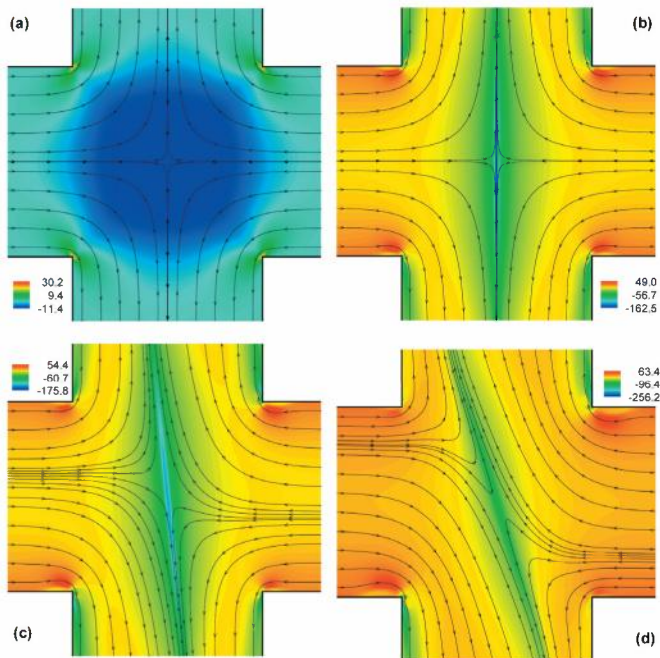

THE BRITISH SOCIETY OF RHEOLOGY

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



Rheology

Bulletin

ISSN-1469-4999

VOL 49 No 1 2008

THE BRITISH SOCIETY OF RHEOLOGY

OFFICERS & MEMBERS OF COUNCIL 2007

President:	Professor P.F.G. Banfill School of the Built Environment Herriot-Watt University Edinburgh EH14 4AS	T: 01314 514648 F: 01314 513161 E: p.f.g.banfill@sbe.hw.ac.uk
Honorary Secretary:	Dr Helen Wilson Department of Mathematics University College London Gower Street, London WC1E 6BT	T: 020 7679 1302 F: 020 7383 5519 E: helen.wilson@ucl.ac.uk
Honorary Treasurer:	Dr David M Binding Dept of Mathematics, University of Wales, Aberystwyth SY23 3BZ	T: 01970 622775 F: 01970 622777 E: dmb@aber.ac.uk
Honorary Abstracts Editor & Publication Manager:	Dr Nick E Hudson Dept of Pure & Applied Chemistry, University of Strathclyde, 295 Cathedral Street, Glasgow G1 1XL	T: 0141 548 2162 F: 0141 548 4822 E: n.e.hudson@strath.ac.uk
Honorary Membership Secretary:	Dr Philip W James School of Mathematics and Statistics, University of Plymouth, Drake Circus, Plymouth PL4 8AA.	T: 01752 232777 F: 01752 232780 E: phil.james@plymouth.ac.uk
Honorary Bulletin Editor:	Dr Bogdan Dobraszczyk School of Food Biosciences, University of Reading, Whiteknights, Reading RG6 6AP	T: 0118 378 8714 F: 0118 931 0080 E: b.dobraszczyk@reading.ac.uk
Ordinary Members of Council:	Prof Mike F Webster Dept of Computer Science, University of Wales, Singleton Park, Swansea SA2 8PP	T: 0179 229 5656 F: 0179 229 5708 E: m.f.webster@swansea.ac.uk
Marketing Co-ordinator	Mr Derek Bell Yew Tree Cottage, Bradley Hill, Upper Soudley Gloucestershire	T: 01594 826466 F: 01594 826631 E: derekbell@rheology-help.co.uk
Past-Treasurer	Prof Rhodri P Williams Department of Chemical Engineering, University of Wales, Singleton Park, SWANSEA SA2 8PP	T: 0179 229 5195 F: 0179 229 5708 E: p.r.williams@swansea.ac.uk
Industry/Non-Newtonian Club Co-ordinator	Dr Jason Stokes Unilever Corporate Research, Unilever R&D Colworth, Sharnbrook, Bedford MK44 1LQ.	T: 01234 222482 F: 01234 248010 E: Jason.Stokes@Unilever.com
Ordinary Member	Dr Xue-Feng Yuan Manchester Interdisciplinary Biocentre, The University of Manchester, 131 Princess Street Manchester M1 7ND	T: 0161 306 4887 F: 0161 306 4911 E: xue-feng.yuan@manchester.ac.uk
Past Secretary	Prof Timothy N. Phillips Cardiff School of Mathematics, Cardiff University, Senghennydd Road, Cardiff CF24 4AG.	T: 02920 874194 F: 02920 874199 E: PhillipsTN@cardiff.ac.uk
Web Development (Temporary)	Mr Jonathan Harvey Dept. Computer Science, University of Wales, Swansea, Singleton Park, Swansea SA2 8PP.	T: F: E: csjon@swansea.ac.uk

T: Telephone; F: Fax; E: eMail

The British Society of Rheology is registered as a Charity - Number 249967

THE BRITISH SOCIETY OF RHEOLOGY



BSR BULLETIN
2008, Vol. 49, No. 1

CONTENTS

Editorial

BSR News

BSR Mid-winter Meeting December 2007
Vernon Harrison Award 2007 Citation: Tim Reis
Abstract of Vernon Harrison Award PhD: *The Lattice Boltzmann Model for Complex Flows* by T. Reis
BSR Annual Award 2007: Dr G H Meeten
BSR-TA Instruments Rheometric Prize
Abstract of BSR-TA Prize presentation: *Rheological modification of reduced fat chocolate induced by the addition of limonene*, by Line Do et al.
The Vernon Harrison Annual Doctoral Prize 2008
Minutes of the 66th BSR Annual General Meeting
Notice of the 67th BSR Annual General Meeting
Commentary 320th BSR Council Meeting, Lake Vyrnwy Hotel
Commentary 321st BSR Council Meeting, University College London
BSR Student Travel Grants

Aims of the Society

Karl Weissenberg - The 80th Birthday Celebration Essays:

Non-Newtonian Club News

Rheology Reviews 2007

Conference Announcements

Industry News

Conference & Courses Dairy

Hon Editor:

Dr Bogdan Dobraszczyk

School of Food Biosciences, The University of Reading,

Whiteknights, Reading RG6 6AP, UK

b.dobraszczyk@reading.ac.uk

ISSN 1469-4999

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 next copy date will be in May 2008 and, 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 for details (Bogdan Dobraszczyk, b.dobraszczyk@reading.ac.uk).

COVER ILLUSTRATION

The figure illustrates the bifurcation to a steady asymmetric state that can be observed when a viscoelastic liquid flows through a perfectly symmetric “cross-slot” arrangement. The instability is purely-elastic in nature and at higher Deborah numbers the flow becomes unsteady. Inlet flow is through the east and west “arms” and outlet flow through the north and south. Streamlines are superimposed upon contours of the first normal stress difference to provide an indication of the stress field. These simulations were obtained using the upper convected Maxwell model and a finite volume numerical method at creeping flow conditions **(a)** Newtonian fluid, **(b)** $De = 0.3$, **(c)** $De = 0.32$ and **(d)** $De = 0.4$

We are always looking for appropriate colour or black and white pictures for the front cover of the Bulletin and Rheology Abstracts (preferably of a rheological nature!). Please contact either Bogdan Dobraszczyk (Bulletin Editor, b.dobraszczyk@reading.ac.uk) or Nick Hudson (Abstracts Editor and Publications Manager, n.e.hudson@strath.ac.uk). Contributions are always welcome!

ERRATUM

The photo shown on page 104 of the previous issue of the Bulletin (Vol 48, No 3) was not Joel Miller, recipient of the 2006 Vernon Harrison award, but Dr. Ian Ratcliffe and Dr Rowan Blanchard, both formerly of NEWI, Wrexham.

BSR NEWS

BSR Mid-winter Meeting December 2007

"The Rheology of Foams and Emulsions" was a very successful meeting, held on 10-11 December 2007 at Imperial College London's Royal School of Mines. We had a full programme of excellent talks, along with the prizewinners' lectures for both the Annual Award (Gerry Meeten) and the Vernon Harrison Award (Tim Reis). There were some excellent posters: the BSR-TA poster prize was awarded to Line Do from the University of Nottingham. Her poster was on *The impact of some formulation and structural parameters on the viscosity of reduced fat chocolate*.

Vernon Harrison Award 2007 Citation: Tim Reis

Vernon Harrison was one the founder members of the British Rheologists Club in 1940 and he served the British Society of Rheology, as it later became, in a number of ways as council member and office holder, receiving the Society's Gold Medal in 1970. When he died in 2001 he bequeathed a sum of money to the Society and it was decided to establish a prize with it, aiming to encourage younger scientists. The Vernon Harrison PhD prize is awarded to the person who has graduated with a PhD in the preceding year, with a thesis on a rheological topic, which is adjudged to be the best of those nominated for the award by their supervisors. The adjudicating sub-committee reads the candidate's own summary of the work, a nomination from their supervisor and a supporting statement from the external examiner of the thesis.

Tim Reis graduated from Cardiff University in 2007 with a thesis entitled "The Lattice Boltzmann model for Complex Flows", which is concerned with numerical modelling of hydrodynamic phenomena. Tim's own summary follows this note so would only note that he has written 5 papers from the work, at least 2 of which have now been published (2007). In his supervisor's words, Tim was an exceptional research student, well motivated with original ideas, and made a number of important contributions to the development of the subject, points which were supported by the external examiner.

As President, it gave me great pleasure to present, during the Society's mid-winter meeting on the rheology of foams and emulsions, the British Society of Rheology

Vernon Harrison PhD Award for 2007 to Dr Tim Reis for his thesis “The Lattice Boltzmann model for Complex Flows.”

Phil Banfill

A short summary of Tim Reis’ work is given below.



The President presents Dr Tim Reis with the 2007 Vernon Harrison Award

The Lattice Boltzmann Model for Complex Flows

T. Reis

The lattice Boltzmann equations (LBE) is a discrete kinetic model for simulating hydrodynamic phenomena. As a numerical tool for fluid mechanics it offers a number of interesting properties that are potentially advantageous compared to its continuum rivals. These include a linear streaming operator, unconditional linear stability, geometric flexibility, a simple and efficient algorithm, and being fully local in space and time allowing for very powerful parallel processing. The basic model is characterised by an isotropic lattice and a two-step evolution process (consisting of propagation and collision) describing the motion of particles through the domain. This description is based not on the precise details of microscopic physics but merely on the laws of symmetry and conservation.

The LBE is often promoted as a numerical simulation tool that is particularly suitable for predicting complex flows. My thesis has attempted to justify the above statement, and hence offer an attractive alternative to the traditional CFD techniques, with the following methodology: by first conducting a detailed examination of the LBEs' credentials for Newtonian flows, including the theoretical basis of the model and a thorough numerical evaluation of a number of flows of increasing complexity; and then with the foundations layed, incorporate multi-phase and visco-elastic contributions into the basic model. The original contributions offered by my thesis are:

1. a new method of solving the difficult dispersion equation of the generalized LBE using a perturbation analysis [1];
2. a detailed study of the influence of Reynolds number and aspect ratio on the flow over a cylinder using an LBE [2];
3. the derivation and numerical validation of an axisymmetric LBE [3], [4];
4. the extension and numerical validation of a LBE for binary fluids [5];
5. a comparison and classification of some proposed viscoelastic LBEs.

The most common LBE uses a one-parameter collision operator to describe a fluids relaxation to a local equilibrium state at the mesoscopic level. A more detailed account of a fluids characteristics can be included in the lattice Boltzmann framework by constructing a full collision matrix spanned by the lattice velocities, the spectral properties of which determine the hydrodynamic and kinetic quantities. The transport coefficients can be found from the resulting dispersion equations of this so-called generalised LBE but due to the complexity of the problem this is usually accomplished numerically. In my thesis and recent article [1] I have shown how a formal perturbation analysis can be used to determine these coefficients analytically. This is particularly useful for visco-elastic LBEs since it provides a mathematically rigorous technique for incorporating and assessing memory effects within the kinetic origins of the model.

A common benchmark test in computational fluid dynamics is the flow over a cylinder. The influence of the Reynolds number and aspect ratio on the drag coefficient, lift coefficient and Strouhal number were systematically studied using a LBE with advanced boundary conditions and the predictions were shown to be in close agreement with those recently obtained using a stylised finite volume method. A study of the velocity field clearly showed the onset of von Karman streets in the cylinder wake and a series of mesh refinements demonstrated convergence. A journal article containing this work is currently in preparation [2].

In the next project I developed an axisymmetric lattice Boltzmann equation and showed it to be a second-order approximation to the axisymmetric Navier-Stokes equations. I applied my equation to Stokes' flow over a sphere and found an excellent agreement between the analytical and numerical approximations for the drag coefficient for all $Re < 1$. At higher Reynolds numbers our

results agree with an empirical formula for the drag, showing that this project has linked numerical, analytical and experimental studies. The theoretical development of the model has been published in Physical Review E [3] and a further article on the numerical evaluation of the model is currently in press [4].

A lattice Boltzmann model for immiscible binary fluids with different viscosities and densities has been developed. In the macroscopic limit I have shown that this model recovers the Navier-Stokes equations for two phase flow. This was achieved by constructing an operator that induces the appropriate surface tension term in the macroscopic equations. I derived a theoretical expression for surface tension from my model and have shown it to be in excellent agreement with numerical measurements. The model was first used to study Poiseuille flow in a two-dimensional channel for two and three layer configurations of immiscible fluids. Good agreement with the analytical solution was obtained in both cases and a greater accuracy was obtained when the number of lattice nodes in the transverse direction was increased. The three layer configuration maximises the mass flux for a given pressure gradient. Spinodal decomposition of binary mixtures has been studied. In the case of a mixture of two fluids with the same density but different viscosities the model predicts that, in equilibrium, one large low viscous bubble is surrounded by the more viscous fluid. This prediction agrees with rigorous theoretical minimisation of energy arguments. I have also performed simulations to demonstrate that my model can predict binary flows with much larger density ratios than other LBEs. Both the non-equilibrium rod test and the coalescence of two identical bubbles test were completed successfully and the results have led me to believe that my new collision operator can capture qualitative and quantitative two-phase flow phenomena. Finally, I proposed an axisymmetric multiphase lattice Boltzmann equation. This model is simple to implement and some test cases have been performed to demonstrate its capabilities. This material has been published in the Journal of Physics A: Mathematical and Theoretical [5].

I have also discussed the extension of the lattice Boltzmann equation to visco-elastic models. The significant steps in the theoretical development of the models have been described and the merits and shortcomings of each highlighted. I offer a classification scheme for the proposed visco-elastic LBEs based on their kinetic, geometric, and macroscopic attributes and argue that the state-of-the-art LBEs for non-Newtonian fluids are those which are shown to be a direct discretisation of the Fokker-Planck equation. Such lattice Fokker-Planck models should stimulate much enthusiasm in the CFD community since an elegant and efficient numerical scheme to solve this powerful kinetic equation has long been sort. It is likely to be particularly worthy of contemplation to computational rheologists for the Hookean dumbbell model is known to be equivalent to the Oldroyd-B model and can describe the dynamics of polymeric liquids. It is also worth noting that other modern tube-based kinetic models for polymeric melts, such as the Pom-Pom and Rolie-Poly models, also give rise to Fokker-Planck-type equations for their polymer configuration function, highlighting a possible important challenge for the LBE. Finally I stress that although I have shown that visco-elastic lattice Boltzmann models have the potential to offer a promising alternative to traditional continuum-based numerical methods for viscoelasticity, they are still in their infancy compared to more traditional solvers and further study is clearly needed if such models are to seriously compete with existing numerical techniques.

References

- [1] T. Reis and T.N. Phillips. An alternative approach to the solution of the dispersion relation of a generalized lattice Boltzmann equation. Submitted to Phys. Rev. E (2007).
- [2] T. Reis and T.N. Phillips. A lattice Boltzmann study of flow over a cylinder. In preparation.
- [3] T. Reis and T.N. Phillips. Modified lattice Boltzmann model for axisymmetric flows. *Phys. Rev. E*, 75:056703, 2007.
- [4] T. Reis and T.N. Phillips. Numerical validation of a consistent axisymmetric lattice Boltzmann model. Accepted, Phys. Rev. E.
- [5] T. Reis and T.N. Phillips. Lattice Boltzmann model for simulating immiscible two-phase flows. *J. Phys. A: Math. Theor.*, 40:4033–4053, 2007.

BSR Annual Award 2007

Dr G H Meeten

A few years ago the BSR Bulletin featured a series of articles in which Sherlock Holmes and Doctor Watson bemoaned the apparent demise of the industrial rheologist as a species of humanity. I know this because I was editor of the bulletin at the time. It eventually emerged that the author was Neil Cogswell, himself an industrial rheologist and sometime President of the BSR, and the ideas he voiced through his imaginary discussants even found their way into a scholarly paper in *Journal of Rheology*. Gerry Meeten is living proof that industrial rheology is not dead and he has devoted the last 20 years to rheological problems of industrial interest for Schlumberger Cambridge Research.

Gerry is a physicist and a Fellow of the Institute of Physics, having completed a degree at the Sir John Cass College. That College became part of the City of London Polytechnic in 1970, which in turn became London Guildhall University in 1992 and now, London Metropolitan University, after a merger. University of London degrees were awarded to graduates of the college and Gerry gained both a BSc and PhD, and he subsequently joined the staff as lecturer and then senior lecturer in physics. He helped build up a postgraduate research group working on the optical and dielectric behaviour of liquids, polymers and colloids, and it was from this that his interest in fluids developed. In 1987 he joined Schlumberger and began applying his expertise to oilfield research, a rich field which includes drilling, cementing, fracturing of strata, performance logging and the development and application of sensors for various purposes.

The fluids of interest here are typically complex granular suspensions, which are quite challenging to characterise, and Gerry has risen to that challenge, advancing knowledge and understanding of squeeze-flow methods, vane in cup rheometers, capillary rheometry and a novel recirculating pumped-cup rheometer to deal with the problem of particle settlement. Another problem of practical significance is the filtration of the liquid phase through the suspension, leading to blockages in pipes or in the wellbore, and Gerry has looked at that through theoretical and experimental approaches. All this has been backed up by his practical grasp of experimental measurement methods in liquids, such as dichroism, birefringence, reflectance, ultrasonic velocity, scattering, refraction and extinction. The outcome is a list of over 100 publications in scientific journals, several patents for which he is the named inventor, and countless internal reports for Schlumberger. These are impressive achievements for an industrial rheologist, where the main focus is not on academic publications.

In addition, Gerry has supported the BSR, not only by membership and contributing to meetings such as this one, but also spending a term of office on the Council, including the time consuming job of editor of *Rheology Abstracts*, in the

time before the widespread availability of bibliographic database methods, when much pushing of paper was involved.

As President, it gave me great pleasure to present, during the Society's mid-winter meeting on the rheology of foams and emulsions, the British Society of Rheology's Annual Award for 2007 to Dr Gerry Meeten in recognition of his contribution to advancing the rheology of industrially important materials.

Phil Banfill



The President presents the 2007 BSR Annual Award to Dr Gerry Meeten

Rheology via Optics

GH Meeten

**Schlumberger Cambridge Research, High Cross,
Madingley Rd, Cambs CB3 0EL**

It was my recent pleasure to receive the BSR Annual Award of 2007 for Contributions to the Rheology of Industrially Relevant Materials, at a BSR meeting on the Rheology of Foams and Emulsions at Imperial College on 11th December. In this article I hope to explain how I came to be a rheologist, of sorts.

After Northampton Grammar School with modest A-levels in 1959, I spent two years at Plessey's Caswell laboratories near Towcester, followed by undergraduate years in London at The Sir John Cass College; a Victorian Polytechnic. By 1964 I had a University of London degree in physics. Although I was aware of some rheology in the degree curriculum, nothing particularly rheological had stirred my interest apart from a coaxial-cylinders rheometer used for undergraduate teaching. This had been made by Emil Hatschek, who was Reader in Colloid Science at the College sometime in the period 1920-30. He wrote his famous book in that period (Hatschek 1928) and it was reviewed, largely favourably, by Eugene Bingham (1931). This book I read with historical interest in the college library. Hatschek's instrument had refinements hardly used today, such as guard rings at each end of the stator to minimise end-effects. A nice account of such matters and of the origins of concentric cylinders viscometry has been given recently by Dontula et al. (2005).

Although I was a determined but largely directionless graduate, my years at Plessey Caswell had given me a taste for research, and coincidentally Dr John Champion wanted to expand his group at Sir John Cass College. He had shown how measurements of the optical birefringence induced by shear in liquids of centrosymmetric molecules (such as carbon tetrachloride) could support the theory of liquid structure. He had designed and made a coaxial-cylinders machine with end-windows to transmit a beam of light, parallel to the common rotation axis, through a liquid sheared in the annular gap (Champion 1960). Several things about his work interested me and I read that flow birefringence in liquids was described first by JC Maxwell (1873) who had discovered it in 1866. Undergraduate texts made no mention of the Maxwell effect (as it is often called) which for me gave it some allure. The research literature asserted that molecules in a liquid must be both non-spherical and optically anisotropic for the effect to occur. It was ascribed to the non-random orientation of molecular axes induced by shear flow in competition with rotational Brownian motion. However, John Champion's results for the centrosymmetric carbon tetrachloride molecule contradicted this view, and suggested another origin.

By 1964, and despite almost 100 years since Maxwell had discovered his effect, good experimental measurements on molecular liquids were still very few, particularly on chemical homologues. By comparison, suspensions of

macromolecules and colloids had been quite well studied, and the effect was used to study particle shape and size. However, for most molecular liquids the optical birefringence is very weak on account of intense rotational Brownian motion. Moreover, the optical beam suffers internal reflections in an annular gap at high shear rates, owing to the radial gradients of temperature and hence refractive index caused by viscous heating. Thus few comparisons had been made between experiment and theory. Many flow birefringence measurements in Newtonian molecular liquids pre-dated GI Taylor's work on instability in annular shear, and had been made unwittingly in non-laminar shear flow (Jerrard 1959). And so it was time, I felt, for new experiments on flow birefringence. However, John Champion had become interested in the dielectric properties of large rigid-rod biopolymers, and particularly on the effect of flow on their alignment. He wanted to develop shear-dielectric experiments to measure the dielectric properties of smaller molecules; even molecular liquids. Another of his many interests was polymer solution rheology, and he showed me how to convert the flow birefringence apparatus into a rheometer (Champion and Birkby 1967). His determined energy was obvious, but I do not think any of us recognised his extraordinarily inventive talents, both in the laboratory and in the mechanical workshop. He could go into a workshop with an idea and come out with apparatus. Postgraduates in his research group assumed that any experimentalist had these valuable skills, only to discover later how wrong we were.

I worked hard in the winter of 1964-65 to adapt John Champion's coaxial cylinders flow birefringence apparatus to make dielectric measurements. The mechanics were stable and the electronics were very sensitive, but shear-heating was dominant and it defeated us. However, I learnt a little about rheology, albeit obliquely. In 1965 we reviewed earlier studies of flow birefringence in molecular liquids. Older measurements, and the chemical purity of the liquids, were dubious. The theories were old; 1928 and 1938. So for my PhD project I set about improving the flow birefringence measurement technique and devising new experiments; e.g. using simultaneously applied electric and shear fields. Electro-optical birefringence had been discovered by John Kerr in 1875. In fluids, it is known to originate from the non-random orientation of optically anisotropic molecules in the electric field. My experiments showed that the two separate birefringences could be added tensorially to give the measured value, and that the two-field experiment could not distinguish between rival theories of flow birefringence as had been claimed.

I took a lectureship in the Department of Physics of the City of London Polytechnic, which had been formed in 1968 by merging The Sir John Cass College with other nearby educational institutions. In my next few years rheology took second place to electro- and magneto-optic studies in molecular liquids, but I could not help but learn some rheology from the work of John Champion and his students. Our Haake rheometer with its flat-bed plotter introduced me to non-Newtonian fluids.

Two close events caused me to return to rheology, both via the colloidal state. One was the publication of a report of a multidisciplinary panel on the science of colloidal dispersions by the UK Science Research Council (SRC 1972). This was a call to the UK scientific community to regain expertise in colloid science on which much of modern industry depended. Academic and industrial rheology then became important owing to SRC funding. The other was a very fruitful long-term collaboration with Dr. Len Gate of English China Clays. Len worked on kaolinite clay, used for coating paper, and was interested in the optical properties of clay particles. In many collaborative experiments we orientated clay particles using both shear and magnetic fields and studied their optical and geometric properties. I learnt a lot from Len Gate about the scattering by wavelength-sized particles, and the diffuse propagation of light in concentrated assemblies of particles.

In 1987 I returned to industry at Schlumberger Cambridge Research (SCR), which had been founded in 1982 for research to underpin the Company's business of oilfield services. I was impressed by the range of activities under the capacious tent-like roof, and by the serious attention given to fundamental sciences. Much of the Company's business involved pumping functional fluids such as drilling muds and cement slurries through pipes and bores in rocks. Thus the rheology of complex fluids and soft solids was hard to avoid. It was in my early years in Cambridge that I joined the BSR, with some guilt, as previously I had enjoyed many of their meetings without the responsibility of membership. This guilt was assuaged slightly by serving on the BSR Council for a few years as Abstracts Editor, and I began to value my membership.

With the help of many valued Schlumberger colleagues I became aware of rheometrical measurement problems such as those caused by wall-slip, or by the migration of granular particles driven by gravitation or centrifugation in rheometers. My initial interest in yield-stress fluids and soft solids sprang from the engineering need of many functional fluids to possess a yield stress, and the problems of drill string sticking in filter cake (a soft solid of high yield stress) at a well bore wall in permeable rock formations. These interests remain with me.

Let us return to Maxwell, who wrote (1873): "In 1866 I made some attempts to ascertain whether the state of strain in a viscous fluid in motion could be detected by its action on polarized light. I had a cylindrical box with a glass bottom. Within this box a solid cylinder could be made to rotate. The fluid to be examined was placed in the annular space between this cylinder and the sides of the box. Polarized light was thrown up through the fluid parallel to the axis, and the inner cylinder was then made to rotate. I was unable to obtain any result with solution of gum or sirup of sugar, though I observed an effect on polarized light when I compressed some Canada balsam which had become very thick. I am not aware that this method of rendering visible the state of strain of a viscous fluid has been hitherto employed; but it appears capable of furnishing important information as to the nature of viscosity in different substances."

Importantly for rheology, Maxwell noted that “....a given liquid differs from a solid in having a very small rigidity, or in having a small time of relaxation, or in both ways.” This concept is still under discussion today (Dyre 2006). Maxwell found that the principal stress directions coincided with Stokes’ stresses at $\pm 45^\circ$ to streamlines, and he proposed that liquids are solids with a small time of relaxation (fugitive rigidity). Major inferences from a very simple experiment! We know now that flow birefringence probably exists in all liquids and that the effect arises from the distribution, orientation or deformation of molecules. We also now know that the principal stress directions are not always at $\pm 45^\circ$ to the streamlines for non-Newtonian fluids.

And so my path to fluid rheology started from optics, like Maxwell’s, but modesty forbids any further comparisons! I should like to end by expressing my sincere gratitude to the President and Council of the BSR for the BSR Annual Award.

References

- E Bingham (1931) Book Reviews. *J. Rheol.* 2:236
- JV Champion, JW Birkby (1967) Streaming birefringence and viscosity of liquids at high velocity gradients. *Brit J Appl Phys* 18:485-490
- JV Champion (1960) The measurement of flow anisotropy in pure liquids. *Proc Phys Soc* 75:421-433
- P Dontula, C W Macosko, L E Scriven (2005) Origins of concentric cylinders viscometry. *J Rheol* 49:807-818
- JC Dyre (2006) Solidity of viscous liquids. IV. Density fluctuations. *Phys Rev E* 74: 021502 1-9
- E Hatschek (1928) *The Viscosity of Liquids*. G Bell and Sons Limited, London
- HG Jerrard (1959) *Turbulence in Apparatus for Measurement of Streaming Double Refraction*
- J Appl Phys* 21:1007-1013
- JC Maxwell (1873) On double refraction in a viscous fluid in motion. *Scientific Papers Vol II: 379-380*. The scientific papers of James Clerk Maxwell, Ed. WD Niven, Cambridge University Press 1890
- SRC (1972) *Colloid Science: Report of a multidisciplinary panel on the science of colloidal dispersions*. UK Science Research Council

BSR-TA Instruments Rheometric Prize

At the 2007 BSR Mid-Winter meeting, held at the School of Mines Imperial College London, TA Instruments were proud to present the inaugural TA Rheometric Prize for the best poster presentation to Miss Line Do of the University of Nottingham for her joint poster with Nestle on “the impact of some formulation and structural parameters on the viscosity of reduced fat chocolate”. This award, judged by members of the BSR marks the start of a partnership between TA Instruments and the BSR in promoting and rewarding the efforts of academic participants at such meetings.

Along with the usual certificate, the winner was also awarded a substantial travel grant to present their work at another rheology conference and it is hoped this year that Miss Do may be able to attend the XVth International Congress on Rheology in Monterey.

TA Instruments are pleased to be able to help the BSR reward the academic efforts in rheology and it is hoped that this support will encourage increased participation in presenting such work at future BSR meetings whilst providing the winner an opportunity to widen their experiences in both presenting and attending other European or International conferences.

A short abstract of Line Do's presentation is given below.



Mr Pete Hodder of TA Instruments makes the award to Miss Line Do

Rheological modification of reduced fat chocolate induced by the addition of limonene

T-A Line Do¹, Bettina Wolf¹, John R Mitchell¹, Joselio Vieira²,
Jeremy Hargreaves²

¹ The University of Nottingham, School of Biosciences, Division of Food Sciences, Sutton Bonington campus, Loughborough, Leics, LE12 5RD, UK.

² Nestlé PTC York, Haxby road, York YO91 1XY, UK.

In response to consumers' growing desire for healthy balanced lifestyles, decreasing the fat content of food products such as chocolate has become of prime interest for food manufacturers. In terms of microstructure, chocolate is a suspension of solid particles (sugar, cocoa and sometimes milk solids) dispersed in a fat continuous phase, containing mainly cocoa butter, which is liquid above 35°C. Decreasing the fat content of chocolate leads to an increase in the chocolate molten viscosity, which is due to increased particle-particle interactions. This makes chocolate manufacture more difficult when the fat content is below 30%wt and adversely affects its eating quality. A patent (1) claims that the addition of about 3%wt limonene to chocolate leads to a significant decrease in the chocolate viscosity facilitating the production of reduced-fat chocolates. Limonene is a low molecular weight hydrophobic compound usually utilised as a flavour. The aim of this research is to understand the functionality of limonene in decreasing the viscosity of molten chocolate.

Because limonene is a hydrophobic material, it is hypothesised that it mixes with the cocoa butter, the continuous phase of chocolate, and consequently affects some physical properties of cocoa butter. Figure 1 shows that replacing a fraction of the cocoa butter by limonene in a 25%wt fat chocolate leads to a significant viscosity decrease, from about 9 to about 7 Pa s, whereby in the shear range investigated the flow behaviour is Newtonian.

Two hypotheses regarding the action of limonene were tested: 1) limonene has a lower density than cocoa butter and therefore increases the volume fraction of the continuous phase 2) limonene decreases the viscosity of the cocoa butter and therefore the chocolate continuous phase. A third hypothesis that limonene would adsorb to the particle surfaces and improve particle dispersion was dismissed since the limonene molecule does not have an amphiphilic structure.

Our data does also not support hypothesis 1. Density measurements showed that, although limonene has a lower density than cocoa butter (837 and 894 kg m⁻³ respectively), replacing 3% out of 25% of cocoa butter by limonene does not affect the continuous phase volume to a sufficient extent (+0.3%vol) to explain the decrease in the chocolate viscosity observed.

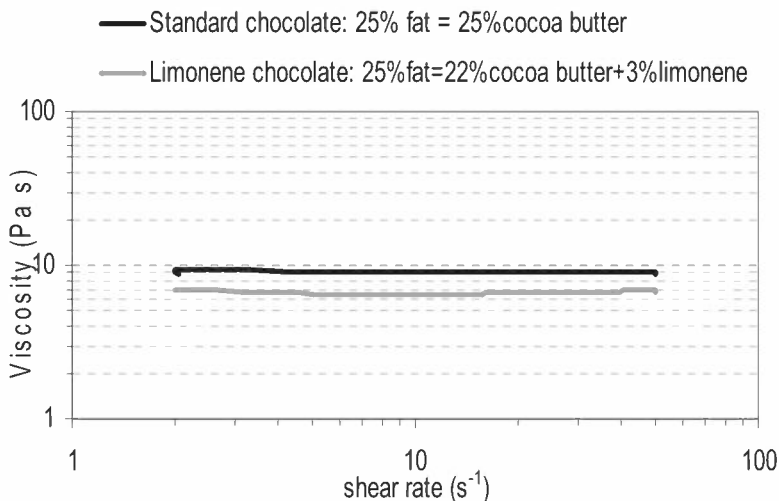


Figure 1: Viscosity of 2 reduced-fat chocolates (25%wt fat) at 40°C - After a 15 minute pre-shear at 5 s⁻¹, the shear rate was increased from 2 to 50 s⁻¹ in 3 minutes using concentric cylinders.

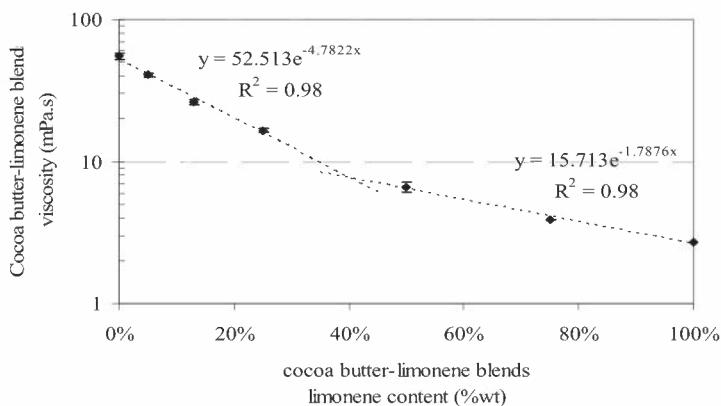


Figure 2: Viscosity of cocoa butter-limonene blends. Each blend showed a Newtonian behaviour and was sheared from 0.01 to 1 Pa in 5 minutes using concentric cylinders.

Finally, we show that hypothesis 2 is likely to explain limonene chocolate viscosity reduction. As seen in Figure 2, it appears that the addition of a small quantity of limonene to cocoa butter leads to a large decrease in viscosity. For example, at a limonene to cocoa butter ratio of 3:22, the viscosity is only of 26

mPa s compared to 55 mPa s for pure cocoa butter. The viscosity decrease may simply be a result of increasing the amount of a lower viscous component in a simple mixture, or there may be specific interactions between limonene and cocoa butter. Limonene could be decreasing triacylglyceride interactions in cocoa butter accounting for the fat viscosity. At this stage of the investigations we may also not rule out phase separation. An indication for a more complex behaviour is given by the fact that the viscosity – limonene concentration relationship was found to be linear with a change in slope around 40% limonene, see Figure 2.

In summary, this study demonstrates the potential for controlling the viscosity of liquid fat or liquid fat based dispersions by replacing some the liquid fat by a small hydrophobic compound, such as limonene in the case of molten chocolate.

(1) Beckett, S.T., Preparation of chocolate with limonene to reduce fat content, U.S. Patent 6200625 (1999).

The Vernon Harrison Annual Doctoral Prize 2008

The Vernon Harrison Prize is awarded annually by the British Society of Rheology for the most distinguished PhD thesis in rheology. This aims to recognise excellence, creativity and novelty in research and is awarded to the postgraduate student who, in the opinion of the adjudicating committee, has made the most original and significant contribution to any branch of rheological research (experimental, computational or theoretical) leading to the award of a PhD degree in a given academic year. The prize is partly supported by the Vernon Harrison Bequest.

Entries are now invited for the 2008 award. The prize will be £500, an illuminated certificate and a copy of Rheology Reviews. Any person who has submitted and successfully defended a thesis in any area of rheology at a higher education institution in the United Kingdom between 1 September 2007 and 31st August 2008 is eligible.

Each entry should consist of:

- a two page summary of the research written by the candidate, emphasising in clear terms the key achievements which especially distinguish it as a candidate for this award;
- a letter from the thesis supervisor confirming the recommendation of the award of a PhD to the candidate and supporting the case for the award, highlighting the specific original contributions of the candidate;

- the name and address of the external PhD examiner, who should have been contacted by the supervisor to ensure that they are willing to give an independent reference if approached by the assessors.

-
The Committee may subsequently ask to see a copy of the final version of the thesis to help them reach their decision.

An Adjudicating Committee appointed by the Council of the British Society of Rheology will consider the entries. Particular attention will be given to the scientific originality and quality of the thesis, its coherence and overall presentation and the significance the research to the field in general. Theses where rheology is a major, but not the sole, scientific theme will be considered. Entries will be selected by the Adjudicating Committee for presentation at the Winter Meeting of the British Society of Rheology (date and venue to be decided). The Adjudicating Committee may award any number of first and secondary prizes. Travel funds will be available to assist candidates to attend the prize meeting.

Proposals for the 2007-8 Award should be sent **by September 15th 2008** to the BSR Secretary:

Dr Helen Wilson
Department of Mathematics
University College London
Gower Street
London WC1E 6BT, UK

Tel: +44 20 7679 1302
Fax: +44 20 7383 5519
email: helen.wilson@ucl.ac.uk

**British Society of Rheology
Minutes of the 66th Annual General Meeting
Lake Vyrnwy Hotel, Mid Wales**

Tuesday, April 3rd, 2007, starting at 5.15 pm

1. Present

The President, the Hon. Secretary and 31 members.

2. Apologies for absence

Received from D Bell, NE Hudson, J Stokes, PR Williams and X-F Yuan.

3. Minutes of the 65th 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

Malcolm Mackley reported that the BSR had maintained its momentum for yet another year. He noted that it was particularly pleasing to see that National Meetings had been reintroduced to the portfolio of the Society's activities. These included a successful December 2006 Winter Meetings on Biorheology and Biomedical Applications at Manchester University organised by Dr Xue-Feng Yuan. In addition, over the past year, Dr Jason Stokes has masterminded Non Newtonian Club Meetings that have been both popular and useful at a regional level.

The President reported that the BSR website was now fully functioning and thanked both Prof Mike Webster and Dr Jon Harvey for setting up a powerful portal for the BSR to use now and in the future. He added that Dr Derek Bell has ensured that the BSR adds financial value from the site by securing advertising on both the web and other BSR publications.

The President expressed his thanks to Bogdan Dobraszczyk for his contribution in maintaining both interest and content in the BSR Bulletin.

He reported that Prof Ken Walters had now stepped down as guest editor of Rheology Reviews and that Prof Roland Keunings had kindly agreed to take over. He added that Prof Walters had ensured the Reviews had a high academic standing and we feel we are in safe hands with the new editor. David Binding ensures that the reviews appear in a timely and orderly way and Nick Hudson masterminds Rheology abstracts and paper circulation to members.

He reported that Dr Phil James was continuing the good work of his predecessor, Prof Webster, in ensuring that membership numbers are kept up scratch.

The President expressed his opinion that the BSR remains well managed with a Corinthian spirit, by a small band of dedicated rheologists. He added that it was particularly pleasing to see a new generation of Rheologists being involved in the running of the BSR, namely Drs Jason Stokes, Helen Wilson and Xue-Feng Yuan.

Finally, the President reported that the BSR was in a reasonable financial state, but the subject and its participants are continuously evolving and therefore the BSR needed to continuously reposition itself in an ever and faster changing landscape than in the past.

5.2 Treasurer

Dave Binding presented the Treasurer's report. He reported that the operating loss for 2006 was around £5K and that subscription income for 2007 was down compared with the corresponding position the previous year. He encouraged anyone who had not done so already to pay their subscription for 2007. He added that the publishing activities of the Society were essentially cost neutral. He attributed a significant contribution (£3K) to the operating loss to web development costs and added that this would fall in subsequent years since the Society will only be paying for maintenance work. He reported that the deficit of £1K on Rheology Reviews during 2006 will disappear completely in the present year due to sponsorship and a reduction in authors' fees. He added that it was his goal to be able to offer this publication gratis to the membership.

5.3 Hon. Secretary

Tim Phillips reported that there had been four nominations for the Vernon Harrison Doctoral Prize in 2006 and the prize had been awarded to Dr Joel Miller from the University of Cambridge – the prize lecture and presentation had immediately preceded the AGM. The 2006 Annual Award was made to Dr Oliver Harlen at the BSR Midwinter Meeting in Manchester in December 2006.

Tim Phillips reported that he had written to Thomson Scientific about the inclusion of Rheology Reviews in the IST Citation Index. Thomson Scientific had agreed to this and articles in Rheology Reviews would now be covered by the Index to Science Book Contents (ISBC) and the Current Book Contents (CBC) section of the print version of Current Contents.

5.4 Membership Secretary.

Phil James reported that the membership of the Society was currently around 460, a figure that included 66 honorary members. The membership was domiciled as follows: UK – 330, EU – 60, Rest of the World – 70. He added that the numbers were slightly inflated through members gained by attendance at meetings. There were 7 new members, while 4 members had resigned during the year. He commented that membership subscriptions for 2007 were down and that he would be contacting members individually by email to address this issue.

5.5 Bulletin Editor.

Bogdan Dobraszczyk reported that he had edited his fifth issue of the Bulletin and thanked those members who had contributed articles for the Bulletin during the year. He encouraged the membership to continue to submit material for publication in the Bulletin. Malcolm Mackley thanked Bogdan for his work on the Bulletin.

5.6 Abstracts Editor.

Nick Hudson provided a report on Rheology Abstracts. As editor he received between 3,000 and 4,000 abstracts a year. He asked members to send him abstracts directly and added that he would welcome any potential abstractors to his team of abstracters.

6. Officers and Council members

There being no further nominations to Council, the nominations circulated with voting papers were approved by postal and electronic voting and unanimously by those present at the meeting. The Council for 2007-08 was therefore elected as follows:

President	Professor Phil Banfill
Hon. Secretary	Dr Helen Wilson
Hon. Treasurer	Dr. Dave Binding
Membership Secretary	Dr Phil James
Bulletin Editor	Dr. Bogdan Dobraszczyk
Abstracts Editor	Dr Nick Hudson

Ordinary Members of Council

Mr Derek Bell
Professor Tim Phillips
Dr Jason Stokes
Professor Mike Webster
Professor Rhodri Williams
Dr Xue-Feng Yuan

On stepping down as President of the Society, Professor Malcolm Mackley thanked Council for their support and work during his Presidency and congratulated the incoming President, Professor Phil Banfill, on his election.

7. Any other business

Phil Banfill thanked Malcolm Mackley for all that he had done for the Society during his term of office. He added that he was honoured to be the next President of the Society.

Date of next meeting. The 67th Annual General Meeting of the Society would be held on 18 March 2008 in Liverpool.

There being no other business the meeting closed at 6.02 pm.

T N Phillips, Hon. Secretary
P Banfill, President

THE WORLD STANDARD

Brookfield... the best keeps getting better



Whether you need to measure viscosity, controlled rate, or controlled stress – or maybe you just need to make a simple yield stress measurement – Brookfield has an affordable rheometer for you. Our experience and commitment to excellence is what makes a Brookfield instrument the most widely used in production and control as well as quality control. Check out our full range of instru-

ments including a new, enhanced version of our popular, high end rheometer with features and benefits you can't afford to miss! With dedication to improvement, innovation and excellence, you can always be sure that the best will just keep on getting better...when it's a Brookfield!



Tel: 1279/451774 Fax: 1279/451775

email: sales@brookfield.co.uk

Website: www.brookfield.co.uk

BOSTON CHICAGO LONDON STUTTGART GUANGZHOU

► Stability at the limit!



Anton Paar

I'm the coolest of them all.

The new air-bearing measuring drive of the Physica MCR rheometer series ensures stable, precise results at the smallest and largest torques and speeds.

Technical innovations:

- Toolmaster™ system
- TruGap™ system
- New RheoPlus software
- EC powerdrive motor

For more information about the series and new features, take a look at www.anton-paar.com



Ask your local Anton Paar representative for a quotation or contact us directly:

Tel: Tel: +44 (0)1992 514730
E-mail: info.gb@anton-paar.com

TA INSTRUMENTS

IT'S NOT A RHEOMETER...IT'S THE NEW ARES-G2 RHEOMETER.



NEW ARES- G2 RHEOMETER

- Unique separate motor and transducer technology
- New FRT with 5,000,000:1 dynamic range
- New high torque, friction free brushless DC motor with high resolution optical encoder
- Inertia free dynamic measurements to 100 Hz
- New advanced strain and stress control
- New touch screen with intuitive graphical interface
- New Force Convection Oven with Camera Viewer
- New Smart Swap™ Peltier Plate with Solvent Trap
- New TRIOS Software

WWW.TAINSTRUMENTS.COM



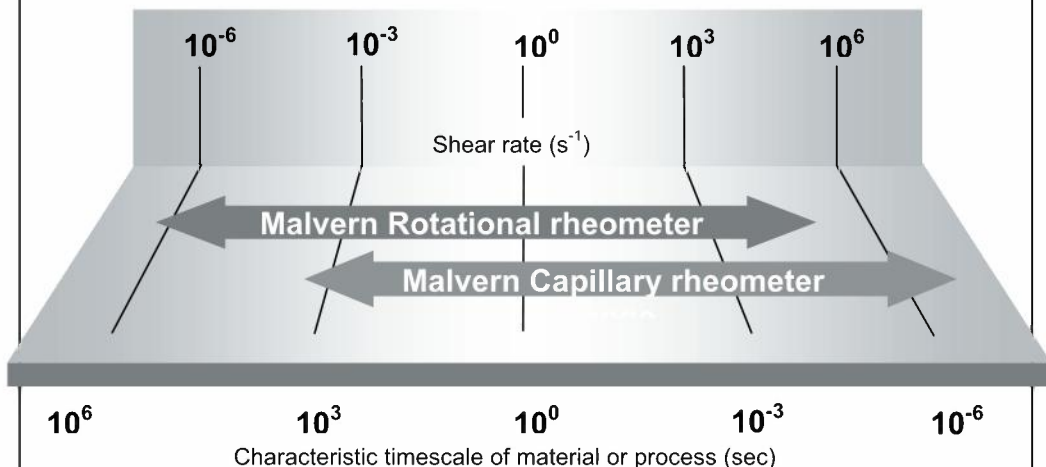
Innovations in rheological solutions



Malvern's rheological instruments have the unique ability to directly characterise material properties over 13 decades of shear rate. This means that physical material parameters can be measured, as well as their impact on process operation and end-use function.

These intelligent solutions apply to all industries where the rheological characteristics of a material determine its processability, performance and consumer acceptance.

Malvern is the only material characterisation company with specialist resources in the measurement of particle size, shape, zeta potential, molecular weight and rheology. Malvern has the understanding and expertise to advise on how these microstructural parameters influence bulk rheological properties.



Visit the Malvern Instruments website to view audio visual presentations in rheology & light scattering

www.malvern.com

British Society of Rheology

Notice of the 67th Annual General Meeting

The 67th Annual General Meeting of the British Society of Rheology will be held on Tuesday March 18th 2008 at The Foresight Centre, Liverpool, starting at 16.20.

The minutes of the 66th Annual General Meeting are in the Bulletin enclosed with 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 as follows:

President	Prof. P. F. G. Banfill
Hon. Secretary	Dr. H. J. Wilson
Hon. Treasurer	Dr. D. M. Binding
Membership Secretary	Dr. P. W. James
Bulletin Editor	Dr. X.-F. Yuan
Abstracts Editor	Dr. N. E. Hudson

Ordinary members of Council

Dr. B. Dobraszczyk
Dr. J. Embery
Prof. T. N. Phillips
Dr. J. Stokes
Prof. P. Rh. Williams
Prof. M. F. Webster

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
Mathematics Department
University College London
Gower Street
London WC1E 6BT
25th January 2008

Commentary – 320th BSR Council Meeting, Lake Vyrnwy Hotel, April 4th 2007

April 4th 2007 was a clear bright but cool day in the Mid-Wales countryside as scientists discussed complex rheology in the final session of the INNFM spring meeting. Proceedings closed about 1230, chairs and tables were moved and projectors packed away so the 320th Council Meeting could start, with a sandwich lunch to sustain us. It all felt very familiar from 2003 when I had previously been a Council member, but now I had to chair the meeting, as President. An unfamiliar role in very familiar territory, as many of the issues have stayed current over the intervening years.

We discussed ideas for award recipients, subscription income, membership payments, Rheology Reviews and its costs, sponsors and editorial policy, and travel bursaries to attend the forthcoming European meeting in Naples. The website has really taken off since I last sat at this table. The number of page hits continues to rise, which will please our advertisers and we noted that, gratifyingly, last year's advertisers had stayed with us. However, we all recognised the need to keep the content up to date, with all Council members able to add their own news. We agreed to retain the existing site management processes and would be developing a conference managements module for future meetings.

We discussed a full programme of future scientific meetings, with emulsions and foams for December 2007, and the joint INNFM/BSR meeting in Liverpool in March 2008, and future plans dependent on the outcome of the voting in Naples, which would decide the venue of the 2009 European meeting. By the time this report appears in print it will be common knowledge that Cardiff was successful in bidding to host this meeting. Good news indeed! Other good news is the renaissance of the Non-Newtonian Club, guided by Jason Stokes. In his absence we heard that a meeting was planned for June in a Midlands location, still to be finalised.

And finally, the meeting finished about 4.00, having discussed a familiar mix of topics with both new friends and longer term friends and I left feeling reassured that the Council has a firm grip of the Society's affairs and looking forward to the rest of my two-year term of office.

Phil Banfill

Commentary 321st BSR Council Meeting University College London 20th September 2007

The 321st BSR Council Meeting took place in the Department of Mathematics, University College London, within sight of the British Library and the impressively gothic splendour of the newly refurbished St Pancras Station. The meeting took place on the 7th floor, despite the receptionist not believing that the 7th floor existed! In the temporary absence of the new BSR President Phil Banfill (stuck at Gatwick), Helen Wilson bravely took the chair and welcomed everyone to the meeting.

In Matters Arising, Xue-Feng reported a healthy balance of £560 from the Manchester BSR Winter Meeting held last December. Additional nominees were sought for the BSR Annual Award to be presented at the BSR Winter Meeting in London. This generated a lively discussion on the merits of various candidates, and it was decided to leave the final decision to the awards subcommittee (BSR President and two immediate past Presidents). Possible recipients of the BSR Gold Medal award were also discussed, and Tim Phillips circulated the criteria for award of the Gold medal. Names were again passed on to the awards subcommittee.

Owing to transport difficulties, the reports of the President (Phil Banfill) and the treasurer (Dave Binding) were postponed until after lunch. Constant text messages from Phil kept us up to date on his progress – he was currently stuck at East Croydon!. Membership Secretary Phil James proposed 6 new members who were approved by Council. Phil reported 8 resignations, giving a total BSR membership of 461. Phil suggested providing some incentive for prompt payment, which was discussed at some length; it was agreed that BSR should provide some benefit for prompt payment of membership fees– such as discounted or free Rheology Reviews. In the Secretary's Report, Helen Wilson reported that the next announcement for the BSR Travel Awards for 2008 should appear in the next Bulletin. As no entries had yet been received for the Vernon Harrison Award, a reminder email would be sent out and a News item put on the website.

After looking longingly at the sandwiches which had arrived earlier, lunch was taken at 1.00, during which David Binding arrived after a marathon journey from Aberystwyth, looking in need of a strong coffee. After a short lunch, David Binding gave the Treasurer's report: he said everything was fine! He was prevailed upon to give more detail, and just as he was getting into his stride Phil Banfill finally made it at 1.35, after a truly heroic journey from Edinburgh. Dave revealed that the BSR finances were in good condition, with a balance of around £50,000, and an income of £500 in excess of expenditure for 2007. Helen was relieved of her duties by Phil Banfill, who apologised for his late arrival. He reported that, since the last Council meeting, Cardiff had been successful in their bid to host the Annual European Rheology Conference in April 2009, which was excellent news.

Bogdan reported that all was well with the Bulletin; with many news articles in the next issue, which should appear some time around November.

A website update was received from Jon Harvey. There was discussion of the types of maintenance work that had been required over the last year, and general satisfaction with the service received. The conference manager on the website was ready to be used and to be tested on the forthcoming BSR winter meeting. There followed a long discussion over the list of moderators for the various regions of the website, many of which were out of date. New allocations were decided in various categories. There was discussion of the post of webmaster. It was decided that an official Council post of Website Officer was not necessary, and that it was up to BSR Council members to submit items to the website in order to keep it up to date. Members attending conferences, especially travel award holders, should be encouraged to submit a brief report (with photo) to the website. Phil Banfill expressed Council's thanks to Jon Harvey for the update and for maintaining the website.

Jason Stokes reported that a successful Non-Newtonian meeting had been held in Oxford in June, hosted by Peter Martin. Around 30 people had participated with several very good student presentations. The student prize had been awarded to Janice Giudice from Oxford University for her presentation on Non-Newtonian fluids and finite elements. The next meeting was planned to be held at Unilever Port Sunlight on Friday 23rd November. Jason is always looking for enthusiastic young lecturers to act as hosts and would welcome suggestions for future meetings.

Dave Binding reported that the 2007 issue of Rheology Reviews would be very late as he had been holding out for a final review which, eventually, had had to be abandoned. As a result, the current issue will consist of only 3 reviews.

The BSR winter meeting was to go ahead at Imperial College on Foams and Emulsions, 10-11th December 2007. Simon Cox suggested an industrial sponsor for a prize for the best student poster. This meeting will include lectures from the Annual Award winner and the Vernon Harrison Award winner. The 2008 Spring meeting of the INNFM meeting was announced to be held in Liverpool on Complex Flows of Complex Fluids, University of Liverpool, 17-19th March. The programme will include the BSR presidential presentation. The European Society of Rheology AERC meeting will be held in Cardiff on Wednesday 15 to Friday 17th April 2009. This is a change to the Thursday-to-Saturday pattern, following a questionnaire answered at the last meeting in Naples.

The date of the next Council meeting was fixed for Tuesday 11th September at Imperial College London, immediately following the close of the Foams meeting. The Council meeting finished at 3.35 pm.

Bogdan Dobraszczyk

BSR Student Travel Grants

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 be a member, 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 14th March 2008; successful applicants will be 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:

Dr Helen Wilson
Mathematics Department
University College London
Gower Street
London WC1E 6BT, UK

Tel: +44 20 7679 1302
Fax: +44 20 7383 5519
email: helen.wilson@ucl.ac.uk

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.

Karl Weissenberg - The 80th Birthday Celebration Essays

Some years ago one of our members, Professor John Harris, arranged for a number of eminent scientists to write essays on various aspects of Karl Weissenberg's scientific career in honour of his 80th birthday. This was subsequently published. The executors and family of the late John Harris have asked that these essays now be made available to the rheological community as a whole, and the BSR are glad to be the agents for this. The essays are being published in forthcoming issues of the BSR Bulletin.

Karl Weissenberg was born in Vienna in 1893 and studied at the Universities of Vienna, Berlin and Jena studying mathematics as his main subject. He later became Professor of Physics in the University of Berlin and has also held a variety of Professorships at other Universities. He has made fundamental contributions in both Crystallography and Rheology during a long and active scientific career.

This volume contains a collection of contributions by a number of well known scientific authors which gives the most comprehensive account available up to the present time of the range and depth of the scientific work of Weissenberg and locates his places in the development of both Crystallography and Rheology.

To view the Essays in full, visit:

<http://innfm.swan.ac.uk/bsr/weissenburg/contents.htm>

RHEOLOGY REVIEWS 2006

**Edited by
D. M. Binding and K. Walters**

The field of rheology is extremely broad and continues to grow rapidly. With applications in almost every walk of life, important work is published in a very large number of journals and other media. Although modern computer-based technology enables the location of relevant studies satisfying certain criteria, it cannot determine the importance, or indeed, the significance of the studies. For this, it is necessary to tap the knowledge and experience of the world's most prominent specialists in rheology. This publication aims to achieve this.

"Rheology Reviews 2007" has been slightly delayed but will be published within a few weeks.

Purchases may be made on-line. For details, please visit the BSR web site:
http://innfm.swan.ac.uk/bsr/frontend/rheology_review.asp



NON NEWTONIAN CLUB

The Non-Newtonian Club 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.

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.

Jason Stokes

Email: jason.stokes@unilever.com

BSR meeting of the Non-Newtonian Club Unilever Research and Development Port Sunlight 23rd November 2007

The last meeting of the Non-Newtonian Club was hosted by the Unilever Research and Development centre in Port Sunlight on the 23rd November 2007. This one-day event consisted of a series of lectures by recognised rheologists as well as post-graduate students, with a wide range of subjects and interests represented.

The diversity of subjects was evidenced by the four speakers from the University of Manchester, who, although all carried out their work in the department of Chemical Engineering, presented on very different topics.

Subrahmanyam Pasumarty, who finished his PhD work in that department and is currently working in Unilever Port Sunlight, gave insights on the microstructure of

structured liquids and the use of rheology to follow their aging, while Mustafa Nasser, who is currently finishing his PhD studentship in Manchester presented on the use of shear and compression rheology to characterise kaolinite-polyacrylamide suspensions with different molecular weight and charge and the relevance to their performance in different industrial processes. Rui Zhou showed the work she did for her Master's degree on the rheological characterisation of silk based materials. Dr. Xue-Feng Yuan, lecturer, presented on quantitative characterisation of complex fluids in microscopic flow and the modelling of the behaviour of these flows under different timescales and different dimensions

Modelling plays an important role in many rheological studies, and works on that area were presented by Dr. David Heyes, from the University of Surrey, who uses simulation to model the behaviour of soft and ultrasoft sticky colloid particles, and by Dr. Rob Poole, from the University of Liverpool, who successfully modelled the asymmetric flow exhibited by fluids in a microfluidic cross-slot geometry.

Dr. Tom Dobbie from NEWI gave an insightful talk on how the choice of rheology to characterise fluids must be relevant to the application by showing results obtained from PDMS tamponade agents used in vitreoretinal surgery. Peter Olmsted, from the University of Leeds, presented some recent results on the phenomenon of shear banding in complex fluids and the effect of boundary conditions.

The recognition for the best presentation of a study by a student was awarded to Souad Assighaou for her work on droplet behaviour under large deformation with a particular emphasis on the 3-dimensions characterisation of the universal relaxation process of a droplet shape after a large strain jump. She carried out this work in the context of her PhD at the Université du Maine, Le Mans (France) before joining Unilever Research and Development in Port Sunlight.

This rich diversity of topics and methods provoked a lot of interesting questions and debates with the audience during and in between presentations, which is a sign that these meetings allow the dissemination of information relevant to rheologists of different backgrounds, both academic and industrial.

CONFERENCE ANNOUNCEMENTS

INSTITUTE OF NON-NEWTONIAN FLUID MECHANICS BRITISH SOCIETY OF RHEOLOGY, UNIVERSITY OF LIVERPOOL

“COMPLEX FLOWS OF COMPLEX FLUIDS”

University of Liverpool, UK

March 17-19, 2008

Programme The conference will commence at 12 noon on Monday March 17th and finish at lunchtime on Wednesday, March 19th, 2008. The theme of the Conference will be Complex Flows of Complex Fluids and is being held in Liverpool to coincide with the city being European Capital of Culture 2008. Distinguished scientists who have already agreed to give plenary lectures include; M A Alves (Porto, Portugal), A N Beris (Delaware, USA), J Cooper-White (Queensland, Australia), G G Fuller (Stanford, USA), A J Giacomini (Wisconsin, USA), O G Harlen (Leeds, UK), R Keunings (Louvain, Belgium), G H McKinley (MIT, USA), S J Muller (UC Berkeley, USA), M S N Oliveira (Porto, Portugal), P J Oliveira (Covilhã, Portugal), J R A Pearson (Cambridge, UK), F T Pinho (Minho, Portugal), R I Tanner (Sydney, Australia), M H Wagner (Berlin, Germany) and P R Williams (Swansea, UK).

We envisage sessions devoted to, amongst others, micro-fluidic flows, purely-elastic and inertio-elastic instabilities and turbulence in non-Newtonian liquids. In addition Professor K Walters FRS will give a talk about the life and work of J G Oldroyd who held the Chair of Applied Mathematics at Liverpool from 1965 until 1982. The BSR Presidential address will also be delivered at the conference.

Venue The meeting will be held on the University campus in The Foresight Centre which is housed in the former Liverpool Royal Infirmary designed by Sir Alfred Waterhouse (with advice from Florence Nightingale). One of the conference dinners will be held in the Merseyside Maritime Museum, part of the historic Albert Dock on the banks of the River Mersey. A block reservation has been made for all delegates at the Premier Travel Inn, Liverpool City Centre.

Costs The total cost of the meeting (with meals and accommodation from Monday lunch to Wednesday breakfast) will be £380. Participants registering before 20 January 2008 will receive a £30 discount on their registration fee. Accompanying persons sharing a room with a participant will be charged £100.

Organizers The meeting will be organized by Dr R J Poole and Professors M P Escudier FREng (UoL), T N Phillips (BSR) and K Walters FRS (INNFM). Queries regarding hotel bookings and registration matters should be addressed to Dr Poole (robpoole@liv.ac.uk).

Block letters throughout please

Full name (including title).....

Organization

Full address

.....

Tel

Fax

Email

☐ **Normal Registration.** I wish to attend the conference and I enclose a cheque for £380 made payable to the University of Liverpool (after 20 January 2008).

☐ **Early Registration.** I wish to attend the conference and I enclose a cheque for £350 made payable to the University of Liverpool (before 20 January 2008).

☐ I shall be accompanied by and I enclose a cheque for £100 made payable to the University of Liverpool

Please return this form to:

Dr Rob Poole

Department of Engineering University of Liverpool

Brownlow Hill, Liverpool L69 3GH, UK

Tel: +44 (0)151 7944806

Fax: +44 (0)151 7944848

Email: robpoole@liv.ac.uk

Mechanics of Time Dependent Materials

**March 30 - April 4, 2008
Portola Plaza Hotel
Monterey, California**

We invite you to submit an abstract for the 6th international conference on Mechanics of Time-Dependent Materials, to be held at the Portola Plaza Hotel, Monterey CA, March 30 - April 4, 2008. The conference is held in coordination with the journal of the same name. (Profs. Igor Emri and Wolfgang Knauss, editors-in-chief.) The hotel overlooks beautiful Monterey Bay.

The Monterey Peninsula Airport is located 10 minutes from downtown, hotels and the Conference Center. There are five major airlines that provide over 80 arrivals and departures per day. Monterey is located on the California coast, 120 miles (200 km) south of San Francisco, 70 miles (112 km) south of San Jose and 330 miles (750 km) north of Los Angeles, all of which have international airports.

We are soliciting papers involving constitutive, time (rate)-dependent behavior of **all** materials. The time-dependent mechanical response should be non-negligible in cases involving non-mechanical fields.

Papers dealing with modeling and experimental aspects of the subject area are sought. Possible topics include, but are not limited to: characterization and modeling of behavior at multiple scales; viscoelasticity, viscoplasticity; transport, chemically and electronically active processes; multiphase and biomaterial systems; thermodynamics; shape memory; mechanics of testing; micro/nanoindentation on time-dependent materials; dynamic rate-dependent behaviors; large deformations; residual stresses; time (rate)-dependent damage and failure; polycrystalline, single crystal and nanocrystalline behaviors; multifunctional materials; mechanics of processing; design methods; environmental interactions; experimental methods and techniques; linear and non-linear time-dependent behavior; time (rate)-dependent composite materials of all types; numerical analysis; physical aging; rheological properties; temperature, pressure, and moisture effects on time dependence; damping related topics.

The program will feature: several distinguished plenary speakers addressing a selection of the described topics; a day highlighting US and international governmental support with keynote by Dr. Janez Potocnik, Commissioner for Science and Research for the European Union; an extensive sightseeing excursion in the beautiful Monterey peninsula region.

A short/tentative abstract indicating your intent to attend must be submitted by JUNE 15, 2007. A short 3-page paper will be required if accepted. A CD proceedings of the required 3-page papers will be distributed at the event. Authors are encouraged to submit optional full-length papers as they are completed to Mechanics of Time-Dependent Materials journal. This can be done expeditiously by submitting directly to one of the conference chairs, or alternatively to the journal on-line.

A block of rooms at the conference hotel will be available for the substantially discounted price of US \$179+tax per night. A number of rooms at government rate will be available to individuals with government ID.

You are welcomed to redistribute this announcement to other distinguished researchers. We look forward to seeing you in beautiful Monterey.

Organising Committee

Richard Hall, Air Force Research Laboratory, richard.hall@wpafb.af.mil

Hongbing Lu, Oklahoma State University, hongbin@okstate.edu

H. Jerry Qi, University of Colorado, Qih@colorado.edu

Igor Emri, University of Ljubljana

Wolfgang Knauss, California Institute of Technology

Krishnaswamy Ravi-Chandar, University of Texas at Austin

Dr. Richard Hall

richard.hall@wpafb.af.mil

<http://www.ae.utexas.edu/MTDM08/>

Food Colloids 2008 Creating Structure, Delivering Functionality

**Le Mans, France
April 6-9, 2008**

Food Colloids 2008, is the twelfth in the series of biennial European conferences dedicated to the area of food colloids. The conference will be concerned with fundamental and applied aspects of food dispersions, emulsions, foams and gels.

The conference will be hosted by the Polymers, Colloids and Interfaces Group at the University of Le Mans, and co-organized by the Biopolymers, Interactions and Assemblies Laboratory - INRA Nantes and INSERM U646- University of Angers.

<http://www.inra.fr/foodcolloids2008>

XVth International Congress on Rheology

**Monterey, California
August 3 to August 8, 2008**

The Society of Rheology invites you to participate in the XVth International Congress on Rheology, which will take place in Monterey, California from August 3 to August 8, 2008. The Congress convenes every four years and brings together the world's leading rheologists to present the latest advances and developments in this field.

The Congress will include opening and closing plenary lectures, fourteen keynote lectures (including the Bingham lecture) by eminent rheologists, contributed oral presentations organized into sixteen mini-symposia, and a poster session. Two short courses will be offered on the weekend before the Congress, August 2 - 3, 2008.

In addition to the technical programme, an active social programme is planned which will introduce the participants to the wonderful attractions of the coastal environs of Northern California.

<http://www.rheology.org/ICR2008/>

ICTAM 2008

Adelaide, Australia, 24th to 30th August 2008

The XXII International Congress of Theoretical and Applied Mechanics (ICTAM) will be held in Adelaide, Australia between 24–30 August 2008.

The Congress, ICTAM 2008, was invited by the Australian Academy of Science upon the recommendation of the Australian and New Zealand Theoretical and Applied Mechanics communities. A consortium of universities in South Australia will host the meeting. The Congress venue is the Adelaide Convention Centre. President of ICTAM 2008 is Professor Ernie Tuck of the University of Adelaide.

The International Union of Theoretical and Applied Mechanics is an international non-governmental scientific organisation belonging to the International Council of Scientific Unions (ICSU). It was founded in 1948, with the objectives to form a link between persons and organisations engaged in scientific work in mechanics and related fields, and to promote the development of mechanics, both theoretical and applied, as a scientific discipline.

The International Congress of Theoretical and Applied Mechanics (ICTAM) is held every four years. It provides an important means of meeting the objectives of IUTAM through the gathering of the mechanics community. The first ICTAM was held in 1924, in Delft, The Netherlands.

Location

The Adelaide Convention Centre is located in the heart of Adelaide, South Australia, along Adelaide's civic avenue, North Terrace. International travellers to Adelaide are served by the newly completed Adelaide International Airport.

<http://ictam2008.adelaide.edu.au>

EURHEO Call for Applications

Dear fellow Rheologists,

EURHEO - European Masters in Engineering Rheology, recently selected by the European Commission within the ERASMUS MUNDUS Programme, opened the Call for Applications for its 1st edition (2008/2009), a substantial number of grants being available for students and visiting scholars.

EURHEO aims to offer a pioneer advanced education programme on Rheology and its applications to different Engineering areas. It combines the expertise of seven leading European Universities in the field of Rheology and the syllabus is designed to provide its graduates with the necessary competences to understand the relevance of Rheology in Materials Science and Engineering and apply the knowledge gained in solving real-world Engineering problems both autonomously and included in multidisciplinary research teams.

The full Masters will have a duration of 120 ECTS credits, or 2 academic years, using English as the primary language of instruction with French and Spanish as secondary languages. Each student will have an individually tailored study plan for the two years.

The application deadlines are as follows:

- * For non-European students and scholars applying for the ERASMUS MUNDUS scholarship: January 31, 2008

- * For non-European students and scholars NOT applying for the ERASMUS MUNDUSscholarship: April 15, 2008

- * European students: May 30, 2008.

All the information on EURHEO, as well as the application form are available at the EURHEO website: <http://www.uminho.pt/eurheo>

INDUSTRY NEWS

TA Instruments

1. Introduction of the new ARES-G2 rheometer

TA Instruments recently introduced the new ARES-G2 rotational rheometer at the 79th Annual Society of Rheology Meeting held in Salt Lake City, Utah. The ARES-G2 is the most distinctive rotational rheometer for research and development. Its introduction represents the culmination of five years of ground-up intensive R&D effort and stands as testament to TA's commitment to innovation and continual improvement to the fundamental rheological measurements.

The ARES-G2 remains the only commercially available rheometer to offer unique separate motor and transducer technology for the purest rheological measurements. No other rheometer is capable of measuring stress independently of the applied shear deformation. The ARES-G2 offers unrivaled accuracy, flexibility, and ease-of-use through improved specifications, new environmental systems, advanced options, expanded test modes, and new intuitive TRIOS Software with seamless test sequencing capability.

The ARES-G2 stands ready to meet the widest range of applications offering a variety of SmartSwap™ temperature systems and advanced testing accessories such as UV curing, extensional viscosity fixture, dielectric, electrorheology and optical analysis. The ARES-G2 incorporates our newly-patented, non-contact temperature sensor technology for active measurement and control of both upper and lower plate temperature.

The fully integrated fast data acquisition enables all raw signals to be simultaneously acquired in all test modes. The high data sampling rate of 8KHz in the oscillation mode provides better resolution of both the magnitude and phase of the measured signals and allows better harmonic resolution with accurate evaluation of up to the 10th harmonic.

Many other unique features and enhancements have been incorporated into this new generation of ARES, which makes the ARES-G2 more than just a rheometer.

2. TA Instruments introduce UV curing options to their AR series of stress-controlled rheometers

Also introduced at this year's SOR meeting were two UV options for the AR series of stress-controlled rheometers. These two SmartSwap™ accessories for rheological characterization of UV curable materials are available for both the AR-G2 and AR2000ex rheometers.

One of the UV options is a unique accessory, which uses self-contained LEDs to deliver UV light with a very narrow band around a peak of 365nm. This unique offering boasts many benefits associated with LED technology.

The other accessory uses an established light guide and reflecting mirror assembly to transfer UV radiation from a high-pressure mercury light source. The UV light source accessory is configured using a lower SmartSwap™ assembly with the light source mount, collimator and 5mm light guide. A UV light source (Exfo Omnicure S2000) with wavelengths in the range of 320 to 500 nm, and triggering cable are optional.

Both the LED and UV Light Guide accessories include removable quartz plate, remote radiometer/dosimeter, UV light shield, and nitrogen purge cover (to provide an inert atmosphere). Measurements can be performed at ambient conditions or with optional temperature control to a maximum of 150°C using the AR Series Electrically Heated Plates (EHP) option. Disposable plates are also available for hard UV coatings that cannot be removed from the plate once cured.

Celsum Technologies

1. New Workability Test for Fresh Cement and Concrete

The CTPT2 Two Point Workability Test for fresh cement and concrete is being relaunched with an improved drive to allow accurate control down to very low rotational speeds. A version is also in production which has the capability of conducting the Vane Test for assessing yield strengths, as well as workability. Please contact us for more details.

Joanna

Celsum Technologies Limited

Celsum Technologies Limited, The Innovation Centre, De Montfort University, 49 Oxford Street, Leicester LE1 5XY, United Kingdom

sales@celsum.com

Anton Paar

1. Half Price Rheometers?

Rheometer manufacturers under pressure from shareholders to continuously improve dividends will often offer customers so called “special deals”, e.g. 40% discount, in order to persuade them to trade up their rheometer to the latest model. Such offers can sound very tempting - but how genuine are these words – do you really know and is it really possible to know?

Anton Paar are different:

a.. We are owned by a charitable trust and are not subjected to the pressures of the stockmarket.

- b.. We are the only rheometer manufacturer who performs all of our own engineering in house. As a result we always offer our customers high performing quality rheometers at a fair price.
- c.. We will trade in rheometers of any make or model but will always make our price offers clear and easily understandable.
- d.. You will receive is a quality instrument of similar price to those offered at these large discounts, as well as fair pricing on service and accessories in the future.

Anton Paar is proud to be recognised as company operating a transparent and consistent price list. Buy a rheometer from us and you will always know how it is priced. For further information on Anton Paar trade-in deals please contact steve.goodyer@anton-paar.com

2. New High Throughput Rheometer from Anton Paar

Anton Paar is proud to present the High Throughput Rheometer (HTR). A solution that completely holds its own - a fully automated, robotically operated rheometer. Not losing an ounce of the MCR series world-renowned accuracy – yet giving customers back their entire working day.

For further information contact Steve Goodyer, steve.goodyer@anton-paar.com

3. Welcome to Claudio Filippo

We are pleased to welcome Claudio Filippo into the role of Sales Engineer for the North of England and Scotland. Claudio joins us from the Dept. of Chemical Engineering at the University of Calabria, where he completed his degree and then went on to work in the Rheology Laboratory for 3 years, working with Prof. Bruno De Cindio. The University of Calabria has a close relationship with United Biscuits in the UK and during his time at the University Claudio also spent 6 months working as a rheology trouble-shooter for the technical group at United Biscuits. This involved working with well known brands such as Digestives, Jaffa Cakes and Jacobs Cream Crackers. Claudio has extensive experience measuring foodstuffs such as doughs, jams and chocolate but also measured many other interesting materials during his time in Calabria. Claudio can be contacted via the following email address: claudio.filippo@anton-paar.com

CONFERENCE DIARY

2008	CONFERENCES & MEETINGS
17-19 Mar Liverpool	Complex Flows Of Complex Fluids Institute Of Non-Newtonian Fluid Mechanics, British Society Of Rheology, University Of Liverpool, University Of Liverpool, UK Dr Rob Poole , Department of Engineering University of Liverpool T: +44 (0)151 7944806 F: +44 (0)151 7944848 E:robpoole@liv.ac.uk
30 Mar-4Apr Monterey CA	Mechanics of Time Dependent Materials Portola Plaza Hotel, Monterey, California
6-9 April Le Mans, France	Food Colloids 2008 Creating Structure, Delivering Functionality http://www.inra.fr/foodcolloids2008
15-19 June Salerno Italy	24th Annual Meeting of the Polymer Processing Society http://www.pps-24.com/
15-16 Dec Leeds	Microstructure and Rheology BSR Midwinter meeting 2008, University of Leeds John Embery, phyje@phys-irc.leeds.ac.uk
2009	
15-17 April Cardiff Wales	5th Annual European Rheology Conference, Tim Phillips, phillipstn@CARDIFF.AC.UK
15-18 Jun Zurich Switzerland	5th International Symposium on Food Rheology and Structure Zurich, Switzerland - Peter Fischer - x41-44-6325349 x41-44-6321155 - secretary@isfrs.ethz.ch - www.isfrs.ethz.ch

2008	COURSES
	TA Instruments Rheology courses: 27-28 Feb (Manchester), 28-29 May (Crawley), 3-4 September (Manchester), 26-27 November (Crawley) www.tainstruments.co.uk
3-6 Jun 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



**CTPT2 Two Point Workability Test
For Fresh Cement And Concrete**

Now available also: The CTPVT Two Point and Vane Test



**Celsum
Technologies**
We Apply Science!

Web: www.celsum.com

Tel: +44-(0)116-207-8807

Fax: +44-(0)870-120-9370

Email: sales@celsum.com

The Innovation Centre, De Montfort University, 49 Oxford St, Leicester LE1 5XY UK

Which rheometer accessory do you need today?

Speed up formulation development and process optimization by benefiting from the Thermo Scientific HAAKE MARS rheometer with the broadest accessory portfolio available!

- RheoScope module to combine rheology with microscopy
- Peltier temperature control unit to predict storage and temperature stability
- Universal clamp for measurements in original sample container (such as crème pots or mascara container, etc.)
- Wide variety of measuring geometries

Which rheometer accessory do you need today?

Call us at +49 721 4094 444 for more.



Thermo Scientific HAAKE MARS rheometer

Thermo Fisher Scientific · Dieselstr. 4 · 76227 Karlsruhe
www.thermo.com/mars · info.mc.de@thermofisher.com