKinley (MIT)
Prof Evan Mitsoulis (National Technical University of Athens))
Prof Anoush Poursartip (The University of British Columbia)
Prof. Alexandro Rey (McGill University)
Prof. Eric Shaqfeh (Stanford University)
Prof. U.T. Sundararaj (The University of Alberta)
Prof Kostas Tzoganakis (The University of Waterloo)
Prof John Vlachopoulos (McMaster University)
Prof Paula Wood-Adams (McGill University)

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Prof Ken Walters, FRS

FOR MORE INFO PLEASE VISIT:

www.prcr3.com

Organized by

The Canadian Rheology Group and The University of British Columbia

**THE 3RD INTERNATIONAL CONFERENCE OF THE
HELLENIC SOCIETY OF RHEOLOGY (HSR)
PATRAS, GREECE, JUNE 10-14, 2001**

The meeting is open to all scientists and engineers conducting research or being interested in the fields of RHEOLOGY and FLUID MECHANICS.

Topics include:

- polymer melts and solutions
- structure and dynamics of polymers
- colloids and suspensions
- molecular modeling and numerical simulations
- experimental, theoretical and computational fluid dynamics

The program will consist of plenary lectures, invited lectures, and oral contributions. Also, a special session will be dedicated to Professor Andreas Acrivos on the occasion of his retirement from the Levich Institute.

A number of prominent rheologists and fluid mechanicians from around the world have also accepted to participate in the Meeting, as "surprise" invited lectures, honoring Prof. Acrivos.

For more information, please visit the web page of the Hellenic Society of Rheology and of the Meeting:

<http://esperia.iesl.forth.gr/~hsr/HSR.html>

With our very best regards,

Vlasis Mavrantzas
(Chairman of the Organizing Committee)

John Tsamopoulos
(Chairman of the Scientific Committee)

7TH EUROPEAN SCHOOL OF RHEOLOGY
SEPTEMBER 10-14, 2001
organised by the
European Society of Rheology and
the Belgian Group of Rheology

A short course on

RHEOLOGICAL MEASUREMENTS

APPLICATION TO POLYMERS, SUSPENSIONS AND PROCESSING

hosted for the 4th time by the K.U. Leuven, Department of Chemical Engineering

AIM

The aim of the course is to give practicing engineers and chemists, as well as young PhD students an understanding of

- the fundamentals of rheology
- principles of rheological measurements
- applications to problem solving

FACULTY

Prof. G.G. Fuller, Stanford University

Prof. R. Keunings, University Catholique de Louvain

Prof. C.W. Macosko, University of Minnesota

Prof. G. Marrucci, University of Naples,

Prof. H.E.H. Meijer, T.U. Eindhoven,

Prof. J. Mewis, K.U. Leuven,

Prof. P. Moldenaers, K.U. Leuven,

Prof. J. Vermant, K.U. Leuven

For more information on the course or to request a detailed program brochure, check the web page at:

<http://www.cit.kuleuven.ac.be/cit/ltrk/course.html>

or contact Peter Van Puyvelde

[\(peter.vanpuyvelde@cit.kuleuven.ac.be\)](mailto:peter.vanpuyvelde@cit.kuleuven.ac.be)

**SUMMER SCHOOL ON
"ANALYTICAL AND NUMERICAL METHODS IN NON-
NEWTONIAN FLUID MECHANICS"
25-29 JUNE, 2001
UNIVERSITY OF MINHO, GUIMARAES, PORTUGAL**

OBJECTIVES

The University of Minho and the University of Wales Institute of Non-Newtonian Fluid Mechanics are organising a Summer School with the aim to interest young researchers into the field of Rheology and Non-Newtonian Fluid Mechanics by helping to bridge the gap between the available theoretical tools and the existing problems of a mathematical nature in industry and academia.

LECTURERS AND LECTURE FORMAT

K. Walters, University of Wales
A. R. Davies, University of Wales
M. H. Wagner, Technical University of Berlin
G. Marrucci, University of Naples
R. Keunings, Catholic University of Louvain
F. P. T. Baaijens, University of Eindhoven

The School will take place in the Azurem Campus of the University of Minho and will consist in morning and afternoon lectures, with some time allotted for the discussion of subjects of particular interest to the audience.

INFORMATION

For more information on the course, please check the web page at:

<http://www.ecum.uminho.pt/SummerSchool>

or contact the Secretariat at

s.school@ecum.uminho.pt

**GOLDEN JUBILEE MEETING OF THE
GERMAN SOCIETY OF RHEOLOGY (DRG)
14-16th MAY 2001**

On-line registration for the Golden Jubilee Meeting of the DRG,

Berlin, May 14 to 16, 2001,

is now available at

http://www.bam.de/partner/drg/anm_form.html

The programme will include plenary lectures by H. Rehage (Essen), H. Münstedt (Erlangen-Nürnberg), M. Modigell (Aachen), and E. Windhab (Zürich), contributed papers, poster sessions, an exhibition, and a jubilee banquet.

The conference language will be German; contributions in other European languages are welcome.

A number of travel grants for Ph D students presenting papers are available; for details on how to apply see

http://www.bam.de/partner/drg/ank_2001.html

BSR MEMBERSHIP NEWS

NEW MEMBERS

UNITED KINGDOM	
Mrs Sally Everitt Dept of Applied Mathematics University of Leeds Leeds LS2 9JT	Dr Matthew R Giles Performance Chemicals Associated Octel PO Box 17 Ellesmere Port Cheshire
Miss Janine Harwood CIBA Speciality Chemicals Water Treatments PO Box 38 Low Moor Bradford	Dr Helen Wilson Dept of Applied Mathematics University of Leeds Leeds LS2 9JT

AIMS OF THE SOCIETY

The way liquids flow and solids deform affects all aspects of life.

Extraction and processing of crude oil, moulding of plastics, use of toothpaste, spreading of margarine, painting and the lubrication of joints in the human body are all examples of processes depending upon rheological behaviour. Rheology is defined as the science of the deformation and flow of matter.

If your work is concerned with rheology in any way, then you have much to gain by joining the British Society of Rheology - publications, conferences and access to fellow members who, while working in a different discipline or industry, may be facing similar problems to yours.

The Society is non-profit making and is registered as a charity.

RECRUITMENT OPPORTUNITIES

Thermo Haake is a leading manufacturer of viscometers and rheometers located in the Southern Germany (Karlsruhe is 1 hour South of Frankfurt) with ambitious growth- and profit-related goals.

Details can be found at

<http://www.thermohaake.com>

We are looking for a

Product Specialist / Rheometer

to expand our sales support team in Karlsruhe.

The position requires a scientific education in chemical engineering, polymer chemistry or physics. Experience in sales and sales support of high-tech products is an advantage. A high level of computer-proficiency is an essential job requirement. Excellent written and spoken (fluent) English skills are a must as we support our rheometers world-wide; any additional languages would be very valuable. Practical experience in the rheology of fluids and/or polymer melts is an advantage for this position.

The Rheometer Sales Team reports directly to the Rheology Business Unit Manager and is responsible for sales and support of all Thermo Haake Rheology products (<http://www.haake.de/rheology.htm>).

Specific tasks include:

- Direct support for rheometer sales and applications internationally (see our sales partners at <http://www.haake.de/intrhteam.htm>)
- Technical support of the domestic sales force (see our domestic salesforce at <http://www.haake.de/gerrhteam.htm>)
- World-wide support of direct customers (by phone, mail and personal visits)
- Arranging and carrying out of educational seminars in rheology (Germany and abroad)
- Attending exhibitions and conferences to present products and papers
- Working in the Rheology Sales Team actively helping to define new instruments and concepts.

Thermo Haake offers a very attractive compensation package and a secure career. If you are interested to work in an innovative team (<http://www.haake.de/rheteam.htm>) with the latest high-technology

products around the world, then please send your application with CV to Thermo Haake personal@thermohaake.com

Thermo Haake, Dieselstr. 4, D-76227 Karlsruhe, Tel. +49 (0) 721-4094-202

INDUSTRY NEWS

Bohlin Instruments acquires Rosand rheology product lines

Bohlin Instruments Ltd, Cirencester, UK, the world leader in rheological test equipment, has acquired the rheology product lines of Rosand Precision Ltd, together with the Rosand trademark.

The product lines included in the arrangement are the highly acclaimed RH7 and RH2000 capillary rheometers as well as melt flow index products, on-line rheology products and VICAT softening point equipment.

Bohlin will market the products, which will retain the Rosand brand, through its existing sales channels including direct operations in Germany and the USA, as well as the United Kingdom.

Bohlin's management expects that the acquisition will add substantially to revenues in 2001, which have been rising by over 20% per annum based on organic growth.

Bohlin Group's Managing Director, Dr Richard Hall commented: "The Rosand product lines are entirely complementary to Bohlin's ongoing business activity which is focused on rotational rheometers. Indeed, the Rosand product line has contributed significantly to our German revenues since we started to act as a distributor in 1996. The move serves to reinforce our position as a major global player in the rheology business."

For further information on the above and all Bohlin products, contact Lynda Watson at lw@bohlin.co.uk

HAAKE changes name to Thermo Haake

Karlsruhe, GERMANY; October 2000 – HAAKE announced today that it has changed its name to Thermo Haake as part of a new corporate identity strategy initiated by its parent company, Thermo Electron Corporation (NYSE: TMO). The program is designed to establish a strong affiliation between Thermo Electron and its 80-plus globally recognized brands, including Haake, and to promote Thermo Electron as a single, unified company.

Like Haake, each of Thermo Electron's businesses will add the prefix "Thermo" to its existing name. Businesses will continue to market their products under product-specific trademarks, such as Phoenix circulators, RheoStress rheometers, ViscoTester viscometers, PolyLab torque rheometers and MeltFliXer melt flow indexers.

"By sharing our talent, technologies, and resources as an integrated company, Thermo Haake and each of our sister businesses will be better able to provide customers with more comprehensive solutions," said Roland Schultner, Managing Director of Thermo Haake. "The direct tie with Thermo Electron also allows us to benefit from our parent company's size, scope, and financial strength."

Richard F. Syron, chairman and chief executive officer of Thermo Electron, said, "We want the world to know us as one \$2.2 billion global technology company that encompasses many well-known brands, such as Thermo Haake. We firmly believe that this new direction will allow our customers to fully understand, and take advantage of, the enormous breadth of our product offerings in markets ranging from life sciences to telecommunications to on-line quality control."

Thermo Electron is taking a modest approach to implementing the identity program, choosing to allocate financial and other resources to business and product development rather than to a major corporate-image campaign. While corporate guidelines have been established, the actual implementation is the responsibility of the company's business units. Most of the material, equipment, and systems produced by Thermo Electron businesses will reflect the new "Thermo Brand" names by March 2001.

Thermo Electron Corporation is a global leader in providing technology-based instruments, components, and systems that offer total solutions for markets ranging from life sciences to telecommunications to food and beverage production. For example, the company's powerful technologies help researchers sift through data to make discoveries that will fight disease or prolong life. They allow manufacturers to fabricate ever-smaller components required to increase the speed and quality of communications. And they automatically monitor and control online production to ensure that critical quality standards are met safely and efficiently. In 1999, Thermo Electron's instrument businesses, based in Waltham, Massachusetts, reported \$2.2 billion in revenues and employed approximately 14,000 people worldwide. For more information on Thermo Electron, visit <http://www.thermo.com> on the Internet.

CONFERENCES

You are also advised to visit the BSR home pages where an extensive list of conferences is maintained by Chris Petrie: <http://www.bsr.org.uk/>

2001	
2-3 Apr Bristol UK	STRUCTURE AND DYNAMICS IN SHEAR FIELDS - CALL FOR PAPERS Organised on behalf of the Colloid & Interface Science group of The Royal Society of Chemistry Dr I D Robb, North East Wales Institute, Mold Rd, Wrexham, UK T:+44 (0)1978 293133 F:+44 (0)1978 290008
9-11 Apr Portsmouth UK	INDUSTRIAL FOOD PROCESSING: EXPERIMENTS AND NUMERICAL SIMULATION Organised by The Institute of Non-Newtonian Fluid Mechanics and The British Society of Rheology Professor T. E. R. Jones, Department of Mathematics and Statistics, University of Plymouth, Drake Circus, Plymouth PL4 8AA, Devon, UK T: 01752 232735 E: ejones@plymouth.ac.uk
14-16 May Berlin DE	GOLDEN JUBILEE MEETING OF THE DEUTSCHEN RHEOLOGISCHEN GESELLSCHAFT (DRG) E: drq@bam.de
10-14 Jun Patras GR	3RD INTERNATIONAL MEETING OF THE HELLENIC SOCIETY OF RHEOLOGY Dedicated to the retirement of Prof Andreas Acrivos Info: esperia.iesl.forth.gr/~hsr/hsr.html
8-13 Jul Vancouver, BC CA	3RD PACIFIC RIM CONFERENCE ON RHEOLOGY Organised by The Canadian Rheology Group and The University of British Columbia Info: www.prcr3.com
23-27 Sep Melbourne AU	6TH WORLD CONGRESS OF CHEMICAL ENGINEERING Meeting Planners, 108 Church Street, Hawthorn, Victoria 3122, Australia T: +61 (0)3 9819 3700 F: +61 (0)3 9819 5978 E: chemeng@meetingplanners.co.au Info: http://www.meetingplanners.com.au/chemeng
21-25 Oct Bethesda, ML US	73RD ANNUAL MEETING OF THE SOCIETY OF RHEOLOGY Details will be added when available.
T: Telephone; F: Facsimile; E: Email; Info: WWW URL	

COURSES

2001	
29 May – 1 Jun Loch Lomond UK	THEORETICAL, EXPERIMENTAL AND INDUSTRIAL ASPECTS OF RHEOLOGY Dr N E Hudson, Dept of Pure & Applied Chemistry, University of Strathclyde, 295 Cathedral St, Glasgow G1 1XL, UK T: +44 141 548 2162 F: +44 141 548 4822 E: n.e.hudson@strath.ac.uk
4-8 Jun Minneapolis MN USA	26TH ANNUAL SHORT COURSE ON RHEOLOGICAL MEASUREMENTS: APPLICATION TO POLYMERS, SUSPENSIONS, AND PROCESSING Directed by Chris Macosko. Contact David Giles, University of Minnesota, Department of Chemical Engineering and Materials Science, 421 Washington Avenue SE, Minneapolis, MN 55455, USA T: +612 625 0880 F: +612 626 1686 E: giles002@tc.umn.edu
25-29 Jun Minho PT	SUMMER SCHOOL ON "ANALYTICAL AND NUMERICAL METHODS IN NON-NEWTONIAN FLUID MECHANICS" Organised by The University of Minho and the University of Wales Institute of Non-Newtonian Fluid Mechanics Contact the Secretariat. E: s.school@ecum.uminho.pt Info: http://www.ecum.uminho.pt/SummerSchool/
10-14 Sep Leuven BE	7TH EUROPEAN SCHOOL OF RHEOLOGY Organised by the European Society of Rheology and the Belgian Group of Rheology. Contact Peter Van Puyvelde E: peter.vanpuyvelde@cit.kuleuven.ac.be Info: http://www.cit.kuleuven.ac.be/cit/ltrk/course.html
12-16 Nov Glasgow UK	PROCESS RHEOLOGY Dr N E Hudson, Dept of Pure & Applied Chemistry, University of Strathclyde, 295 Cathedral St, Glasgow G1 1XL, UK T: +44 141 548 2162 F: +44 141 548 4822 E: n.e.hudson@strath.ac.uk

2002	
3-6 Jun Loch Lomond UK	THEORETICAL, EXPERIMENTAL AND INDUSTRIAL ASPECTS OF RHEOLOGY Dr N E Hudson, Dept of Pure & Applied Chemistry, University of Strathclyde, 295 Cathedral St, Glasgow G1 1XL, UK T: +44 141 548 2162 F: +44 141 548 4822 E: n.e.hudson@strath.ac.uk
11-15 Nov Glasgow UK	PROCESS RHEOLOGY Dr N E Hudson, Dept of Pure & Applied Chemistry, University of Strathclyde, 295 Cathedral St, Glasgow G1 1XL, UK T: +44 141 548 2162 F: +44 141 548 4822 E: n.e.hudson@strath.ac.uk
T: Telephone; F: Facsimile; E: Email; Info: WWW URL	

ONES THAT GOT AWAY...

2001	
14-15 Feb Hilton Head SC US	72ND ANNUAL MEETING OF THE SOCIETY OF RHEOLOGY (SOR)
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