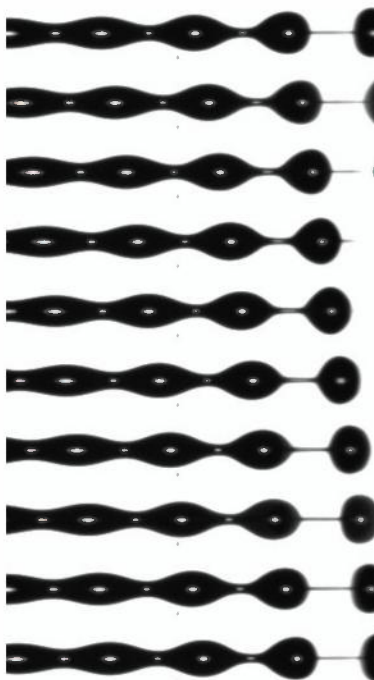

THE BRITISH SOCIETY OF RHEOLOGY

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THE BRITISH SOCIETY OF RHEOLOGY

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Publication Manager and Rheology Review	Dr Nick E Hudson Department of Pure & Applied Chemistry, University of Strathclyde, 295 Cathedral Street, Glasgow G1 1XL Dr Rob Poole Department of Engineering, University of Liverpool, Chadwick Building, Peach Street Liverpool L69 7ZF	T: 0141 548 2162 F: 0141 548 4822 E: n.e.hudson@strath.ac.uk T: 0151 7944806 F: 0151 7944848 E: Robpoole@liverpool.ac.uk
Industry/Non-Newtonian Club Coordinator	Dr Bettina Wolf School of Biosciences, University of Nottingham, Sutton Bonington LE12 5RD	T: 0115 9516134 F: 0115 9516142 E: bettina.wolf@nottingham.ac.uk
Web Development (Temporary)	Mr Jonathan Harvey Department Computer Science, University of Wales Swansea, Singleton Park, Swansea SA2 8PP.	T: F: E: csjon@swansea.ac.uk

T: Telephone; F: Fax; E: Email

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THE BRITISH SOCIETY OF RHEOLOGY



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CONTENTS

Editorial	70
Aims of the Society	71
Environmental Rheology – by David V Boger FRS	72
BSR News	
Membership News	78
Vernon Harrison Doctoral Prize 2009-10	81
Commentary on the 328th Council Meeting	86
Non-Newtonian Club News	87
Conference Announcement	
BSR 2010 Midwinter Meeting	88
INNFM/BSR 2011 Easter Meeting	90
Industry News	92
Conference & Courses Dairy	95

Hon Bulletin Editor:

Dr Xue-Feng Yuan

Manchester Interdisciplinary Biocentre, School of
Chemical Engineering and Analytical Science,
The University of Manchester, 131 Princess Street,
Manchester M1 7ND

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EDITORIAL

SUBMISSIONS TO THE BULLETIN

Submissions to the Bulletin may be made by any practical means – post, email, disk, fax, pigeon, donkey, guide dog, *et cetera* but electronically is preferred (saves typing...). Most packages supported (Word, TeX, LaTeX, WordPerfect, ASCII, RTF) but always provide a contact name, address, e-mail, or telephone number in case of problems. The deadline for submission is Feb. 15th, June 15th and Oct. 15th, respectively, for three issues annually. As always, all contributions are 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 (xue-feng.yuan@manchester.ac.uk) for details.

COVER ILLUSTRATION

Jet Extensional Rheometry: A series of video frames showing the breakup of a weakly viscoelastic liquid jet. The fluid is an 0.225 wt% solution of a hydrophobically-modified methylcellulose in water. The jet is being driven piezoelectrically at a frequency of 4.80 kHz; corresponding to a dimensionless frequency just larger than the most unstable wavenumber expected for a Newtonian jet of equivalent viscosity. Each image is taken 24 μ s apart using a stroboscopic illumination system triggered with a slight phase shift (0.1 Hz) from the forcing frequency. Contributed by Vivek Sharma, Jim Serdy, Phil Threlfall-Holmes (Akzo-Nobel) and Gareth McKinley. Research supported by Akzo-Nobel.

We are always looking for appropriate images for the front cover of the Bulletin and Rheology Abstracts (preferably of a rheological nature!). Please contact either Xue-Feng Yuan (xue-feng.yuan@manchester.ac.uk) or Nick Hudson (n.e.hudson@strath.ac.uk). Contributions are always welcome!

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.

You are warmly welcome to visit our web site <http://www.bsr.org.uk/>, and to apply for membership on-line.

ENVIRONMENTAL RHEOLOGY

David V Boger, FRS
Monash University
Clayton, Victoria, Australia

Rheological knowledge can be exploited by many industries to drastically reduce the volume of waste currently produced and stored, and hence reduce the negative social and environmental impact of these industries.

The minerals industry worldwide is an example, while the huge oil-sand mining activities in Canada is another, as is the disposal of human waste. For example, there are copper mines in the world which produce, on average, 250,000 tonnes on a dry basis of fine particle waste per day. Such waste is pumped to a disposal area at relatively low concentration when the material has Newtonian flow characteristics. This disposal area is invariably a very large dam; in fact, disposal areas approaching half the size of Singapore are present in the world. If the waste from such a mine, whether it be from minerals, coal, oil or human waste, is dewatered and the water is reused in the process, the footprint produced by the dam can be reduced dramatically. The dewatered waste is a non-Newtonian fluid; therefore the term Environmental Rheology.

In fact, it is possible to go from wet to dry disposal. There are many incentives to do this ranging from conservation and reuse of water to reducing the considerable risk involved in the failure of these dams and a long-term economic environmental incentive. The most recent bauxite tailings dam failure (7 November 2010) in Hungary does not illustrate the best practices used by the alumina industry worldwide. Figure 1 is a photograph of the Hungarian dam before failure and Figure 2, the same dam after failure (Photographs courtesy of the Austrian newspaper *Erd Standard*). The dam was located in the town of Ajka about 160 kilometres west of Budapest. The tide of red mud from the burst dam was as high as two metres. Seven villages were affected, with 2-7 deaths reported and at least 120 people injured. The red mud waste produced from an alumina caustic plant is



Figure 1: Hungarian Dam



Figure 2: Failure of Hungarian Dam

often at a pH of about 13 (very caustic). Hungarian officials have called this the country's worst chemical accident. The consequence of a dam failure is dramatic and can be tragic. The photograph in Figure 3 shows the rupture in another tailings dam, this time holding the waste from a lead-zinc mine in Spain in 1998. Five million cubic metres of water and particulates containing high levels of heavy metals poisoned two rivers and flooded crops. The company was fined millions of euros; the miner sued the company who built the dam for millions of euros; regional authorities sued the company for millions of euros; and shareholders apparently sued the company for their losses as the company shares plummeted. Cleanup costs exceeded 250 million euros. This is another example of what happens when such a tailings dam bursts; in this case, no lives have been lost.

The consequence of a dam failure is dramatic and can be tragic. The photograph in Figure 3 shows the rupture in another tailings dam, this time holding the waste from a lead-zinc mine in Spain in 1998. Five million cubic metres of water and particulates containing high levels of heavy metals poisoned two rivers and flooded crops.



Figure 3: Failure of the Boliden lead-zinc tailings dam in 1998

The company was fined millions of euros; the miner sued the company who built the dam for millions of euros; regional authorities sued the company for millions of euros; and shareholders apparently sued the company for their losses as the company shares plummeted. Cleanup costs exceeded 250 million euros. This is another example of what happens when such a tailings dam bursts; in this case, no lives have been lost. Significant numbers of lives have been lost in tailings dam failures. In the Stava failure in Italy on 19 July 1985, 268 people lost their lives. More recently on 8 September 2008 at least 250 people lost their lives in the collapse of a waste product reservoir in the Shanxi province, China. In the last twenty years 43 tailings dam failures have been documented. (The interested reader can learn more on the worldwide web by looking up ‘tailings dam failures’.)

Tailings dam failures can virtually be eliminated by moving from a wet disposal Newtonian fluid suspension to a highly concentrated non-Newtonian paste simply by understanding and exploiting basic shear and compression rheology. As the concentration is increased the material becomes non-Newtonian, exhibiting generally pseudoplastic characteristics. Further increase in the concentration sees the beginning of a yield stress and thixotropic behaviour in some wastes.



Figure 4: Alcoa Western Australia, bauxite waste dry stacking

Ultimately one generates a very high yield stress material which may be difficult, if not impossible, to pump. Materials with yield stresses up to 200 Pa can now be pumped with centrifugal pumps and it is technically feasible to dewater and pump at such concentrations and dry stack, as is the case in the alumina industry in Western Australia. (See Figure 4.)

An application of very basic rheological principles involving both compression and shear rheology is all that is needed to reduce the risk, recover water and reduce the footprint. Hence exploiting the rheology can decrease the negative social impact and environmental impact of the particulate fluid waste, not only for the minerals industry but also for the coal, oil and human waste industries. We call this application ‘environmental rheology’.



Figure 5: Mineral waste produced with a compression thickener

The alumina industry has led the world in the move from wet to dry disposal. It would seem that the failure in Hungary could have been avoided with the application of current technology. Figure 5 shows the type of paste material which can be produced in compression thickeners and pumped, while Figure 4 shows a dry disposal area which contrasts markedly with the Hungarian bauxite residue dam shown in Figure 1. While some of the alumina industry is leading the way few other minerals industries have followed. In third world countries the practice of discharging millions of tonnes of fine particle mineral waste into rivers and the sea is not uncommon. The three **R**'s – **R**ecycle, **R**educe and **R**e-use – are often not practised. We should be asking the question, why?

BSR NEWS

Membership News

The Society has welcomed the following new members since the AGM:

Tudur Davies (Aberystwyth University)

Yuchen Wang (University of Strathclyde)

Brian Miller (Meritics Ltd, Dunstable)

Katherine Glover (University of Oxford)

Nilia Salazar (Aberdeen University)

Anders Aufderhorst-Roberts (University of Cambridge)

Paul Campbell (University of Dundee)

Thomas Curwen (AkzoNobel, Slough)

Saumil Vadodaria (Glyndŵr University)

Andrea Goncalves (University of Nottingham)

Edward Hill (ECHA Microbiology Ltd, Cardiff)

Maxime Boudet-Audet (Merton College, Oxford)

Membership Subscription Reminder for 2011

Please note that the subscription fee of £25 for membership of the British Society of Rheology for 2011 is due on 1st October 2010. If you haven't done so already, please arrange payment as soon as possible. Payment may be made by cheque, credit card, paypal or standing order. Our preferred method of payment, however, is by standing order since this reduces the administrative overhead. The Society incurs a charge for each payment we receive by credit card and paypal. A payment form can be found in this issue of the Bulletin as well as on the website (<http://www.bsr.org.uk/renewal.asp>).

You may view your past payment history by logging into the BSR website. If you have forgotten your username and password please let me know and I will forward these on to you. Please check that your contact details stored on the website are correct so that we can ensure that notifications about conferences and meetings, for example, reach you.

Tim Phillips, BSR Membership Secretary

Membership Payment Request/Record Form

*Please renew your BSR Membership for 2011, due 1st Oct 2010
(or update earlier years 2008-2010)*

Payment Method

Membership fee 2008 £25

Membership fee 2009 £25

Membership fee 2010 £25

Membership fee 2011 £25

Total Amount: £_____

Amount *prepaid*: £_____

Outstanding fees due/paid: £_____

Rheology Reviews 2003, 2004, 2005, 2006, 2007 or 2008 £25 per copy

(Order online, or by post to BSR Treasurer indicating your Business Address for postage below, P&P add £2 UK, £3 EU, or £6 elsewhere.)

Payment (circle to indicate method selected)

a. Standing Order

b. Cheque (Sterling drawn on UK bank)/**Cash** (Sterling)/Money Order (Sterling)
Payable to "British Society of Rheology"

c. Credit Card (Visa or Mastercard) (delete as appropriate) **TOTAL £**_____

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<http://www.bsr.org.uk/renewal.asp>),

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Your membership data will be kept on a database (Note: Credit-card details will not be stored in the database). The Society is registered under the Data Protection Act.

Signature

Print Name

Date (dd/mm/yy) ____ / ____ / ____

(taken as date payment actioned)

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Mr Steve J. Goodyer, 11 Chichester Close, Nuneaton, Warwickshire, CV11 6FZ., UK.

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Vernon Harrison Doctoral Prize 2009-10

The BSR awards the Vernon Harrison Doctoral Prize annually for the best Ph.D. thesis in rheology. There were three nominations this year, and the prizewinner is Steven Lind from the University of Cardiff, for his thesis entitled A Numerical Study of the Effect of Viscoelasticity on Cavitation and Bubble Dynamics.

Steven's thesis is concerned with the dynamics of gas bubbles in Newtonian and viscoelastic fluids. These effects are studied numerically using two quite different numerical simulation methods. The first, described in chapters 2 through 6, uses a boundary element method to solve the potential flow outside a bubble with the effects of viscosity and viscoelasticity being confined to the free surfaces. This work is very comprehensive and, in the opinion of his external examiner, would by itself provide sufficient work for a PhD thesis. However, an entirely separate method using a spectral element method to solve the full two-phase fluid problem for viscoelastic fluids is given in chapter 7. This method is considerably more expensive computationally and provides a less accurate representation of the surface than the boundary integral method, however it is not restricted to potential flows and so allows the effects of viscosity and viscoelasticity in the bulk to be considered.

The thesis contains a large body of high quality original work (described in chapters two through seven of this thesis) that is certainly of publishable quality. Indeed two papers, based upon chapters 2 and 6 have already been published in the Journal of Non-Newtonian Fluid Mechanics and three more are under review.

The work in the thesis is written up to a high standard. In particular, the introductory sections show evidence of a good knowledge of the previous work on these problems, and the thesis demonstrated a thorough knowledge of both the numerical and fluid mechanical background to this research. He also attempts to explain how the various phenomena arise from the physical mechanisms. There is also evidence that Steven has taken appropriate care to ensure the accuracy of his solutions.

This is a thesis which makes an original and significant contribution to computational rheology. It contains some intriguing new results on the effects of

viscoelasticity on bubble dynamics and interactions in the large Reynolds number limit.

In deciding the award, the awards committee considered a research summary written by each candidate, and also solicits the opinions of the candidates' Ph.D. supervisors and external examiners. This citation is largely based on Steven Lind's glowing report from his external examiner; both the external and the supervisor described his thesis as one of the best they had had the pleasure to be involved with.

Helen J. Wilson

The chairman of the Vernon Harrison awards committee

A Numerical Study of the Effect of Viscoelasticity on Cavitation and Bubble Dynamics

Bubble phenomena, like other multiphase flows, are ubiquitous. Their prevalence throughout nature and industry mean they have been subject to intense experimental, theoretical and computational research for many years. Short of analytical solutions but for the simplest cases, the numerical modelling of these flows is both necessary and challenging. Non-Newtonian fluids are just as prevalent, and likewise, the numerical modelling can be notoriously difficult. This thesis considers phenomena that reside in the intersection of these two important and challenging fields. In "A numerical study of the effect of viscoelasticity on cavitation and bubble dynamics", two different models and numerical methods are developed in an attempt to describe bubble dynamics in viscoelastic fluids. Besides affording valuable insights into a range of important bubble phenomena, this project has produced two substantial pieces of software, and has resulted in two peer-reviewed publications, with a further three papers currently under review.

With the aim of gaining crucial initial insights, the first model considers a simplified system of governing equations. The fluid flow around the bubble is considered irrotational, with viscous and viscoelastic effects appearing through the normal stress balance on the bubble surface. The resulting set of equations is

solved in an axisymmetric geometry using a boundary element method. The bubble surface is evolved in a Lagrangian manner.

Spherical Bubble Collapse

The problem of spherical bubble collapse is first considered. Employing a Maxwell rheological constitutive equation, the model reproduces all the behaviour observed in previous studies, including the damped oscillation of the bubble radius in time, increased amplitude oscillations with Deborah number and an elastic-limit solution. In addition, the dynamics for the Jeffreys, Rouse and Doi-Edwards-like rheological models are also investigated. Furthermore, valuable insight is ascertained into the relative importance of surface and bulk viscoelastic effects. Much of this work was published in the *Journal of Non-Newtonian Fluid Mechanics* [1].

Bubble Collapse Near a Rigid Wall

The model is then used to investigate the effect of viscoelasticity on the collapse of a single bubble near a rigid wall. This situation is particularly important one. It is well known that during collapse a high speed liquid jet can form, which penetrates the bubble and can impact upon the rigid wall. The impact of this liquid jet and the associated high pressures can damage the wall surface - so called cavitation damage. In this work it was found that viscoelastic effects are able to prevent jet formation, and instead cause bubble oscillation and cusping in the part of the bubble surface nearest the wall. Importantly, the suppression of the liquid jet suggests viscoelasticity has a mitigating effect on cavitation damage. This study is currently under review in *Theoretical and Computational Fluid Mechanics* [2]

Multi-Bubble Collapse Near a Rigid Wall

This investigation extends the previous by considering the dynamics of two bubbles near a rigid wall, along the axis of symmetry. In natural circumstances, bubbles rarely form singly but as part of bubble clouds. Hence bubble-bubble interaction is likely to be important and warrants investigation. An interesting and varied range of dynamics is observed, strongly dependent on initial bubble size, the fluid properties and the distances between the bubbles and the wall. Depending on the proximity of neighbouring bubbles, jets can readily form in viscoelastic fluids, but not in their Newtonian counterparts. This highlights that cavitation damage depends as much on the presence of neighbouring bubbles (and the associated flow), as on the fluid's material properties.

Bubble Collapse Near a Free/Deformable Surface

Besides industrial relevance, bubble dynamics are equally pertinent in biological and medical applications. For example, bubbles that form in the human body during ultrasound procedures can collapse and risk damaging nearby tissue. Furthermore, many biological fluids are viscoelastic in nature. Hence an understanding of bubble dynamics near a free/deformable surfaces (such as tissue), and the respective role of viscoelasticity, is important. As in the rigid wall case, during collapse a jet can form in the bubble, but also in the free surface. While this free surface jet is tall, thin and fast in the inviscid Newtonian case, it was found that viscoelastic effects can markedly suppress jet formation. This once again suggests that viscoelasticity can have a mitigating effect on cavitation and tissue damage. This work is currently under review in the Journal of Fluid Mechanics [3]

Rising Gas Bubbles

This study deviates slightly from the aforementioned studies on collapse phenomena, instead using the model to investigate the dynamics of rising gas bubbles. Bubbles rising in viscoelastic fluids are markedly different from their Newtonian counterparts in that they display a trailing edge cusp, a negative wake, and a rise velocity jump discontinuity. The reason for the jump discontinuity has been debated in the literature for some time. The assumptions inherent in the model allow a remarkable insight into dynamics. The trailing edge cusp is indeed observed, but the irrotational assumption precludes the formation of the negative wake. The corresponding absence of the jump discontinuity suggests that the negative wake is largely responsible, in concurrence with other numerical and experimental studies. This work has been published in the Journal of Non-Newtonian Fluid Mechanics [4]

Bubble Collapse Near a Rigid Wall Revisited

Finally, the problem of bubble collapse near a rigid wall is again considered. However, the problem is now solved using different modelling assumptions and a new numerical scheme. Both the bubble and ambient fluid are explicitly modelled as compressible fluids, with the governing equations solved using a spectral element method. The two phases are distinguished and tracked using marker particles which carry fluid properties such as viscosity and relaxation time. Fluid compressibility also necessitates the use of compressible viscoelastic models and a more complete model is proposed to those used previously in the literature. The results for bubble collapse near a rigid wall qualitatively agree with the boundary element study. Indeed, viscoelasticity can prevent jet formation and produce a

cusped bubble underside. An elastic-limit solution is also observed for large Weissenberg number. Besides allowing further insights into dynamics, this work helped to verify the aforementioned boundary element study, and to confirm that the results presented are a faithful account of bubble dynamics in viscoelastic fluids. This work is currently under review in the Journal of Computational Physics [5]

Concluding Remarks

There is much scope for further work on the two models and numerical methods. This includes the development of fully 3D multi-bubble systems, the study of more sophisticated rheological models, and enhancements to the numerical schemes. This project has fascinated me from the very start and I look forward to continuing this research in the near future. The last 4 years have been challenging, rewarding, and thoroughly enjoyable (the usual trials and tribulations of research aside). I am indebted to my supervisor, Professor Tim Phillips, for his guidance, and to the EPSRC for their financial support. Moreover, I gratefully acknowledge the support provided by the BSR in awarding me a student travel grant to attend the AERC 2010.

Dr. Steven Lind
(steven.lind@manchester.ac.uk)
September 2010

- [1] S. J. Lind and T. N. Phillips, Spherical bubble collapse in viscoelastic fluids, *J. Non-Newtonian Fluid Mech.*, 2010, 165, 56-64.
- [2] S. J. Lind and T. N. Phillips, The influence of viscoelasticity on the collapse of cavitation bubbles near a rigid boundary, *Theor. Comput. Fluid Dyn.* (submitted), 2010.
- [3] S. J. Lind and T. N. Phillips, The effect of viscoelasticity on the dynamics of gas bubbles near free surfaces, *J. Fluid Mech.* (submitted), 2010.
- [4] S. J. Lind and T. N. Phillips, The effect of viscoelasticity on a rising gas bubble, *J. Non-Newtonian Fluid Mech.*, 2010, 165, 852-865.
- [5] S. J. Lind and T. N. Phillips, Bubble collapse in compressible viscoelastic fluids using a spectral element marker particle method, *J. Comput. Phys.* (submitted), 2010.

Commentary on the 328th Council Meeting of the BSR The University of Edinburgh, 15th December 2009

The 328th meeting of the BSR council was held at the School of Physics & Astronomy at The University of Edinburgh immediately following the BSR Midwinter Meeting on “The Flow of Soft Matter”. Apologies were received from Dave Binding, Tim Philips, Phil James and Mike Webster. Advanced apologies for early departure were received from several other members of Council (taxi to Waverley Station had already been booked). As a consequence of these early departures the meeting, like this accompanying commentary, was rather short. Matters arising were summarily discussed and we quickly moved on to the most pressing issues. The 2010 Midwinter meeting will be held at the Sutton Bonington campus of Nottingham University and will be hosted by Bettina Wolf. Bettina was keen that the meeting should be related to local research interests and a theme of Food, Pharma, Health Care and Biological Systems was decided upon. We all agreed that the short and snappy title should attract people if nothing else! The meeting will run from the 13th-14th December and the Council meeting (331st) will be held on the morning of the 13th. The role of Officers and Council members was then discussed; Tim Phillips has replaced Phil James as Membership Secretary; Steve Goodyer has replaced Dave Binding as Treasurer; Mike Webster’s activity with the ESR means he cannot devote the time to an Officer role but he will remain as a co-opted member of council and act as a liaison with the ESR. As all other Officers were content to continue in their roles, that left the problem of Abstracts Editor: Nick Hudson has served in this role for four years plus an exceptional fifth year and now must stand down at the next AGM. All of Council agreed that Nick had done an exceptional job but were rather more muted in their desire to take on the role (the current writer, I must admit, included). Oliver agreed to approach Alex Lubansky about undertaking the role with support from Nick. Officers’ Reports were mainly communicated *in absentia*. The meeting finished with a discussion of *Rheology Reviews*. In his role as Editor, Oliver is currently in the process of commissioning authors for the 2009 edition.

Ordinary member of council:
Dr Rob Poole (robpoole@liv.ac.uk)



The Non-Newtonian Club (NNC) is an informal rheology discussion group which provides low-cost, informal, one-day meetings which provide an excellent forum for industrial and academic rheologists to meet together informally to present work in progress, raising key needs and concerns, and discussing unresolved practical and modelling issues that may be inhibited at more formal conferences. The agenda of the most recent BSR NNC meeting and the corresponding abstracts can be found at <http://innfm.swan.ac.uk/bsr/frontend/nonnewtonianclub.asp>.

The Non-Newtonian Club Meetings are held 2 - 3 times a year and provide a forum for those practicing rheology to meet. Presentations (typically 20-30 minutes) are made by academic and industry-based scientists, as well as young scientists, presenting on a range of topics that involve rheology in a relatively informal and friendly environment. To encourage phd students and 'young' scientists to present, we offer an award for the best presentation from phd students or 'young' scientists. We endeavour to keep these meetings free. Should you wish to host, sponsor, or participate in such an event, please let me know.

The next NNC meeting will be hosted by Maria Charalambides at Room 703, level 7, Mechanical Engineering Department, Imperial College, on the 10th of November 2010. Attendance is free of charge and includes tea/coffee and lunch. The best young speaker will receive a prize sponsored by Anton Paar. For further information visit the BSR website or contact Dr Bettina Wolf at bettina.wolf@nottingham.ac.uk.

Dr Bettina Wolf
BSR Industry and Non-Newtonian Club Coordinator

BSR 2010 Midwinter Meeting
Food, Pharma, Health Care and Biological Systems
December 13 and 14, 2010
The University of Nottingham

Organising committee:

- Bettina Wolf (Food Sciences, University of Nottingham)
- Oliver Jensen (Applied Mathematics, University of Nottingham)
- John Mitchell (Biopolymer Solutions, Sutton Bonington)
- Steve Goodyer (Anton Paar)
- Mrs Val Street (meeting secretary)

Invited speakers:

- **Erika Eiser**, Cavendish Laboratory, University of Cambridge: **Chinese century eggs: Rheology of an unusual protein gel**
- **Tim Foster**, Food Sciences, University of Nottingham: **Cellulose based materials**
- **Steve Harding**, Food Sciences / National Centre for Macromolecular Hydrodynamics, University of Nottingham: **No columns or membranes: Hydrodynamic analysis of molecular weight distribution & conformation of biomacromolecules**
- **Chris Holland**, Oxford Silk Group, Oxford University: **Spinning silk**
- **Oliver Jensen**, Applied Mathematics, University of Nottingham: **Rheological aspects of plant cell expansion**
- **Malcolm Mackley**, Chemical Engineering and Biotechnology, University of Cambridge: **The rheology of starch based swallowing fluids and the way these fluids behave in a model mechanical "Cambridge Throat"**
- **John Mitchell**, Food Sciences / Biopolymer Solutions, University of Nottingham: **Understanding perception and digestion of liquid and soft solid foods: Some rheological challenges**
- **Pete Wilde**, Food Structure & Health, Institute of Food Research, Norwich: **Interfacial rheology of food materials**
- **Ian Wilson**, Chemical Engineering and Biotechnology, University of Cambridge: **Rheology and Marmite™**

- **Gleb Yakubov, Discover, Unilever UK: Surface architecture, lubrication and nanorheological properties of mucins and mucosal bio fluids**

Invitation for contributions:

This BSR Midwinter Meeting is now open for abstract submission for oral and poster contributions. Applicants for poster contributions will be allocated a short slot on day 1 to introduce their poster.

The traditional poster prize will be awarded and the winner will have the opportunity to give a brief talk on day 2.

Registration: Open till 19 November 2010, see Registration form.

Directions: Information will follow shortly.

Accommodation: Main conference hotel will be in Kegworth, public transport to the campus is available. Details can be found on <http://www.bsr.org.uk/>.

Draft programme:

Monday 13 December 2010

10:00 – 11:00 Registration, refreshments, putting up posters

11:00 – 11:10 Conference opening

11:10 – the Sessions including lunch, refreshment breaks and poster
session

19:30 – Conference dinner at main hotel

Tuesday 14 December 2010

8:30 – 14:50 Sessions including lunch, refreshment breaks and award
lecture(s)

14:50 – 15:00 Conference closing

See <http://www.bsr.org.uk/> for news.

UNIVERSITY OF WALES
INSTITUTE OF NON-NEWTONIAN FLUID MECHANICS
Portmeirion Hotel, Gwynedd, U.K.

April 18 - 20, 2011

Programme

In 2011, the UWINNFM will be celebrating its 20th birthday. To mark the occasion, we have booked all the accommodation at the Portmeirion Village and Castle complex (www.portmeirion-village.com) from April 18–20.

The meeting will commence at 12 noon on Monday April 18th and finish at lunchtime on Wednesday April 20th. The theme of the meeting will be “**Non-Newtonian Fluid Mechanics – Progress and Challenges**”.

In normal circumstances, costs at the Portmeirion complex are very high. However, we have been able to negotiate a reasonable financial arrangement with the hotel and, on this special occasion, the UWINNFM will supplement the costs so that they are kept to those for the 2010 Lake Vyrnwy meeting, i.e. £400 for participants and £150 for accompanying persons.

Two of the three speakers at the inaugural 1991 meeting in Swansea, Professors Marcel Crochet and Anthony Pearson, have agreed to lecture at the Anniversary Meeting. The background and history of the UWINNFM will be outlined in a lecture by Professor Peter Townsend (Swansea).

Other speakers who have agreed to give Plenary Lectures include:

D. Baird (Virginia), A. Burbidge (Nestle), R. Buscall, S.Cox(Aberystwyth), I. Emri (Slovenia), G. Fuller (Stanford), C. Gallegos (Spain), J. Giacomin (Madison), O. Harlen (Leeds), J. Hyun (Korea), D. James (Toronto), R. Keunings (Belgium), J. Maia (Cleveland), G.Maitland (Imperial College), O. Manero (Mexico), G. McKinley (MIT), J. Mewis (Belgium), P. Moldenaers (Belgium), S. Muller (Berkeley), T. Phillips (Cardiff), P. Slatter (Melbourne), R. Tanner (Sydney) and M. Wagner (Germany).

Venue: Portmeirion is an Italianate village, the creation of architect Sir Clough Williams-Ellis, which stands on its own private peninsula overlooking the Snowdon mountain range and the sea. It can be reached from London, Liverpool and Birmingham by road and from London and Birmingham by rail. (Portmeirion is about 1.5 km. from Minffordd, which is a station on the British Rail network).

Costs: The total cost of £400 includes the registration fee and full-board accommodation from Monday lunch to Wednesday breakfast. An accompanying person, sharing a room with a conference delegate, will be required to pay £150.

UNIVERSITY OF WALES
INSTITUTE OF NON-NEWTONIAN FLUID MECHANICS

Portmeirion Hotel, Gwynedd, UK.

April 18 – 20, 2011.

Prospective speakers should return this form, together with appropriate payment and a 200 word Abstract, no later than February 1st, 2011.

Block letters throughout please

Title.....

Surname

Forename(s)

Organization

Full address.....

.....

Tel Fax Email

- ☐ I wish to attend the conference and I enclose a cheque for £400 made payable to the University of Wales Institute of Non-Newtonian Fluid Mechanics.
- ☐ I shall be accompanied by and I enclose a cheque for £150 made payable to the University of Wales Institute of Non-Newtonian Fluid Mechanics.
- ☐ I wish to present a paper and I enclose an Abstract.

Please return this form to Mrs Nerys Humphries, Vice-Chancellor's Office, University of Wales Registry, King Edward VII Avenue, Cathays Park, Cardiff CF10 3NS, UK.

INDUSTRY NEWS

Freeman Technology

Freeman Technology Celebrates 10 Years in Powder Testing

Freeman Technology is celebrating 10 years in powder testing as the company's FT4 Powder Rheometer continues to bring significant new understanding and insight into predicting and managing the behaviour of powders under process conditions.

The introduction of dynamic powder characterisation a decade ago represented a considerable breakthrough in powder testing. Using the FT4 Powder Rheometer, a sample is precisely and reproducibly measured whilst in motion, with flow energy as the resultant parameter. Measurements gathered under different conditions quantify: the response of a powder to air; the impact of consolidation; fluidisation behaviour; the effect of moisture; propensity to segregate and many other process-related issues. With its automated, well-defined methodologies, the FT4 Powder Rheometer provides excellent repeatability, delivering the sensitive differentiation necessary for detailed investigative work throughout a product's lifecycle, from formulation through to day-to-day troubleshooting in manufacture.

Driven by industrial need, the FT4 has progressed far beyond the initial concept of a stand-alone alternative powder testing instrument. Today it is more aptly described as a universal powder tester, incorporating dynamic, shear (rotational and uniaxial) and bulk property testing capability, with precision and reproducibility brought to every technique. This powerhouse of powder testing capability is a cost and time-effective option for anyone getting to grips with how to process powders in a truly optimised way.

Further information can be obtained from Trish Appleton, Kapler Communication Knowledge Centre, Wyboston Lakes, Great North Road, Wyboston, Bedfordshire MK44 3BY, United Kingdom

Tel: +44 (0) 1480 479280

Fax: +44 (0) 1480 470343

Email: trish@kapleronline.com

Anton Paar

New In Line Viscometer L-Vis 510

L-Vis 510 is an inline viscometer which is immersed directly in the production liquid. It continuously displays the viscosity and temperature of lubricants, starches, adhesives, suspensions, and many more process liquids, allowing 24-hour production monitoring.

- Stable results, even under adverse conditions.
- Drops in pressure or flow rate do not affect the results.
- Ensures consistent product quality and reduces reject product.
- Uses a new measuring principle, only available from Anton Paar.
- Viscosity range covered from 1 to 50,000 mPas

Please contact angela.meringolo@anton-paar.com for further information.



Rheology Workshop at Bradford University, 1st-2nd December

We still have places available on our next Rheology Workshop which will run at the University of Bradford. This course is a great introduction to the subject for anyone new to rheology or for those looking to further their basic knowledge of the subject. The course incorporates both theory and practical sessions and costs only £399. This price includes “The Rheology Handbook” by course tutor Thomas Mezger (which retails at £100 online).

Win a Free Student Place at the BSR Mid Winter Meeting

Anton Paar are offering all students the opportunity to win a free place at this years BSR Mid Winter Meeting at Nottingham. The prize will include registration, transportation and accommodation (essentially all expenses paid). The closing date of the competition has now been extended to 30/11/10, entry forms can be obtained from angela.meringolo@anton-paar.com (if the winner has already registered for the midwinter meeting then their registration fees will be reimbursed by Anton Paar).

A Job Opportunity at Anton Paar

We are looking for a person interested in a career selling rheometers and viscometers in the UK marketplace. The successful candidate will have a science based degree or PhD with some knowledge of rheology and good interpersonal skills. Rewards will include a competitive salary, pension, company car and 25 days holiday per annum. For further information please contact Guenter Koele on 01992 514730 or guenter.koele@anton-paar.com

CONFERENCE DIARY

2010	CONFERENCES & MEETINGS
13-14 Dec University of Nottingham	BSR Midwinter Meeting 2010 Dr Bettina Wolf (Food Sciences, University of Nottingham) Bettina.Wolf@nott.ac.uk or http://www.bsr.org.uk/
2011	
18-20 April Gwynedd UK	Non-Newtonian Fluid Mechanics – Progress and Challenges Prof. Ken Walters (kew@aber.ac.uk) or Prof. Peter Townsend (P.Townsend@swansea.ac.uk)
10-14 May Suzdal Russia	AERC 2011 – 7 th Annual European Rheology Conference Prof Valery Kulichikhin http://www.rheology-esr.org/AERC/2011
10-14 May Marrakesh Morocco	PPS-27 The Polymer Processing Society 27th Annual Meeting Prof M. Bousmina Conference Website: http://www.pps-27.com or www.pps-27.ma
9-13 Oct Cleveland Ohio, USA	83 rd Annual Meeting of The Society of Rheology Organiser: The Society of Rheology http://www.rheology.org

2010	COURSES & WORKSHOPS
11 Nov London UK	Science of Inkjet and Printed Drops Institute of Physics, 76 Portland Place, London W1B 1NT http://www.iop.org/events/scientific/conferences/y/10/inkjet/
24 Nov London UK	Electrospinning - Principles, Practise and Possibilities Institute of Physics, 76 Portland Place, London W1B 1NT http://www.iop.org/events/scientific/conferences/y/10/electrospinning/
1 - 2 Dec Bradford UK	RHEOLOGY WORKSHOP Steve Goodyer, Anton Paar Ltd, 13, Harforde Court, John Tate Road, Hertford, SG13 7Q T: +44 (0)1992 514730; F: +44 (0)1992 514739 E: steve.goodyer@anton-paar.com
2011	
17-20 May Glasgow Scotland	PROCESS RHEOLOGY: For further information, contact Dr N E Hudson, Dept of Pure & Applied Chemistry, University of Strathclyde, 295 Cathedral Street, Glasgow G1 1XL. Tel: +44 141 5482162; Fax: +44 141 5484822; e-mail: n.e.hudson@strath.ac.uk

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