
THE BRITISH SOCIETY OF RHEOLOGY

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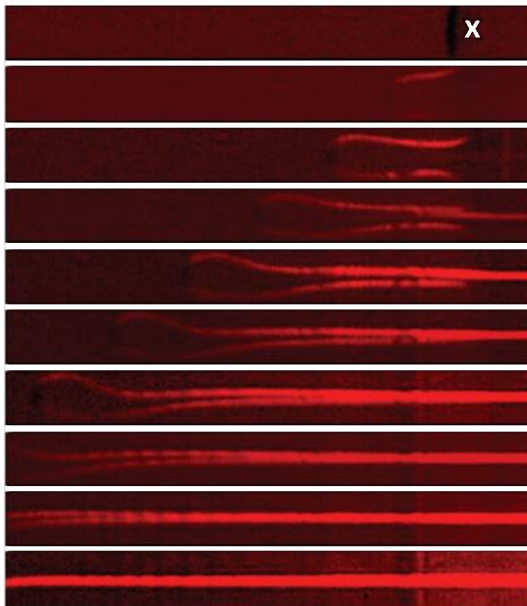
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THE BRITISH SOCIETY OF RHEOLOGY

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THE BRITISH SOCIETY OF RHEOLOGY



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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

Birefringence images of the compression of a birefringent strand on reversal of the flow in the oscillatory cross slots. The strand is initially orientated vertically. (black line in *a*). The “x” in *a* marks the stagnation point. The figures show the time since flow reversal. As the flow reverses the strand compresses and buckles like an elastic sheet before nucleating the new strand which is horizontal and orthogonal to the original. This is likely to be of importance in any periodic flow, such as porous media. This is a 0.03wt% solution of monodisperse atactic poly(styrene) ($M_w=10.2$ million) in dioctylphthalate. The nominal steady strain rate is 410 s^{-1} .

These images were kindly provided by Dr Jeff Odell and Dr Simon Haward of the H.H. Wills Laboratory, University of Bristol.

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.

Rheological Musings

Jeff Odell

H.H. Wills Physics Laboratory, University of Bristol, United Kingdom

I am extremely grateful to the British Society of Rheology for the Annual Award of the Society. Like probably most rheologists, if I am a rheologist, it has been through necessity rather than calling. Rheology is a uniquely complex science, embracing many body interactions, thermodynamics, theory, instability and chaos, modelling and experimentation. Perhaps no-one would choose to do it if the need was not so pressing and the applications so diverse and important. Then again, the attraction of making some sense of such complex phenomena is irresistible. One thing is for sure – the subject needs and attracts a range of specialists, physicists, chemists, biologists, theorists, engineers, mathematicians. The case for interdisciplinary meetings and colloquia and projects in rheology is inescapable. The BSR has played a vital role in this. The mid-winter meeting of the society was probably my last rheology meeting, so perhaps you will indulge me a few musings on the subject.

After graduating from Bristol with a Physics degree in 1971 I undertook an MSc course in Material Science whilst waiting to take up a PhD in superconductivity. The course was taught, in part, by such luminaries as Sir Charles Frank, John Nye and in particular, the father of British polymer physics, Andrew Keller. As part of that course, I did a student project with Andrew Keller on the structure and properties of block copolymers. I found the subject of polymer physics so rich and fresh that I was captivated, this lead to a PhD in flow orientated block copolymers and already it was vital to understand “how it flows” [1].

This relationship with Keller lasted for 27 years and was hugely influential on me in both a scientific and cultural sense. Keller’s understanding of polymers was more instinct than rigour and none the worse for that. It was he who took the beautiful and beguiling birefringence images of growing polymer crystals (“spherulites”) and figured out how long chain polymers could be folded into the twisting ribbons of lamellae [2]. The scale of the polymer coils and lamellae were 20nm, yet all this he divined through optical observations on the scale of 1 μ m. Over this period I am proud to say that I co-authored more papers with Keller than anyone else. Nearly all were in that traditional vein of structure-property relations, but through an interest in processing liquid crystalline and flexible chain polymers, our interest in flow and its effects on subsequent structure grew.

Around 1970 Frank, Keller and Mackley began experimenting on stretching and crystallization of polymer molecules in stagnation point extensional flows. They saw remarkable orientation at the stagnation point in the “opposed-jets” experiment suggested by Frank [3]. They realised the significance of the stagnation point in

providing a singularity at which the extensional flow persisted indefinitely, and that this was an essential requirement for long chain polymers that could require strains of >100 to fully stretch. At around the same time de Gennes [4] and Hinch [5] produced separate theories for the “coil-stretch” transition in a pure stretching flow. One of the most salient predictions of de Gennes was that the polymers in a theta solvent would show critical extension and hysteresis, with a fast initial relaxation time (non-free draining) but a transition to a slow relaxation time as the molecule stretched.

Over the last 25 years, with colleagues, I have become more and more embroiled in this deceptively simple experiment. We have mostly used cross-slots [6,7] to investigate extensional properties of highly dilute (5ppm) to semidilute ($10c^*$) solutions. We have been steadfast in our conviction that this work was worthwhile, since most other rheology is done in simple shear, where polymer behaviour is complex, but unspectacular. Real flows contain shear and extensional flows and stagnation points, experiments show that dramatic things happen in the latter flows, so we believed they would dominate the flow behaviour. You can read about the latest results in this area in [8]. But they are indeed dramatic, with Trouton ratios of up to 4000 even at low concentrations, coupled with significant flow perturbation, even at 300ppm of polymer concentration.

In fact, chasing the low concentrations required to see the response of molecules without flow perturbation has been a theme of the last decade. Now with the advent of microvelocimetry we can see that we need to get to of order $c^*/20$. When we do we can see, for the first time, the hysteresis predicted by de Gennes. This helps to explain the accumulation of strain in cyclic flows, such as porous media [9].

Birefringence as a Structural Probe.

Many of our experiments have used birefringence as a structural probe. This was substantially out of necessity. Scattering X-rays and Neutrons is much too slow to reveal dynamic phenomena and at low concentrations the polymer signal is completely swamped.

Birefringence refers to a physical system where light propagates differently in different directions. Usually this is due to the interaction between the electric vector of the light and the bond polarizabilities of the medium. Birefringence can provide a major insight into molecular structure and origin of non-Newtonian flow stresses; it is non-invasive and is extremely fast. Birefringence relies upon small differences in polarizability, but the “subtraction” is done at molecular level. On the experimental scale zero birefringence is the backdrop upon which flow effects are superimposed. Modern techniques with ultra stable lasers and cooled CCD photon efficient detectors can yield unprecedented sensitivity. The behaviour of macromolecules at 5ppm can be studied and retardations of less than $0.5\text{\AA}$ can be resolved. Further, normally a birefringent microscope image is available, giving

information on the spatial variation of stresses and orientational order created in the flow-field.

There is a problem, however. This is analogous to the phase problem in X-ray scattering: there is not a unique relationship between birefringence and induced microstructure. The same birefringence can arise from more than one molecular structure, so that birefringence analysis will need to contain a model and a conjectured mode of deformation of the model, so that predicted birefringence can be compared with observed birefringence. Sometimes, then, the correspondence is so compelling that the structure is clearly “right”. This was famously the case with Keller’s spherulites. Other times the interpretation can be contentious and unambiguous structures can only be assigned through combination of birefringence studies with other techniques such as light, X-ray or Neutron scattering.

In polymers at rest the chains are locally anisotropic, but the chains exist as “drunkard’s walk” random coils, either interpenetrating in melts and concentrated solutions or isolated in dilute solutions. On the scale of the wavelength of light such coils are physically and optically isotropic. When polymeric fluids exhibit non-Newtonian behaviour it is due to a flow-induced order being imposed upon the molecules. Beyond some flow-rate, characteristic of the system relaxation time, the random coils become orientated preferentially, or, exceptionally, stretched out by the flow-field.

The dependence of birefringence on the degree of extension of macromolecules in flow was first obtained by Peterlin [10]. He considered the problem of the dynamics of macromolecules in flow and used two models: the simple dumbbell and the more realistic necklace model. Other models of uncoiling, for example, the “yo-yo” model of Ryskin and Larson and Hinch who predicted the formation of kinks during uncoiling, would lead to birefringence versus extension curves quite different from that of Peterlin. Such models produce lower estimated molecular strain values for the same birefringence during extension, since orientated folded chains give the same birefringence as extended ones. The relationship between birefringence and structure is ambiguous and models need to be used with caution to interpret results in terms of molecular orientation and conformation

Molecular Rheological Models

Poly(1,4-phenylene-2,6 benzobisthiazole) (PBZT) synthesized by the US Ordered Polymers programme was perhaps the most promising molecule of the 1980’s. Its theoretical modulus, strength, stability and thermal properties were spectacular. Achieving those properties was another matter as it required orientation and coagulation in flowing Chlorosulphonic acid solutions! Around this time Doi and Edwards presented a theory [11] on orientation and relaxation of semi-dilute rod-like molecules, they showed how, treating the rods as narrow, one could predict the decrease in rotational diffusion in semidilute solutions as the rotation of rods had to await the diffusion away lengthwise of constraining rods. PBZT was the ideal test

case so I set about the experiments using a Taylor 4-roll mill to orient and relax the polymer. It quickly became clear that the rotational mobility of the rods was far greater than suggested by the theory [12]. At moderate concentrations the rotational diffusion was highly anisotropic and could not be modelled by a mean-field theory. Worse, at higher concentrations, computer simulations of the diffusion process showed that the “Doi region” did not exist. As soon as the system became semi-dilute, the width of rods was no longer negligible so that the assumption of free lengthwise diffusion to relax the constraints was invalid. The solution went from uninhibited to “log-jam” very quickly.

Despite this the Doi and Edwards theory achieved some popularity. By combining it with a Maier-Saupe potential the thermal and concentration dependence of the transition to the nematic state could be modelled [13]. I am not critical of that, the Doi theory was pretty much the only molecular theory we had. It was wrong, but embodied some little truth and appeared to have some predictive properties. I gradually discovered over the next two decades that this is commonly the case with rheological theories and models.

Computer modelling of extensional flows with stagnation points is a nightmare. Firstly the models themselves are quite unrealistic, FENE, FENE-CR, FENE-CD, EPTT, pom-pom or Giesekus all necessarily represent the physical molecule extremely crudely or not at all. They do not, for instance, model the accumulation of strain in cyclic flows. Secondly, due to the long residence times around stagnation points, the computer model needs to store all strain history and to convect with the molecules, that is they must be Lagrangian. This poses serious modelling problems, and even the fastest supercomputers struggle.

Modelling in general in rheology presents some intellectual problems. Whether Doi, dumbbell, pom-pom or whatever, the models are nothing like the real physical system, but attempt to capture some of the essential physics. Of course the ultimate criterion is: do they work? Well yes and no, most models have many adjustable parameters, often 10-20. It would be a seriously deficient model that could not fit fairly well behaved experimental results with a dozen or so adjustable parameters. But perhaps a polynomial could do as well. If the model is to be more than a comfort blanket giving spurious apparent physicality it should, of course, be predictive. This is a really difficult area, as to test predictivity we usually need to move to a new polymer, with changes in stiffness, molecular weight and distribution, solvent quality etc.

Rheological Sample Characterisation

This brings me to a plea. That is to characterise the systems worked upon as carefully as possible. In a recent EPSRC project it took us 18 months to properly identify the molecular weight distribution of a “standard” Poly(ethyleneoxide) (PEO). The samples cost a fortune and came from the manufacturers with a nice data sheet telling us the molecular weight and polydispersity, which was quite

wrong. Even so a polydispersity of M_w/M_n of 1.1 sounds good, but hides a tenfold spread of molecular weight. It is well known in industry that apparently similar polymers work very differently, the chief suspect is extreme high molecular weight tails that cannot be resolved in size-exclusion chromatography. Polymer characteristics are also a moving target, PEO and many other polymers degrade with time and after a year or so much of the high molecular weight tail will be gone! This may sound like a counsel of despair, but perhaps we should revisit the “standard fluids” such as A1 and M1 that were around 15 years ago.

I cannot end without gratefully acknowledging the contributions of many people to my research, particularly: Professor Andrew Keller, Professor Alejandro Muller, Professor Jose Feijoo, Dr. Steve Carrington, Dr. Nina Dyakonova, Dr. Jenny Tatham, Dr. Simon Haward and Dr. Xue-Feng Yuan.

Over most of my academic career I have been Senior Tutor at Bristol and I have greatly valued the interactions with the undergraduate students. My wife and I are now undertaking a complete change of direction as we are expecting our first foster child in May.

I can honestly say that in my experience the rheological community in the UK has been extremely open, friendly, lively, and more than a little idiosyncratic! I sincerely wish you all the very best in your continuing endeavours.

Reference

- [1] Odell JA and A. Keller A, “Deformation Behaviour of an SBS Copolymer” *Polym. Eng. and Sci* **17** p.544 (1977).
- [2] Hobbs JK, Binger DR, Keller A and Barham PJ “Spiraling optical morphologies in spherulites of poly(hydroxybutyrate)” *J. Polym. Sci. Part B*, **38**, 1575-1583 (2000).
- [3] Frank FC, Keller A and Mackley MR “Polymer chain extension produced by impinging jets and its effect on polyethylene solution.” *Polymer* **12**: 467-473 (1971).
- [4] De Gennes PG “Coil-stretch transition of dilute flexible polymers under ultrahigh velocity gradients.” *J. Chem. Phys.* **60**: 5030-5042 (1974).
- [5] Hinch EJ “Mechanical models of dilute polymer solutions for strong flows with large polymer deformations.!” *Polymères et Lubrification, Colloques Internationaux du CNRS* **233**: 241-247 (1974).
- [6] Odell JA and Carrington SP “Extensional flow oscillatory rheometry”. *J. Non-Newt. Fluid Mech.* **137**: 110-120 (2006).
- [7] Haward, SJ and Odell, JA “Molecular orientation in non-Newtonian flow of dilute polymer solutions around spheres”, *Rheologica Acta*, **43** (4), 350-363, (2004).
- [8] Haward S, Odell JA, Yuan X-F, Li Z “Extensional Rheology of Dilute Polymer Solutions in Oscillatory Cross-Slot Flow: The Transient Behaviour of Birefringent Strands.” Accepted *Rheol Acta*. DOI: 10.1007/s00397-009-0420-6 (2010).

- [9] Dyakonova NE, Odell JA, Brestkin YV, Lyulin AV and Saez AE Macromolecular strain in periodic models of porous media flows. *J. Non-Newtonian Fluid Mech.* **67**: 285-310 (1996).
- [10] Peterlin A, "Streaming birefringence and hydrodynamic interaction" *Pure and Appl. Chem.*, **12**, 563-586 (1966).
- [11] Doi M and Edwards SF "Dynamics of rod-like macromolecules in concentrated solution. Part 1" *J. Chem. Soc., Faraday Trans. 2*, **74**, 560 – 570 (1978).
- [12] Odell JA, Atkins EDT and Keller A "Orientation and Diffusion of Rigid Rod Macromolecules" *J. Polym. Sci, Polymer Letters* **1**, 289, (1983)
- [13] Doi, M., "Molecular dynamics and rheological properties of concentrated solutions of rod-like polymers in isotropic and liquid crystalline phases. *J. Polym. sci, Polym Phys. Ed.* **19**, 229-243 (1981)

BSR NEWS

BSR Annual Award 2009 - Dr Jeff Odell

The British Society of Rheology Annual Award for 2009 is awarded to Dr Jeff Odell. Jeff is a Reader in HH Wills Physics Laboratory at Bristol University where he has spent almost his entire academic career. He has over 100 publications many of which have been heavily cited, as well 5 patents.

He is probably best known in the rheological community for his experimental studies of polymer solutions. He pioneered the use of optical measurement techniques such as flow induced birefringence and laser Doppler velocimetry in the study of dilute polymer solutions and polymeric liquid-crystals, using small scale experiments that predate “microfluidic” devices by 20 years.

His experiments helped to confirm and challenge molecular theories of polymer dynamics. In particular he produced the first conclusive experimental evidence that extensional flows are able to fully extend flexible polymer molecules, and even break them in half. He also demonstrated that the large stresses caused by the large polymers extension could produce significant flow modification even at dilute concentrations.

He is equally well known for his studies of crystallisation where he has again developed unique experimental facilities including time resolved X-ray diffraction, FTIR, Raman spectroscopy and electron microscopy.

Jeff is also a passionate communicator of science. He has written and co-presented three different series of science programs on Radio 4, and has also been a Science consultant for two Children’s science encyclopedias.

Oliver Harlen
The President of BSR

BSR Vernon Harrison Award 2009 - Dr John Duffy

The Vernon Harrison Prize is awarded annually to the most distinguished PhD thesis on the subject of Rheology. It was set up in 2003 following a bequest from the estate of Vernon Harrison.

This year’s award goes to Dr John Duffy from the University of Nottingham for his thesis entitled: *Understanding the Mechanisms Behind Coking Pressure: Relationship to Pore Structure and Thermoplastic Properties.*

In his thesis John has advanced the fundamental understanding of the nature and mechanisms underlying coking pressure through detailed analysis of previous research work and the acquisition of a large body of novel data obtained using a variety of analytical techniques, including rheometry. He showed that the structures of the final cokes relates strongly to the rheological properties of the carbonising coal mass.

Oliver Harlen
The President of BSR

Call for Nominations of 2010 BSR Annual Award and the Vernon Harrison Award

Nominations are invited for the BSR Annual Award 2010. Each year the BSR makes an award to an individual in recognition of their contributions to rheology. The criteria for the award focus on the scientific merit of the candidate: a person who has made a significant contribution to rheology either through a single paper or more sustained activity. The recipient in 2009 was Jeff Odell; in 2008, Peter Olmsted; and in 2007, Gerry Meeten. Nominations, with a brief supporting statement, should be sent to the President, Oliver Harlen on president@bsr.org.uk by the end of May 2010.

The BSR also awards the Vernon Harrison Award annually, for the most distinguished PhD thesis in rheology. Dr John Duffy of the University of Nottingham was the 2009 winner with his thesis on "Understanding the Mechanisms Behind Coking Pressure: Relationship to Pore Structure and Thermoplastic Properties". The next award will be for a thesis examined between September 2009 and August 2010; nominations should be received by the secretary by the end of September 2010. More details will be in a future Bulletin.

New Rules for BSR Student Travel Awards

The 301st Council Meeting established the principle that student travel grants have the objective of encouraging students to disseminate their research. Applicants for a student travel bursary must normally have been a member of the Society for 9 months, may be working worldwide and presenting research at a conference, by paper or poster. The grant will be made on receipt of a report on the event.

The British Society of Rheology wishes to establish a transparent mechanism for the award of travel bursaries and to solicit applications from its student membership. Travel bursaries are available to student members of the Society to present their research at a conference that contains a strong rheological element, in situations where no other sources of funding are available to cover the whole cost of the meeting. Suitable conferences include the International Congress of Rheology, the Annual European Rheology Conference and conferences organized by the Society. The next closing date for consideration of the award of a travel bursary is 26th March 2010 with successful applicants notified by 30th April.

Applicants should include in their submission the name and location of the conference, the title, authors and abstract of the paper submitted to the conference, a breakdown of the projected costs of attending the meeting and a supporting letter from their research supervisor. The support of the British Society of Rheology should be mentioned in the conference presentation. The Society's logo may be used for this purpose. Payment of the bursary will be made on receipt of a report on the conference. The conference report will be published in the Bulletin of the Society. Applications for a travel bursary should be sent to the Secretary (secretary@bsr.org.uk).

NOTICE OF THE 69th ANNUAL GENERAL MEETING

The 69th Annual General Meeting of the British Society of Rheology will be held at the Lake Vyrnwy Hotel, Wales, during the Spring INNFM meeting, on Tuesday March 30th 2010, starting at 17.45.

The minutes of the 68th Annual General Meeting follow this notice.

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

- (i) Election of Officers and Council members.
- (ii) Receipt of a report and accounts from Council.
- (iii) Dealing with matters raised by Council or by any other member and receiving suggestions from members for consideration by Council.

Council's nominations for Officers and Council members are not finalised, but include the following:

Hon. Secretary	Dr. H. J. Wilson
Hon. Treasurer	Mr. S. Goodyer
Membership Secretary	Prof. T. N. Phillips
Bulletin Editor	Dr. X.-F. Yuan

Ordinary members of Council

Dr. D. M. Binding	Dr. R. J. Poole
Dr. S. Cox	Dr. B. Wolf
Dr. N. E. Hudson	

There is no election for President this year, as Dr. O. G. Harlen has served one year of his two-year term.

Further nominations for Council or for any of the Offices are invited. Nominations should be sent to the Secretary or made at the meeting (rule 5(b)). Nominees must be members of the Society, must confirm in writing that they are willing to stand and must be proposed and seconded by two members of the Society. The Hon. Secretary would be pleased to receive notice of any matter that any member wishes to raise at the AGM.

Honorary Secretary:

Dr H. J. Wilson (secretary@bsr.org.uk)
School of Mathematics, University College London
Gower Street, London WC1E 6BT

MINUTES OF THE 68th ANNUAL GENERAL MEETING
Room L03, Aberconway Building, University of Cardiff
Wednesday, April 15th, 2009, starting at 5.40pm.

1. Present

The President, the Hon. Secretary and 22 other members.

2. Apologies for absence

Received from John Embery, Patrick Haxell, Phil James, James Prentice and Jason Stokes.

3. Minutes of the 67th AGM

These were agreed as a true record of the meeting and signed by the President.

4. Matters arising

There were none.

5. Reports of the officers.

5.1. President

Phil Banfill expressed his pleasure, as last year, at the Society's continued support of our area of science, through meetings, conferences, awards and publications. His two years as President had flashed past. He drew particular attention to the scientific meetings organised over the course of the last year. The AGM was being held at the Annual European Rheology Conference in Cardiff, and the President recorded the Society's thanks to Tim Phillips and his colleagues for organising such a splendid parallel-track conference. Last December the Midwinter meeting had been held in Leeds with a theme of Rheology and Microstructure. There had been 75 delegates, and it was particularly good to note the representation from outside the UK, with delegates from as far away as Brazil. Looking forward, next December will see a midwinter meeting hosted in Edinburgh on a loosely soft-matter theme, and in March 2010 the annual INNFM/BSR meeting will take place in Lake Vyrnwy. The INNFM (and its association with the BSR) is approaching its 20th anniversary.

In addition to these formal conferences, the Non-Newtonian Club has been reinvigorated by Jason Stokes over the last couple of years, with meetings in Edinburgh in July 2008 and Birmingham in October. These are smaller meetings of 20-30 people, at a more junior stage in their careers. Since Jason has moved back to Australia, there has been a short hiatus, but it is hoped to hold the next meeting in June 2009.

This year's awards will be reported on elsewhere. Phil acknowledged the support we receive from the rheometer manufacturers, who come to meetings, display their wares, sponsor some of our events and advertise in our publications.

He noted the continued success and survival of the Bulletin and Rheology Abstracts. The Bulletin was reliably a good read. Rheology Abstracts, while certainly not a good read, was packed with fascinating information that is still hard to get hold of elsewhere. It also contributes to the Society's income stream. Rheology Reviews had had a hiatus, but as members would have noted, the 2007 issue had recently come out. The 2008 edition was expected to be out later this month or next.

As he is now leaving Council, Phil expressed his thanks to each of his Council colleagues in turn: to Helen Wilson for keeping things organised as Secretary, to David Binding for his financial work, to Nick Hudson for all his work, but particularly recently for taking on Rheology Reviews and making so much progress. He thanked Phil James for his regular updates on who was where in membership status, and Xue-Feng Yuan for making the Bulletin such a good read. Moving on to the ordinary members of Council, he thanked John Embery for organising last year's December meeting in Leeds. John is stepping down from Council due to ill health and Phil recorded his thanks to John and wished him a speedy recovery. Steve Goodyer had been co-opted during the year to fill a casual vacancy arising on Council, and has been liaising with manufacturers about advertising, sponsorship and so on. Tim Phillips brings his experience to Council but this year has principally been involved with running the AERC meeting. Jason Stokes is also stepping down from Council following his move to Australia; he has been keeping in touch with us by email for the past few months. Phil thanked him again for his work in reinvigorating the Non-Newtonian Club. Mike Webster, although not officially the BSR representative on the ESR, is a highly effective link with the ESR in his role as their Treasurer. Finally Rhodri Williams, who has served on Council for many years, is stepping down this year because of other commitments.

5.2. Treasurer

David Binding presented the Treasurer's report (still subject to audit). He reported that we had had a successful year, making a profit of around £4K, (slightly lower than last year), and that the Society's finances are in good shape overall.

The membership subscriptions were down on last year; this was partly because 2007 had had a big push on back-payments so last year's income contained some contributions which should have been paid in earlier years. The publications were making a profit on all fronts (although the volume of sales of Rheology Reviews was down, as would be expected from the hiatus). The costs of the website were falling year on year, and should fall again next year. Scientific meetings were now a very successful strand of BSR activity, and contribute to the Society's income. The Leeds midwinter meeting had been pump-primed with £400, but had made a profit which will show in next year's accounts. The expenditure figure for Awards included the Annual Award, the Vernon Harrison Award, and two or three student

travel awards. There was also a small correction: the figure marked down from the Liverpool meeting was in fact partly from Liverpool and partly from the previous midwinter meeting in London.

Moving from the income and expenditure to the balance sheet, a depreciation figure had been inserted for all the BSR computers, which essentially took them off the capital (following Anthony Pearson's suggestion at the previous AGM). The books and periodicals were keeping their values in the balance sheet as we were still selling them.

This had been a relatively successful year but he warned us that this year will be different. We will lose at least £1,000 through the loss of interest on our savings. We will monitor sponsorship and advertising revenue, but overall he is confident that we can keep moving forward. A motion to adopt the accounts was proposed by Geoff Maitland, Seconded by Roy Carter and approved unanimously.

5.3. Hon. Secretary

The Secretary reported that two nominations had been received for the Vernon Harrison Doctoral Prize, which had been awarded to Dr. Lucio Isa from the University of Edinburgh. He was presented with the award, and gave his lecture, at the midwinter meeting in Leeds. At the same meeting, the Annual Award was presented to Peter Olmsted of the University of Leeds. As the AERC was being held in Cardiff this year, we had taken the opportunity of such a prestigious meeting to award two Gold Medals this year, to Professor Mike Cates of the University of Edinburgh, and Professor Tom McLeish of the University of Durham.

We made just one ordinary student travel award last year - to Dora Medina of the University of Cambridge, to attend the International Congress of Rheology in Monterey. Line Do, who won the BSR-TA poster prize at the midwinter meeting in London, also used her prize to attend the ICR in Monterey. This year's poster prize was won by YuanYuan Dong of the University of Nottingham, who was attending the AERC in Cardiff.

5.4. Membership Secretary

In the absence of Phil James, the report was presented by the Secretary. She reported that the membership of the Society is currently (before the AERC in Cardiff) 344, including 68 honorary members. The membership is domiciled as follows:

UK - 73%

EU - 14%

Rest of World - 13%

The total membership reported at last year's AGM was 453 and the drop in membership is due to

- (a) resignation by the membership secretary of those members who had been offered a year's free membership as a result of attending a BSR meeting, and who subsequently did not renew their membership;
- (b) movement to resigned status of around 65 members with incomplete subscription records who did not respond to repeated reminders; and
- (c) the resignation of 6 members.

The total of 344 includes 26 new members from the Leeds meeting and 6 other new members.

Six new Honorary Members were elected: Ken Thomas, Chris Marriott, Mike Williams, Howard Barnes, Jan Mewis and David Boger (these last two being Gold Medal winners who should have been offered Honorary Membership at the time, and have elected to continue to pay subscriptions).

Three members (Eirian Jones, Roy Doe and Hans-Werner Bewersdorff) had died during the year.

Take-up of membership following the offer of a year's free membership has not been great, so these potential members are now asked to confirm that they wish to join the BSR before they are made members, and they are advised to enter their personal details through the website in order to receive all BSR publications.

5.5. Bulletin Editor

Xue-Feng Yuan thanked all those who write articles for the Bulletin. This year, all the submitted papers had been in good shape. He expressed his view that he would like to produce some sort of leading article - possibly controversial - in each edition., Some discussion followed about the fact that these articles are not peer-reviewed, and may be likely to elicit a response from the membership: a lively debate on the pages of the Bulletin would be entirely suitable.

5.6. Abstracts Editor

Nick Hudson reported that we are still producing Rheology Abstracts, because there are still a number of institutions buying it, and it is a small earner for the society. The membership automatically get electronic access to Rheology Abstracts. There is a dearth of abstractors (Ian Ward having stopped contributing) and he asked anyone interested to volunteer. Phil Banfill echoed that this is not an onerous task; and Nick requested also that when members publish an article of their own, they should send him the abstract.

6. Motions

6.1. Electronic Notification of AGM

The meeting considered the following modification to section 7(b) of the constitution (added text in *italics*):

Notice convening the Annual General Meeting shall be sent to the members not less than three weeks before the meeting. The notice shall

specify ... circulated to the members. *This notice will normally be by email to members with the same information being displayed on the Society's website, but individual members may request a paper version of notices by writing to the Secretary.*

The motion was passed unanimously.

6.2. Exceptional extension to tenure for Officers on Council

The following modification to section 5(b)(ii) of the Constitution was considered:

5(b)(ii) a member shall not *normally* be eligible to fill the same office for more than four years successively: *in the exceptional situation that no nomination for a particular office has been received by the AGM a member may continue in the same office for a further year*

Geoff Maitland proposed modification of the final "further" to "fifth" to avoid ambiguity; this modified motion was passed unanimously.

7. Officers and Council members.

Motion 6.2 above having been passed, Dave Binding was nominated to continue as Treasurer for a fifth year and Nick Hudson as Abstracts Editor. In addition, Rob Poole had been nominated since the notice of AGM had been sent out. There being no further nominations, the Officers and Council members nominated were approved unanimously by those voting at the meeting. The Council for 2009-10 was elected as follows:

President	Dr. Oliver Harlen
Hon. Secretary	Dr. Helen Wilson
Hon. Treasurer	Dr. Dave Binding
Membership Secretary	Dr. Phil James
Bulletin Editor	Dr. Xue-Feng Yuan
Abstracts Editor	Dr. Nick Hudson

Ordinary Members of Council

Dr. Simon Cox	Dr. Rob Poole
Mr. Steve Goodyer	Professor Mike Webster
Professor Tim Phillips	Dr. Bettina Wolf

8. Any other business

The presidential chain of office - and the post of President - was passed from Phil Banfill to Oliver Harlen.

Oliver said it was a great honour and privilege to be elected President, particularly at such a big and prestigious meeting. He proposed a vote of thanks to Phil Banfill for keeping the BSR on track, with things going well across the board. He drew particular attention to the Winter meetings, which are now well established, and the awards, in particular the annual Vernon Harrison Doctoral Award, the student travel awards and the new TA-sponsored student poster prize, all of which were very healthy for attracting new people to rheology and the Society.

Date of next meeting. The 69th Annual General Meeting of the Society would be held in March 2010 in Lake Vyrnwy.

There being no other business the meeting closed at 6.25pm.

H. J. Wilson, Hon. Secretary
School of Mathematics
University College London

P.F.G. Banfill, President
School of the Built Environment
Herriot-Watt University

A Report on the 2009 BSR Midwinter Meeting

On 14 and 15 December 2009, for the first time ever, the BSR Midwinter Meeting was held North of Hadrian's Wall, at the School of Physics and Astronomy of The University of Edinburgh. Its theme was *The Flow of Soft Matter* and its aim was to provide an overview of the current research on the rheology of soft matter – an exciting field in which theory, simulations and experiments meet to explain the flow of complex fluids. With a steadily increasing output of papers in this field, the time seemed right to bring the BSR Midwinter Meeting to Scotland's capital.

The program attracted about 55 delegates from 7 different European countries, working at a total of 23 different universities / research institutes and 9 companies. These numbers clearly show that the flow of soft matter is of great interest to a wide community, both because of the academic challenges related to these systems and because of the many (potential) industrial applications.

The overall term 'soft matter' refers to materials that are neither simple liquids nor crystalline solids.¹ As such, they share a few characteristic features. First of all, their typical length scales are mesoscopic, with building blocks having a size in between that of atoms and macroscopic granules, though the boundaries on both sides are fading, as shown by several contributions to this meeting. Secondly, despite the fact that many soft materials display thermal fluctuations, they are often in a meta-stable state, either dominated by 'crowding' and/or other interactions or strongly affected by flow. So-called soft glassy materials, including foams, emulsions, dense suspensions and gels, featured prominently at the meeting, with emphasis on how 'particle' interactions and flow-induced structural relaxations are related to the nonlinear rheology, yield stress and '(un)jamming' of the material. These and other aspects of soft-matter flow are interesting from an academic point of view. They are also directly relevant to processing and use of various products, e.g. foodstuffs, creams, pastes, paint, etc. This continues to challenge researchers to develop new characterization methods, theoretical models and simulation techniques.

The opening talk by Martin van Hecke (University of Leiden) highlighted new aspects of the flow of foams, in particular the crucial role of disorder in the nonlinear rheology of these systems. The interplay between non-affine motion, elastic deformations and rate-dependent viscous forces causes a non-trivial power-law scaling of stress with shear rate and a crossover between different flow regimes. It was also shown that these systems serve as useful model systems to study the 'jamming' point. The talk by Matthias Möbius (Trinity College Dublin), in the same session, also featured foam rheology, but with a focus on imaging structural relaxation in a linearly sheared 2D foam and its relation to bulk rheology.

¹ Richard A. L. Jones: *Soft Condensed Matter*, Oxford University Press (Oxford, UK), ISBN: 978 0 19 850589 1 (2007).

He showed that foam flow is not quasistatic, i.e. the characteristic strain for bubble diffusion is *not* independent of strain rate. He connected the nonlinear dependence of relaxation rate on shear rate to the viscous stress, and showed that bubble relaxation follows a non-equilibrium Stokes-Einstein relation. In a later session, Simon Cox (Aberystwyth University) discussed flow of 2D foams in the dry limit. The combination of numerical simulations and imaging of foam dynamics proves a fruitful route for investigating force fluctuations and stress fields, e.g. in confined flows or in the sedimentation of two objects through a foam. In the latter case, the plasticity of the foam causes interesting behavior, opposite to what happens in Newtonian liquids. Clearly, despite more than 100 years of research on foams, understanding their yielding and flow continues to challenge physicists and rheologists.

An emerging class of soft materials consists of polymer/(nano)particle composites. Marina Saphiannikova (Leibniz Institute of Polymer Research, Dresden) discussed flow-induced agglomeration in carbon nanotube/polycarbonate melts. Both flocculation, causing an increase in moduli during low-amplitude shear, and de-agglomeration at large shear were studied. The observed effects were successfully modeled by considering stresses both from the polymer matrix and those arising from the tube network. Nilesh Patil (Loughborough University) considered the effects of dispersed nanoparticles on flow-induced crystallization of poly-ethylene. The influence of particles with different aspect ratios was described along with rheological changes of the melt due to the added particles. Such studies can clearly benefit a better control on crystallization during polymer processing.

A class of soft materials directly relevant to applications (e.g. drilling fluids) is that of synthetic clays. In his contribution, Geoffrey Maitland (Imperial College London) considered suspensions of hectorite clay, which themselves have a complex and history-dependent rheology. Addition of mineral particles of varying shapes strongly increases the moduli and yield stresses, but also makes the gels more ‘fragile’, having a lower yield strain. Having to catch a sleeper heading South, Geoffrey’s travel schedule also appeared somewhat fragile; his contribution was much appreciated.

Oliver Harlen (University of Leeds) discussed extensional and shear flow of suspensions of deformable particles, relevant for systems like capsules, blood cells, etc. He showed simulations of suspensions for different concentrations and explained how, for moderate concentrations, hydrodynamics causes significant enhancements of particle deformation and viscosity compared to theoretical predictions for dilute systems.

An example of the often complex liquid/solid-like properties of soft matter was given by Mark Haw (Strathclyde University). He discussed (un)jamming in suspensions of hard-sphere colloids - the ‘fruit fly’ of suspension rheology - flowing into constrictions. After initial jamming, concentrated suspensions can

revert to viscous flow via vortices in the flow pattern, thereby destroying ‘force chains’ and enabling a low-friction flow mode. Mark’s proposition that such effects, combined with ‘self-filtration’, can have far-reaching consequences, e.g. on the formation of the Earth’s crust, appeared to survive an audience vote that was invited by the speaker himself!

The second day started with a talk by Mike Cates (University of Edinburgh), who gave an overview of recent theories of shear banding in soft glasses. In contrast to ‘traditional’ banding in e.g. micelles, where regions of nonzero shear rate coexist, the solid-liquid coexistence in banding of soft glasses may be explained by spatial gradients in flow-generated ‘noise’ in these disordered systems. Differences between dynamic and static yield stresses could offer an alternative explanation. Despite these developments, there is a long way to go towards a universally accepted picture for banding in these systems.

New developments in *nonlinear* rheology of soft matter were discussed by Joerg Laeuger (Anton Paar). He showed how careful analysis of Lissajous or related figures in Large Amplitude Oscillatory Shear (LAOS) or ‘cyclic loading’ allows reliable characterization of the nonlinear response, circumventing problems as may arise in e.g. Fourier Transform Rheology.

Returning to shear banding phenomena, James Adams (University of Surrey) discussed a model to explain recently observed non-uniform flow in entangled polymers. He showed that an appropriate constitutive model, but one without classic non-monotonic behavior, is able to account for (transient) banding phenomena, which is another step towards classifying the diverse banding phenomena in soft matter. In Suzanne Fielding’s talk (Durham University), she considered more traditional shear banding models, but extended these to account for instabilities on the interface between shear bands in different flow geometries, as observed in recent experiments. The model predictions showed an impressive agreement with experiments, a satisfactory result, at least for the time being...

Laura Campo-Deaño (Katholieke Universiteit Leuven) discussed capillary breakup of filaments of polymer solutions. She presented a method to circumvent problems due to Rayleigh instabilities in low-viscosity filament breakup, employing slow retractions combined with high-speed imaging to characterize the extensional rheology.

The talk by Bettina Wolf (University of Nottingham) illustrated how the need for a better understanding of practical issues, such as taste perception of food, can motivate new studies of extensional flow of biopolymers, guar gum in this case. The results showed interesting extensional thinning and thickening effects, depending on the gum concentration.

Guillaume Ovarlez (Université Paris Est) revisited the topic of yielding in soft matter. New experiments, in which the flow response in one direction was tested during simultaneous application of a secondary flow, measured the three-dimensional yield criterion and they provided valuable data on flow-induced relaxation in these systems. Such information is useful to understand flow in complex geometries and, more generally, new methods like these can give a strong impulse to the field.

The talk by Fathollah Varnik (Ruhr University Bochum) made a direct link between ‘traditional’ soft glasses and atomic/molecular glass formers. He discussed simulations of a model Lennard-Jones glass undergoing channel flow, showing blunted flow profiles similar to those in typical yield-stress fluids. The results could be explained in terms of dynamic and static yielding, as simulated in planar shear, but revived the discussion around shear banding in soft glasses.

Manlio Tassieri (University of Glasgow) presented a method to perform broadband micro-rheology with optical tweezers. The time-dependent particle trajectory in an imposed flow was related to the frequency-dependent moduli of the system, allowing linear viscoelastic properties to be measured across a wide frequency range. The last talk of the meeting, by Andrew Harrison (University of Edinburgh), was also concerned with micro-rheology. It focused on correlated motion of tracers in dilute suspensions of colloids measured via a two-point method. It was shown that unexpected effects can appear in tracer correlations, even for small concentrations of host particles. Both these talks showed that micro-rheology remains a useful tool in soft-matter research.



Figure 1: Jeffrey Odell from the University of Bristol at the start of his acceptance lecture for the 2009 BSR Annual Award, entitled *The Life Cycle of Birefringent Strands and Rheological Consequences*. Note the intriguing, albeit possibly disturbing, title slide in the background.

The last two sessions of the meeting also featured the presentation of several Awards. The most prestigious of these, the BSR Annual Award, was handed out to Jeffrey Odell from the University of Bristol (Figure 1)², “in recognition of the advances he has made in experimental rheological techniques through the course of his career”. Odell’s acceptance lecture was a very clear presentation on *The Life Cycle of Birefringent Strands and Rheological Consequences*. It also contained some appealing movies of birefringent strands in microfluidic oscillatory extensional flow and a genuine moral regarding the importance of polymer sample characterization.

² All pictures presented here courtesy of Tiffany Wood.



Figure 2: The heavily decorated BSR President Oliver Harlen (left) presents John Duffy (right) with the spoils of the 2009 Vernon Harrison Award, annually given to the best Ph.D. thesis on rheology during that academic year. Duffy, now at Malvern Instruments, received this award for his work at the University of Nottingham with Karen Steel on the *Use of high temperature rheometry for understanding the mechanisms governing coking pressure*.

To recognize excellence, creativity and novelty in research, the BSR decided in 2003 to institute the annual Vernon Harrison Award, for the most distinguished Ph.D. thesis in any branch of rheology in a given academic year. This year, the prize was awarded to John Duffy, now at Malvern Instruments, for his work at the University of Nottingham with Karen Steel on the *Use of high temperature rheometry for understanding the mechanisms governing coking pressure*. He received a certificate and a £500 check from the BSR President, Oliver Harlen (Figure 2). His acceptance lecture was an interesting demonstration of how the rheological characterization of materials, coke in this case, may help in optimizing industrial processes, i.e. the production of iron from ore via smelting using coke as a reducing agent.

The oral presentations were complemented by a range of excellent posters, presented in a separate session on Monday afternoon and during lunch and coffee breaks. Since 2007, TA Instruments has kindly sponsored an Award for the best poster presentation by a student at the BSR Midwinter Meeting, the BSR-TA Rheometrics Poster Prize. This year, the poster by Zhuo Li (University of Manchester), entitled *Non-linear Dynamics of Semi-dilute Polymer Solutions in Microfluidics: A Study of a Benchmark Flow Problem*, was deemed best by a panel of adjudicators. Miss Li received the prize, a fast-track BSR Travel Award of £350 to attend a conference of her choice, from TA's Charles McCue (Figure 3).



Figure 3: Zhuo Li (middle), from the University of Manchester, receives the 2009 BSR-TA Rheometrics Poster Prize from TA Instrument's Charles McCue (right). This award, a £350 fast-track BSR travel grant, is handed out each year at the BSR Midwinter Meeting for the best poster presentation by a student.

We would like to thank all the speakers, poster presenters and attendants for making the 2009 BSR Midwinter Meeting in Edinburgh such a success. We also like to thank the exhibiting companies (Anton Paar, Linkam, TA Instruments and Thermo Fisher) for their financial support, even in times of economic downturn. Finally, we like to acknowledge support from David Binding (BSR Treasurer), Misti Cooper (admin) and Jonathan Harvey (website). We hope that, unlike the Romans, the BSR will not consider Hadrian's Wall as the end of the world and will decide to hold another BSR Midwinter Meeting in Scotland in the near future. A word of caution though: bring along a warm jumper, for it can get rather cold up North in December!

Rut Besseling and Job Thijssen
School of Physics and Astronomy
University of Edinburgh

Conference Report: The 81st Meeting of the Society of Rheology



The 81st meeting of the Society of Rheology was held in Madison (Wisconsin, USA) with the contribution of over 270 oral presentation, 3 plenary sessions and about 100 posters. With more than 470 participants, this meeting was of the highest attendance ever known for a meeting of the Society of Rheology.

The meeting was held in the Conference centre of Madison, the famous “Monona Terrace”, designed by the American architect Frank Lloyd Wright. Lloyd said “the Monona terrace is the long awaited wedding between the city of Madison and the Lake Monona”.

The conference was held over 3 ½ days, with 5 parallel sessions covering 11 themes classically encountered in Rheology conferences.

I attended more than 50 talks covering a large range of subjects. To keep this report short -for the sake of the reader - I will only discuss the 3 plenary lectures.

The first plenary lecture was given by N. J. Wagner and was entitled “Microstructure and rheology relationships for concentrated colloidal dispersions: Shear thickening fluids and their applications”. This was a great overview of the origins of shear thickening behaviour. He also showed how Rheo-SANS (small angle Neutron scattering) could give a great insight into these systems. The origin of the stress is believed to be thermodynamic at low shear rate (Brownian motion). In contrast, at high shear rate, particles are thought to be jammed in the system, the origin of the stress hence being hydrodynamic. For industrial applications, careful choice of particle surface coating can enhance/prevent shear thickening.

The second plenary lecture was given by G. B. McKenna as the winner of the Bingham Medal for 2009. It was entitled “Interrogating the physics of amorphous solids: rheological and mechanical measurements”. He elaborated on the technical difficulties encountered when investigating glass or rubber material. He also showed two techniques developed in their lab: the torsional measurement and the nanoscale bubble inflation (now inflating bubbles of 1-2microns!).

Finally, the third plenary talk was given by A. K. Sood with the title “Spatio-temporal chaos and negative shear rate fluctuations in sheared soft matter systems” He showed results indicating that the variation of the stress (resp. strain) at constant strain (resp. stress) as a function of time was a low-dimensional chaos “rheochaos”. By coupling rheological measurements with a LaSER observation, a spatio-temporal estimation of rheochaos was obtained and this was correlated to phenomena such as shear-banding.

I gave a talk at the meeting of Society of Rheology entitled “Viscoelastic nature of guar gum solutions in large deformation flows”. This work results from collaboration with the group of Prof. Justin Cooper-White at the University of Queensland (Brisbane, Australia) on extensional flow behaviour of biopolymer solutions evaluated in flow contraction microfluidic devices and associated with the CaBER. I received a lot of interesting comments that will undoubtedly help me in the preparation of a manuscript presenting my results.

I also enjoyed this conference for the large exhibition of rheology companies and the very friendly atmosphere. I went alone to the conference and this really drove me to go talk to people! I met many interesting people and it contributed to make this conference a very rich experience.

I would like to thank the British Society of Rheology for kindly awarding me a travel grant, which enabled me to undertake the journey to Madison.

Anne-Laure Koliandris
Division of Food Sciences
University of Nottingham

Commentary on the 327th Council Meeting of the BSR University College London, September 3rd 2009

London – September 2009. This council meeting was held in London to allow the Honorary Secretary, Helen Wilson, to be close to home, and hospital! By the time this commentary is published Helen and her husband are proud parents of a new baby and some of us have met the family at the BSR winter meeting in Edinburgh.

This was only my second Council meeting and as a new member of the council, that's the job: writing the commentary. Much easier than our officers' task, in particular to mention is Nick Hudson who is the Honorary Abstract Editor & Publication Manager. The Rheology Reviews kept us busy for our pre-lunch discussion (meeting start 12noon). Janet Freshwater from the RSC talked us through options of how the society could take the reviews forward since at some point Nick and his helpers will retire. No decision has been made and for the time being there is no change and we stopped for lunch.

The officers then gave their reports and there were no issues – as far as I can remember unfortunately having forgotten about this unfinished document until the bulletin editor reminded me so it is about 5 months after the meeting now. Not a very good start as council member, apologies!

The non-Newtonian Club has been mentioned, and the idea is to have a meeting in late spring/early summer in London but a host has still to be identified.

Then it was bye byes till Edinburgh.

Bettina Wolf



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 take place in Schlumberger Cambridge Research sometime in June 2010. We are still looking for speakers from anyone involved with rheology as long as their material relates to the subject. Attendance is free of charge and includes tea/coffee and lunch courtesy of Schlumberger Cambridge Research. The best young speaker will receive a prize sponsored by Anton Paar. For further information visit the BSR website or contact steve.goodyer@anton-paar.com

Steve Goodyer

Macro2010: 43rd IUPAC World Polymer Congress

SECC, Glasgow, UK

11-16 July 2010

The 43rd IUPAC World Polymer Congress, 'Macro2010', is the latest in the series of the biennial meetings of the IUPAC Polymer Division. The series has been running for several decades and is the largest international multi-symposium conference dedicated to all aspects of polymer science and engineering.

Call for oral abstracts deadline fast approaching!

Oral abstract deadline – 29 January 2010

Poster abstract deadline – 9 April 2010

For your chance to present your work, submit an abstract online now at www.macro2010.org/cfp. We would like to invite you, as a British Society of Rheology member, to submit an abstract for Macro2010: 43rd IUPAC World Polymer Congress. There are plenty of available speaker slots within the programme of 28 symposia. As a BSR member, you are eligible for a £50 discount when registering for Macro2010. In order to claim this discount, enter the following promotional code when registering online:

Standard promo code: PROMO005BSR

Student promotional code: PROMO005BSRSTU

Early bird registration deadline: 14 May 2010

Standard registration deadline: 11 June 2010

Visit www.macro2010.org for information on the full programme, to submit your abstract and to register for the congress.

Regards,

RSC Conferences

+44 (0)1223 432380 / 432554

Macro2010@rsc.org

INDUSTRY NEWS

TA Instruments

TA Instruments launch Advanced Peltier System for ARES-G2 Rheometer

When the ARES-G2 was launched with all of its enhancements, including the redesigned motor and transducer components, the advancements in performance have been seen to be significant. However, TA know that with such high levels of performance, any additional accessory has to be designed to compliment and not hinder and so the introduction of the APS (Advanced Peltier System) again demonstrates not only this approach but also a product that is best suited for the customer.

The APS combines the renowned Peltier performance with the dual functionality of featuring both parallel plates (cone and plate) and DIN concentric cylinder systems, (over a temperature range of -10 to 150°C), whilst the Smart Swap integration means that the system is friction free and so does not hinder the exceptional low torques performance of the ARES-G2. The plate configuration is a new quick-change system that comes standard with a 60 mm diameter hardened chromium surface and a unique bayonet fixture that allows the user to quickly and easily adapt the plate surfaces such as crosshatched or sandblasted. The APS also features an efficient heated solvent trap cover for blocking evaporation during testing of volatile materials.

The concentric cylinder system is available with conical, recessed, vane, helical and double gap rotors. The APS can be used with both UV and ER configurations and will provide the basis for future developments and combined techniques.

TA Instruments DMA-RH Accessory

The Dynamic Mechanical Analysers of TA Instruments have a proven track record in characterisation of many materials, but the recent addition of the Relative Humidity accessory has provided users with the ability to measure mechanical properties of a sample under controlled and/or varying conditions of both relative humidity (5-95%) and temperature (5-120°C). The DMA-RH is designed for use with a wide range of materials and clamping geometries. This technology is of particular use to applications in polymers, electronic materials, foods, pharmaceuticals and fuel cell components.

Training Courses and Seminars

As always, a series of Basic Rheology Courses will be hosted by TA Instruments this year. However, this year we have also planned a series of additional courses

covering QC through to Advanced Rheology. All course and seminar details can be found on our website (www.tainstruments.co.uk).

Anton Paar

New E-learning Courses Available

An excellent introduction to the characterisation of viscoelastic materials using oscillatory techniques is now available on CD. This can be ordered from the URL below or by using the contact details below. Other courses relating to rotational methods, viscometers and density meters are also available.

<http://www.anton-paar.com/US/en/94>

Video Explaining TruGap

The patented TruGapTM function from Anton Paar continuously measures the measuring system gap and easily outperforms the Automatic Gap Compensation feature used in rheometers with old technology. To learn how TruGapTM works view the video from the URL below or request a copy by using the contact details below. <http://www.anton-paar.com/GB/en/102>

For further information on any of the above items please contact: steve.goodyer@anton-paar.com, telephone Anton Paar on (01992) 514730 or visit www.anton-paar.com.

Malvern Instruments

Kinexus Expert System Rheometry Promotes Formulation Success

Manufacturers and materials professionals can now access an online article that describes the efficient application of performance-controlling design rules through the use of expert system rheometry. Using the 'rSpace' expert software in the innovative Kinexus rheometry platform from Malvern Instruments, the development and application of design rules is not only straightforward but allows a formulation or product microstructure to be engineered for optimal performance. The paper is entitled 'Expert system rheometry' and was published in September by materialstoday.com. It can be downloaded following a free registration procedure from: <http://www.materialstoday.com/view/4202/expert-system-rheometry>.

Authored by Samiul Amin, Rheologist from the Novel Measurements Group at Malvern Instruments and Steve Carrington, Rheology Product Manager, the paper presents a more straightforward route towards engineering the next generation of complex and nanostructured fluids.

Inks, drilling fluids, shower gels and drug delivery vehicles are just a few examples of the many industrial and consumer products based on colloidal and

nanostructured complex fluids. The successful formulation of these materials is promoted by understanding how rheological behaviour, which typically dictates performance, relates to underlying microstructure. However, this knowledge can be difficult to obtain for those without the necessary expertise. Drs Amin and Carrington explain how Malvern's Kinexus tackles this rheometry challenge head on. They also provide application examples to include the rheological characterisation of associative telechelic polymers typically used as structuring and thickening agents.

Kinexus is a unique rheometer from Malvern Instruments designed to meet rheology needs across a wide variety of research sectors, industries and application areas, for users at every level of experience. It enables precise analysis of the rheology of materials: from liquids to soft solids, processability to product performance, temperature to time dependence. A true applications-led interface brings 'expert system' guidance and SOP-driven processes to rheological measurement, while intelligent software invites users to work at the level most appropriate to them - to solve a problem with an application-led approach, experiment using established methodologies, or design tests from scratch.
www.malvern.com/kinexus

Presentation and Award Lecture at BSR Meeting 14/15 December 2009

Malvern Instruments Product Technical Specialist for Rheology, Dr John Duffy, has been awarded the prestigious Vernon Harrison doctoral prize given annually by the British Society of Rheology (BSR). He will receive his award, and give his award lecture, at the BSR Midwinter Meeting at the University of Edinburgh's School of Physics and Astronomy, Edinburgh, Scotland, on 14-15 December 2009.

Dr Mike Kaszuba, Malvern's Technical Specialist Supervisor said: "This is a superb achievement. John was awarded his Doctor of Philosophy degree in November 2008 from the University of Nottingham for his work on rheological studies of the microstructure of molten coal as it undergoes carbonisation. By then, Malvern had already snapped him up. Known for the high calibre of our in-house scientific specialists, we recognized the importance of the rheological expertise and industrial experience that John brings to the company and the benefits for our customers." After receiving his BSc (Hons) Applied Chemistry from Liverpool's John Moores University, John Duffy's PhD studies followed more than seven years in industry at Unilever and Boots.

Malvern on the Road! Complimentary Seminars

These seminars are the ideal platform to learn about the range of products for particle and material characterisation available from Malvern Instruments and are suitable for those wishing to broaden their general knowledge as well as for those wishing to learn more about a specific area.

Less μ Presentations covering applications with small 'particles' e.g. nano-particles, colloids, micelles, polymers, proteins and gels. Using size, zeta potential, molecular weight, intrinsic viscosity and rheology techniques to build a better understanding of the performance of these materials

More μ Presentations covering applications with large 'particles' e.g. powders, aerosols, sprays, granules and slurries. Using particle size and droplet size, particle shape, chemical identity and rheological properties to characterise product and process performance in the lab and in the plant

More μ 20 April Manchester 21 April Cambridge

Less μ 27 April Manchester 28 April Cambridge

For venues later in the year please visit our website or contact Alison Vines at Malvern Instruments Ltd, telephone 01684 892456 and email Alison.vines@malvern.com or register at <http://www.malvernevents.com>

Web Based Seminars

Listen to our technical presenters (and guest presenters from academia and industry) give live web-based presentations on virtually all subjects relating to various aspects of particle characterisation and rheology. All you need an internet connection - and you can learn and interact with the experts.

See details and possibility for registration at <http://www.malvernevents.com>

CONFERENCE DIARY

2010	CONFERENCES & MEETINGS
29-31 March Lake Vyrnwy Wales	Institute of Non-Newtonian Fluid Mechanics Easter Meeting Contact: Professor P. Townsend, p.townsend@swansea.ac.uk http://www.bsr.org.uk/meetings.asp
7-9 April Göteborg Sweden	AERC 2010 – 6th Annual European Rheology Conference Alexandra Andrén E-mail: aerc2010@rheology-esr.com http://www.rheology-esr.org/AERC/2010/
11-16 July Glasgow	IUPAC 2010 World Polymer Congress (Macro2010) Contact: Professor Peter A. Lovell, School of Materials, the University of Manchester, email: pete.lovell@manchester.ac.uk ; Tel: +44(0)161 306 3568; Fax: +44(0)161 306 3586.
1-6 August Sapporo Japan	5th Pacific Rim Conference on Rheology Hokkaido University, Sapporo, Hokkaido, Japan Conference Website: http://prcr2010.com
18-22 Oct. New Mexico USA	82nd Annual Meeting of the Society of Rheology Conference Website: http://www.rheology.org

2010	COURSES & WORKSHOPS
20 April Manchester	More μ Presentations Alison Vines at Malvern Instruments Ltd, telephone 01684 892456 and email Alison.vines@malvern.com or register at http://www.malvernevents.com
21 April Cambridge	
27 April Manchester	Less μ Presentations Alison Vines at Malvern Instruments Ltd, telephone 01684 892456 and email Alison.vines@malvern.com or register at http://www.malvernevents.com
28 April Cambridge	
18-21 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
13-16 June Northampton MA, USA	XVIth International Workshop on Numerical Methods for Non-Newtonian Flows Contact: Mike Graham (graham@engr.wis.edu) and Jonathan Rothstein (rothstein@ecs.umass.edu). Website: http://www.ecs.umass.edu/mie/faculty/rothstein/IWNMNF_home.html
14 - 15 July Loughborough 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



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