
THE BRITISH SOCIETY OF RHEOLOGY



BSR BULLETIN
2005, Vol. 47, No. 2

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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, *et cetera* but electronically is preferred (saves typing...). Most packages supported (Word, TeX, LaTeX, WordPerfect, ASCII, RTF) but always provide a contact name, address, eMail, or telephone number in case of problems.

The next copy date will be in October 2005 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 cover illustration shows sound waves in a magneto-rheological slurry.

We are continually looking for colour or black & white pictures (preferably of a rheological nature!) for the front cover of the Bulletin and Rheology Abstracts. Please contact Bogdan Dobraszczyk (Bulletin Editor) or Nick Hudson (Abstracts Editor & Publications Manager). Suggestions are always welcome!

BSR NEWS

British Society of Rheology

**Annual General Meeting, Tuesday March 22nd, 2005
Lake Vyrnwy Hotel, Wales**

Report by the President, Professor Geoffrey Maitland

Ladies and Gentlemen, the past year - or rather 15 months since the last AGM - has been another busy period for your Council. The focus in 2003 was to improve the service to the membership through investment in an extensive upgrade of the Society's website, the introduction of on-line membership and subscription facilities, electronic access to our publications and regular e-mail updates on forthcoming events and rheology news. We hope that these changes are now having a beneficial impact on the membership and welcome feedback and suggestions for continued improvement.

Over the past year we have been turning our attention to how we can sustain these initiatives and improve the Society's role in the encouragement of Rheology through presentation and debate of topical issues. With the advent of annual European Society of Rheology meetings, alongside the four-yearly International Congress, the national societies need to adapt their role in the conference arena and focus on areas and formats not necessarily covered by these large meetings. The BSR sees its role to encourage grass-roots rheology in the UK, especially amongst young scientists, to promote interactions across the academic-industry interface and to provide a forum for focused debate of emerging topics in rheology. We are firming up on a pattern of meetings built around an annual Winter Meeting in December, centred on one or two major themes, alongside close links to this regular Spring Meeting of our colleagues at the University of Wales Institute for Non-Newtonian Fluid Mechanics, with a few one-day meetings interspersed between these two regular conferences. In the spirit of consulting closely with our membership, Council has decided to seek suggestions from for the theme and venue for our 2005 December meeting, so please let us have your views.

On the international front, there was a good contingent from the UK at the 14th International Congress in Seoul in August, where the excellent organisation and hospitality of our Korean hosts, for both the technical sessions and social events, resulted in a splendid conference. I hope that the BSR can succeed in its aim to act as a bridge between the exciting international scene and the wealth of ideas

and needs circulating within the UK rheology community. To this end your Council has submitted a bid for the 2007 Annual European Rheology Conference to be held in Cardiff during May of that year. We are grateful to David Binding, Tim Phillips and Nick Hudson for the work they have put in so far in preparing this bid. We face stiff competition from the Italian Society and will know whether we have been successful when the European Society of Rheology Committee meets at the 2005 conference in Grenoble next month. At that meeting, our Membership Secretary Professor Mike Webster has been nominated as Treasurer of the ESR for the period 2005-9; assuming this goes through, it will be good to have this continuing direct link with the Executive Council.

On the business front, our priority has been to ensure the financial sustainability of some of the initiatives put in place over the last few years. The re-designed website is proving key to our membership, on-line publication and communication targets but requires continual attention to retain its impact. This has a maintenance cost associated with it and our aim, as in the past with our paper publications, is to ensure that we cover these costs through subscription and advertising revenue. So we have been working to produce a viable business plan for this. The second volume of Rheology Reviews was published in 2004, containing seven substantial reviews by international experts. This, like the first volume, has been well received and we are very grateful to Ken Walters and David Binding for all their efforts in successfully launching this flagship project. It takes time for a new scientific publication to establish itself and Council has willingly subsidised the initial volumes to make it as widely available as possible at an attractive cost. However, in the medium term Rheology Reviews must at least cover its own costs and so another target of Council this year has been to put in place a plan for achieving a break-even situation by 2006.

The Society has been active in the last 15 months in recognising excellence and achievement in our subject with the award of two Gold Medals, our highest award, alongside the 2003 and 2004 Annual Awards, the Vernon Harrison PhD Prize and distinguished service award. Our Secretary will be reporting on these in more detail shortly. It has been good to have our 2000 Gold Medallist, Professor Roger Tanner, who received his award at the time of the International Congress in Cambridge, return to that city last week to deliver a keynote lecture on 'Rheology and Crystallisation' at a Society micro-symposium on this topic.

To encourage academic-industry links, the Society has agreed to take over the coordination of the highly successful Non-Newtonian Club, run as an informal rheology discussion group for many years by Dr Steve Beckett of Nestle plc. We intend to maintain the low-cost, informal, one-day format of these meetings and hope to make them available to a wider audience of applied rheologists.

They provide an excellent forum for presenting work in progress, raising key needs and concerns, and discussing unresolved practical and modelling issues that may be inhibited at more formal conferences. We have held two successful Non-Newtonian Club meetings under the BSR badge so far – in Reading last September, organised by Bogdan Dobraszczyk, and in Chipping Campden last week, organised by Gary Tucker – and look to the membership to support Council in its efforts to find a steady stream of people willing to organise one of these one-day events.

On the people front, it is sad to record the death in August 2004 of one of our past Presidents, Dr Mervyn Jones, who served the Society well over many years including a period as custodian of the Scott Blair Collection in Aberystwyth. At this AGM, Rhodri Williams is stepping down as Treasurer after over 4 years in this onerous position. I would like to thank him for all he has done to control the Society's finances and help with stabilising our subscription situation. Gordon Brown cannot claim sole rights on financial prudence – Rhodri has done a sterling job in alerting Council to the financial realities within which our sometimes ambitious plans must operate. Gary Tucker, our Abstracts Editor, is another Officer standing down at this meeting. We owe him a debt of gratitude for the calm and efficient way in which he has sustained the quality and effectiveness of this much-valued publication over the last n years. Fortunately both Rhodri and Gary have agreed to be nominated to continue on Council, so hopefully we will continue to benefit from their experience in that capacity for some time to come. Bill Frith has come to the end of his period on Council and so is not eligible for re-election this time; so many thanks to Bill for his informed input and contributions over the past four years.

Finally, I would like to thank all the Officers and Council members for their dedication to the Society's cause, hard work and support over the past year. I have much enjoyed working with you all during my term of office and wish you well as you continue in your stewardship of the Society's fortunes. That, Ladies and Gentlemen, concludes my report on the past 15 months activities.

Geoffrey Maitland
22nd March 2005

Report on Conference on Extensional Flow

**Institute of Non-Newtonian Fluid Mechanics
Lake Vyrnwy Hotel, Wales**

March 21st-23rd 2005.

The topic of this year's annual conference of the University of Wales, Institute of Non-Newtonian Fluid Mechanics was Extensional flows. Experts in the field came from all over the world to Lake Vyrnwy, which was chosen to host this year's conference. The conference took place between the twenty first of March and the twenty third of March. By the end of Justin Cooper-White's talk there would have been twenty eight different speakers and a poster session since the end of lunch on the first afternoon. Together with this there would be an AGM for the British Society of Rheology and two fantastic three course Dinners, as well as lunch every day. It was to be an action packed 50 hours for the masses.

To start the conference was Chris Petrie, who was to be a fine choice, as Chris gave the delegates the knowledge on what had gone on previously in the world of rheology. When Chris Petrie started his talk, and indeed the conference, he was to, unknowingly to himself start a trend, which everyone bar none followed. He started by thanking the organisers. This is something that we all must do. Ken Walters and Gareth Roberts did a sterling job in arranging such a fine conference. We would also like to thank TA instruments and Thermo Haake for their kind sponsorship of the event.

As the first talk grew to a close, it was made apparent that the conference would not take the usual format, with conference being less of a conference and more of a workshop. This was to prove to be a great help to people's understanding of the topic. The following three talks were given by Martin Laun, his fellow country man Manfred Wagner and Paula Moldenaers. Martin's talk was a personal view on past work.

The afternoon session started with Don Baird's speech, which brought a smile to some in the crowd, as he had forgotten that he had left notes on his slide show for himself. I must note that this was not anything to be embarrassed about, as the notes were concerning zero shear and strain rate. To follow Don, was to be J. Maia, who gave an interesting talk on extensional rheology of natural and synthetic composites. When he discussed dough, and especially biscuit dough, this was to wet the appetite of the now hungry delegates. The delegates were soon to be put off their food, as one of the biscuits being considered was pea

flavoured and the flavour of the biscuits which would be available for them at the tea breaks was starting to become a real worry!!

To finish the proceedings on the first day, it was to be the new Mr President of the British Society of Rheology, Malcolm Mackley and University of Wales' own Dave Binding. Malcolm started by getting the delegates sympathy votes, showing how many hits he had received for his online journals. He was quite proud of the fact that he had received one hit, but was soon to realise, that the person that had searched his journal was in fact himself. He then explained about localised birefringence strands and problems his Group was having with some computer simulations. The same data was giving one thing on a Monday, and a completely different thing on a Friday. The nodding heads in agreement with Malcolm showed he was not the only one to suffer with this problem. Dave Binding was then kept the delegates awake, as the tiredness set in, and the stomachs began to grumble. The graphs about the pressure drop for contraction and expansion kept delegates interested, and the job was done, as everyone looked forward to the mouth-watering prospect of the dinner. The dinner was to prove an extension of the workshop, as many discussed the day's happenings, in between a beautiful meal, and free wine.

For many people life came back to earth with a bump on the second morning, with not much sleep, and slightly too much wine, the water on offer was much appreciated by many. But, there wasn't much time to mull over the previous nights enjoyments, with three of the biggest names giving talks.

The morning of the second day, was to be dedicated to filament stretching, with Tam Sridhar starting the day, and again setting the tone. Following Tam's speech, the floor was given to Gareth McKinley. In many of the talks given over the period of the three days, it was very evident that Gareth was being thanked for his collaboration with other individuals at Lake Vyrnwy, and given his many intelligent questions, he was to be one of the stars of the conference. Gareth had split his talk up into two parts, and was now talking on "Extension Flows of Low Viscosity Elastic Fluids: Interplay of Viscosity, Inertia and Elasticity" and "Extensional Flow of Viscoelastic Solution through micro-fabricated contractions: Planar and Hyperbolic Configurations". We were here told in the first section that it was best to consider extensional viscosity as a transient material function and subsequently the properties of Low-Viscosity Elastic Fluids.

The afternoon session started with Jeff Odell on "Extensional flow oscillatory rheometry". Jeff was to discuss with us the extension of polymer solutions. As in many other talks, the speaker referred to work carried out by others in the room, to further enforce the feeling of being with the best in the field of extensional

flows. Jae Chun Huyn was to follow, and took no time at all tackling his slides, of which there were many. Following him, was Adrien Leygue, acquitted himself well, and showed that he has a very bright future in the field.

Now, with the Tea break getting ever nearer, there was one speaker left. This was to be Mats Stading, and unfortunately for the delegates, he was to concentrate on food and drink. So, the stomach's grumbled more as Mats discussed the properties of yogurts and considered the importance of shear flow in liquids such as Newtonian liquids.

After the coffee and tea break, it was Russell Davies followed by Rhodri Williams. The University of Wales' own Rhodri Williams presented a lecture entitled "Structural studies of stretched liquids". Rhodri, one of the only Welsh speakers at the talk, explained that liquids could be stretched significantly under tension while simultaneously being subjected to substantial supercooling. The audience's attention showed no sign at all of wavering concentration levels as the day neared its close. Following on from Rhodri wasn't going to be easy.

Ralph Oliver was the only speaker in the conference not to give his talk via a computer, and stuck to the good old overhead projector. Although there were difficulties with the overhead projector, Ken Walters announced that it was the best talk he had heard Ralph give! The British Society of Rheology then had its Annual General Meeting. It was now time to look forward to the Conference dinner. The great food and the wine was enjoyed, with the wine being sponsored by TA Instruments. The after dinner speaker must also be commended for his remark about the Wales Grand Slam winning team, the only disappointment was that it was not mentioned again!

The final day was started with a legend in the field, Roger Tanner giving the first talk on "Recoil from Elongation". He admitted to the delegates that he had lowered himself in a moment of madness to become a rheologist, but wasn't going to lower himself any further to the level of a chemical engineer! The talk was hot off the press, so much so that the title wasn't in the brochure. Following Roger Tanner, was Bernard Costello from the sponsors of the conference, TA Instruments. His talk was on "Melt elongation viscosity of polymers using an extensional fixture for rotational rheometer". To finish the morning's first session was C. Clasen along with Maneula Duxenneuner, with the latter adopting a different approach, giving a poster presentation.



Group photo of delegates at Lake Vyrnwy Hotel Conference on Extensional Flow (Courtesy Peter Bollada, Institute of Mathematical and Physical Sciences, University of Wales Aberystwyth)

With the conference drawing to a close, it was time to consider foams. Firstly, was a new member to the University of Wales', Simon Cox. Simon seemed to have picked a difficult slot, with his talk on "Bubble-scale simulations of foam rheology" being blighted by the hotel's fire alarms and fighter planes which were flying overhead. Simon coped with all this admirably to give a fine presentation, with many good illustrative videos. Simon was followed by Bogdan Dobrasczyk, who gave a talk on the rheology of bubble expansion in baking, and the morning session was brought to a close by Linda Smolka, whose detailed talk made sure that the delegates appreciated their final lunch. To straddle the final lunch, there was to be a BSR Gold Medal address, and a BSR Annual Award Address. The former was given to an old friend of the institute, Jan Mewis, who gave his speech on "(In)elastic time effects in thixotropic materials". The final talk was given by Justin Cooper-White on "'Simple fluids in 'simple' flows: contraction flows, drop formation, deformation and impact on solid surfaces". This was a fitting end to a fine conference, and our congratulations go to both Justin and Jan.

G.D.E.Lanagan
University of Wales Institute of Non-Newtonian Fluid Mechanics

Gold Medal Citation 2004

Professor Jan Mewis

Professor Jan Mewis has been awarded the BSR Gold Medal for his outstanding research in a number of areas in rheology, including his contributions to the fields of suspensions and polymers. A particular feature of Jan's work has been his coupling of rheology with microstructure, and he was one of the pioneers in this difficult and challenging area. He has also, wherever possible, matched carefully executed experimental work with mathematical modelling.

Jan started his lifelong affair with rheology whilst working for industry and he was one of the first to correlate printing press performance with the fundamental rheological parameters of printing inks. Subsequently he has worked very effectively within the academic community both in Belgium, and world-wide. In this citation his work is divided into two sections.

Suspension Rheology

Jan carried out early work with Art Metzner on the extensional viscosity of semi-dilute fibre suspensions and validated Batchelor's theory on the subject. Subsequently he has linked the linear viscoelastic behaviour of suspensions with their interparticle potential and the work in this area is now used, for example, in the formulation of commercial coatings. Jan also explored areas where others might not dare to tread – namely the time dependent behaviour of flocculated colloid suspensions. Here, working with Helsen he pioneered the use of mechanical and dielectric spectroscopy in flowing systems.

He seamlessly moved from suspension rheology and microstructure to his other "love" – namely **Polymer Rheology**. Here he started with simple polymer fluids and then went on to more advanced systems. He made early and pioneering measurements on the effect of flow history on the transient extensional viscosity of polymer fluids. The major part of his polymer work, however, involved more complex systems, namely liquid crystalline polymers and biphasic blends.

Jan and his team generated pioneering transient rheological measurements on LCP systems and discovered powerful scaling laws for their behaviour. Working with other groups, in particular the Naples team, they were able to link rheological behaviour with the LCP domain microstructure. Finally, on the scientific front, Jan has made a significant contribution to the understanding of biphasic polymer blends and here again he used rheology

and rheo-optics to enhance that understanding. He verified the Choi-Schowalter theory for this type of system for the first time and also demonstrated that a scaling law proposed by Doi and Ohta was valid. In this area Jan has worked very successfully with Paula Moldenaers and it is generally accepted that together they have built up one of the world's leading centres of expertise in the field.

On a personal note, Jan and his wife Ria are well known and liked within the academic world at Leuven and also within the rheology community as a whole. Jan is universally known as a kind, warm and charming person. He has been supervisor to 24 PhD students and it is fair to say that he has dedicated much of his life to rheology.

The BSR is proud of both Jan as a person and of what he has achieved throughout his career. It therefore gives us great pleasure to award Professor Jan Mewis the BSR Gold Medal.



Professor Jan Mewis receiving the BSR Gold Medal award from Malcolm Mackley

BSR Annual Award Citation 2004

Justin Cooper-White

Justin Cooper-White has been identified by the BSR as a young rheologist who in a very short time has made a significant impact in the field of rheology. He has acquired a diverse range of research interests and is already worthy of the BSR annual award.

Justin graduated from the University of Queensland in 1991 as a Chemical Engineer and initially spent time working as a process engineer within Shell (Australia). Clearly needing a “greater” challenge, he subsequently did a PhD under the supervision of Professor Michael Mackay. His PhD topic was on the rheology and thermodynamics of polylactide polymers and this subject has formed a platform for some of his current work.

Justin moved from the University of Queensland to the University of Melbourne where he worked with Professor David Boger. This was a life changing experience; and during this time David clearly got the best from Justin, and Justin got the best from David. The relationship blossomed, and Justin’s diverse interest in all things rheological blossomed too. Justin currently has many rheological activities that include: Tissue engineering – where his knowledge of rheology has enabled him to construct porous polymeric scaffolds; Droplet dynamics and impact; Microfluidics.

Justin has already published widely in many different journals. He has also contributed on different rheological and academic organising committees and he is now established as an Associate Professor at the University of Queensland where his future looks both exciting and assured. The BSR acknowledges young rheological excellence and it gives us great pleasure to celebrate, with the BSR annual award, Justin’s past achievements and anticipated future success.



Justin Cooper-White receiving the BSR Annual Award

Encounters with Angels

Some Account of the Conference on Extensional Flows organised by The University of Wales Institute of Non-Newtonian Fluid Mechanics at Lake Vyrnwy, 21st – 23rd March 2005

When I suggested that I should venture into Wales to attend the Conference on Extensional Flows, Holmes assented with some alacrity.

“I suppose, Watson, that you are intending finally to close ‘The Case of the Missing Industrialists’. Regrettably, I shall be unable to accompany you. . . . Matters of national importance . . . my lips are sealed.”

As always, Holmes was correct. I had recalled that our interest in ‘The Case of the Missing Industrialists’ had been triggered by the failure of a meeting of the British Society of Rheology on this exact subject¹. Subsequently, we had followed the trail through Brussels², Aberystwyth³ and Cambridge⁴ without ever being able satisfactorily to unravel the mystery. The matters of national importance that detained him were his proposals for the cricket team to be charged with regaining the Ashes this Summer. (*Ed. some chance!*)

On my return, Holmes had the crumpets and tea all ready waiting. Whilst Holmes poured, I was able to assure him of the excellence of the gathering of 57 delegates representative of the key workers in this field from four continents. Before I could start my second crumpet, he enquired anxiously: “Of the genus *Rheologicus Industrialis*, I presume that you made no sightings.”

“There,” I announced, wiping the crumbs from my waistcoat, “I can set your mind at rest. Although they represented a small minority, there were several present at this meeting. The species is far from extinct. Indeed, one of the industrial delegates erupted volcanically. A speaker had suggested that an industrial attempt to exploit elongational flow behaviour in the production of non-misting aviation fuel had ended in spectacular failure. He had asserted that a remotely flown jet loaded with the modified fuel had burst into flames when it was deliberately crashed. Apparently, the trial had actually been successful. The fuel had **not** ignited spontaneously in a fireball when the plane crashed. However, fifteen minutes after the plane had crashed – as the gentlemen of the press were despondently packing up to go home – an electrical fault had caused a fire. This fire then spread to the spilled fuel on the runway leading to an inferno. Normally, in any airport crash of this kind, fire crews would have been on hand to control such secondary events and the critical fifteen minutes would have given time for successful evacuation anyway. However, fifteen minutes of nothing happening does not make good television; somewhere between the trial and the transmission those fifteen minutes were edited out.”

“Ah, the gentlemen of the press,” mused Holmes, sipping quietly at his third cup of piping hot Oolong tea. “How they love disasters!”

“An industrialist also presented one of the most detailed experimental papers,” I continued. “Amongst other subjects, Laun spoke movingly about brittle rupture in polymer melts at a tensile stress of about 1 MPa independent of how that stress was attained. Such rupture would seem to be an absolutely fundamental consideration.”

“I recall, Watson, that this was also one of the key observations that you made after Cambridge⁴. I suppose that there is still no sign of any academic group working on the fracture mechanics of liquids.”

“There is actually some fascinating work at Swansea. Williams demonstrated some extraordinary morphological phenomena associated with cavitation in defect-free supercooled water. Indeed, water appears to be a far more complex fluid than polymer melts and solutions; perhaps the academic community should study something easier initially.”

Holmes pondered for some time. He then asked to hear about the balance between theory and practice.

“As ever Holmes, theory is far more advanced than experimental observation. Wagner, for instance, gave a sparkling description of his work on transient extensional flows for monodisperse polymers. The extensional viscosity function especially is most extraordinarily complex; indeed Petrie, having suggested that elongational viscosity is all very well in theory, strongly cautioned against any attempt practically to use such concepts. Everyone agrees that, at rest, extensional viscosity is three times the shear viscosity. Shridhar, however, showed that, with increasing deformation rate, this function first rose by about 4%, then fell by an order of magnitude, before rising very strongly by about two orders of magnitude as molecular orientation dominated the flow.”

“This intermediate drop in viscosity is unfamiliar to me,” interjected Holmes. “The fact that it takes place before there is significant orientation also seems most perplexing. Is there any experimental evidence to support this theory?”

“Therein lies the problem,” I conceded. “The experimental evidence shows very much less tension thinning in the intermediate region than the theory suggests. Shridhar suggests that this is because of the experimental difficulty of conducting accurate measurements in a region where the deformation is inherently unstable.”

What may have been the ghost of a smile brightened the visage of my friend when he heard this. He asked what new topics theoreticians were addressing.

“In his continuing investigation of the relative merits of ‘Network’ and ‘Reptation’ theories, Tanner is turning his attention to the prediction of recoil after extension. He notes the need for ‘multiple constants’ and ‘disposable parameters’ in order accurately to fit the data.”

“This attention to the elastic response, is much to be welcomed Watson. I believe that you have shown me quite extensive data for a whole range of

polymer melts indicating that, over the whole range of stress, the extensional modulus is three times the shear modulus. In addition, I seem to recall that each mode of deformation tends to a limiting elastic strain – of about 2 units in extension and 6 in shear; elementary really when geometry is taken into consideration. Since in some measure, the elastic response describes molecular orientation which in turn controls viscous flow, one might have thought that constitutive modelling should start there.”

“Indeed you are right Holmes. Many delegates spoke eloquently about the rubber-like nature of the materials at high stresses. However, to my knowledge, none of the available theories has been tested against those results. Perhaps we can hope that the work of Tanner will inspire others into this field.”

“So, Watson, how would you judge the balance between theory and experimentation at this time?”

“In his Gold Medal address, Mewis did that for me. He pointed out that, for thixotropic systems, there are some eighty theoretical models and only two or three – being generous – sets of useful data to which to fit them. His audience appeared to agree that this was true of the whole field of interest to this conference.”

“I am interested in what you say of thixotropic systems, Watson. You will record that at Brussels², we saw the nascent stages of the new science – morphorheology. Was there any evidence of this at Vyrnwy?”

“Indeed there was Holmes. As well as Mewis, several authors addressed morphologically complex systems such as bread dough (Dobraszczyk), polymer blends (Moldenaers), blends with fibrous materials (Maia), and the thirty plus phases of crystallisation in water (Williams). Although it is clear that the structure depends on the rheological history which in turn depends on the structure, the term morphorheology has not entered the lexicon.”

“Well, Watson, we must be satisfied that these issues are now receiving due attention. Let us move finally to the area that you clearly found most exciting. I refer to experimental technique.”

“Firstly there were excellent reviews by Petrie, Laun, Mackley, Baird and Binding of what one might describe as ‘traditional’ measuring techniques.

“Beyond those traditional methods, there were several exciting developments driven by new technology. High-speed photography and micro-scale engineering are giving scientists the ability to test tiny samples of material in quite extraordinary complex modes.

“In the area of free-surface flows, there were extensive studies – for example by McKinley, James, Hassager, Sridhar – of filament stretching rheometry. The diameter of a drawn thread is monitored by laser scanning; then, by feedback to the control motors, rate or stress can be varied at will. Very low viscosity liquids can be studied and anomalies in the thread line – such as droplet or bead formation can readily be monitored by photography at 1000 frames per

second. James, for example, in his study of the break up of rapidly stretched filaments demonstrated that the whole of the action takes place within 20 milliseconds.

“In the field of constrained flows, the progress is in some ways even more startling. For example, Odell at Bristol has miniaturised a cross-slot rheometer driven by piezo-micropumps to develop oscillatory extensional flow with full optical visualisation of the flow.

“Going down in scale, McKinley showed us contraction flows at the 10 micron scale in a approach that he described as lab-on-a-chip. He was also able to tag and trace individual molecules.”

I paused to gather my breath and secure the last crumpet before continuing. “At an even smaller scale, Muller showed us individual – yes individual – DNA molecules lapping round micron sized pillars, stretching from their initial random coil configuration and then relaxing once the stress was removed. She showed us how, even though subject to the same flow field, individual molecules responded differently. This concept of molecular individualism had also been described by McKinley. One of her most interesting observations was that, although there was some ‘elastic’ recovery after the flow stopped, the molecule did not regain its random coil configuration. To achieve that, it depended on Brownian motion in the solvent rather than the elasticity of the molecule itself. This beautiful observation quite took my breath away.”

“Watson. Your face is as radiant as though you had seen an angel!” exclaimed Holmes. It seems that all is well in the world of extensional rheology and that the subject is now poised for its final simplification.”

“Simplification?” I queried. “What can you mean Holmes?”

“Surely Watson it is obvious. You have seen the evidence with your own eyes that, even in the same flow field, different molecules behave differently. You have also plaintively recorded the cry of industrial rheologists that rupture is an important element of the behaviour of liquids. Is it not clear that rupture is no more than a state when disentanglement between molecules spreads spontaneously through the bulk.”

“Great Fano siphons!” I exclaimed.

“Yes Watson. The principal of molecular individualism, so clearly demonstrated at this meeting, further tells us that such events are happening randomly throughout the material at very much lower states of stress. However, because those events are localised, they are easily healed without leading to rupture. When you add these two elements to what has long been established about the elasticity of rubber-like solids and the essential geometric difference between shear and extensional flows, a satisfying physical picture presents itself.”

“You mean Holmes . . .” But I was not quite sure what he meant. When I confessed that I had not followed his arguments, Holmes leaned forwards. His bony fingers prised the last crumpet from my grasp.

“Really Watson, you must pay attention the next time an angel speaks to you.”

References

- 1 ‘Elongational Flow and the case of the Missing Industrialists’ Bulletin of the British Society of Rheology **34**, 2, 47-50 (1991)
- 2 ‘The Case of the Missing Industrialists, Part 2: The Waterloo Syndrome’ Bulletin of the British Society of Rheology **35**, 3, 80-83 (1992)
- 3 ‘The Case of the Missing Industrialists, Part 3: Parkinson’s Law’ Bulletin of the British Society of Rheology **38**, 3, 88-96 (1995)
- 4 ‘Breaking Point’ Bulletin of the British Society of Rheology **43**, 3, 85-91 (2000)

BSR Microsymposium

Polymer Crystallisation and Rheology

Department of Chemical Engineering University of Cambridge

A microsymposium on rheology and polymer crystallisation was held on the 18th March 2005 at Cambridge. There were three speakers and a group of about twenty people enjoyed a short, but intensive overview of the current state of art relating to the way flow can influence crystallisation and how flow induced crystallisation can modify rheology.

Professor Roger Tanner (University of Sydney) opened the proceedings with a well crafted talk and set the tone of his message by referring to a current model as “the more you think about it the less you like it”! He then constructed his own model based on a phenomenological fit to data from Wassner et. al (Int. Cong. Rheology 2000) relating the effect of strain on the nucleation and growth of spherulites. He then coupled this with to a viscosity enhancement model for growing spherical crystals. Professor Gerrit Peters (Eindhoven University) reviewed the recent work that has been carried out at Eindhoven and this included numerical simulation of spherulite and fibrous crystal growth both with shear and also in non isothermal conditions. Finally, Gaby Hernandez (Chemical Engineering, Cambridge) reported on her PhD work concerned with visualising the way in which flow can induce fibrous crystallisation near the wall of a slit die and how the presence of the fibres can increase processing pressure. The microsymposium was informal and informative. It is clear from what was said that there is still work to be done in this challenging area, particularly in linking molecular, meso and macro length scale effects.

Malcolm Mackley, April 2005

The Vernon Harrison Annual Doctoral Prize – Call For Entries

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.



2004 Vernon Harrison PhD Prize being awarded to Dr Sally Everitt

Entries are now invited for the 2005 award. The prize will be £500, an illuminated certificate and a copy of Rheology Reviews 2005. Any person who plans to submit and successfully defend a thesis in any area of rheology at a higher education institution in the United Kingdom between 1 September 2004 and 31st August 2005 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 2004-5 Award should be sent **by September 30th 2005** to the BSR Secretary:

Professor Tim Phillips
School of Mathematics
Cardiff University
Senghennydd Road
Cardiff CF24 4AG, UK

Tel: +44 2920 874194
Fax: +44 2920 874199
email: *PhillipsTN@cardiff.ac.uk*

**AERC 2005 : 2nd Annual European Rheology Conference
April 21-23, 2005, Grenoble. France.**

Over 400 delegates attended the 2nd Annual European Rheology Conference at Grenoble and this helped make a memorable and in many ways remarkable meeting. It is clear that within a very short period of time the ESR has established the Annual meeting as a high quality event that is attracting high quality rheology within Europe. The UK was well represented, however it was the presence of a very strong French contingent that swelled the numbers. In particular there was a welcome influx of new faces, new ideas and new materials being discussed. At the start of the meeting Prof Roland Keunings was awarded the prestigious Weissenberg medal and he then gave an a lecture on his work in relation to the numerical simulation of polymer dynamics.

The meeting was superbly organised by a French team including Jean-Michel Piau and Nadia El Kissi. The weather, ambience and excellent food all helped this meeting work extremely well. Rheologists should already be putting the dates 27-29th April 2006 into their diary for the next Annual Congress. The venue is Crete!

The BSR made a bid to hold the 2007 Annual Conference in Cardiff, however sadly Naples won a closely fought contest. 2008 will be the International Congress in Monterey USA and so we can only hope Cardiff will be chosen in 2009.

**6th International Symposium on Applied Rheology
Korea University, Seoul.**

Prof Malcolm Mackley accompanied by his wife Margaret attended the 6th International Symposium of Applied Rheology at Korea University in Seoul on May 19th 2005. The symposium was masterminded by Prof Jae Chun Hyun and eight speakers were invited to talk about their recent work. Prof Antony Beris (Delaware USA) gave an account of his recent simulation studies where he introduced viscoelastic flow to turbulent flow within a channel in order to predict the “Thoms Effect” for drag reduction. Prof Pino Marrucci (Naples USA) gave a lecture on molecular modelling for polymer melts where he carefully reviewed the development of ideas following the pioneering work of Doi and Edwards. The BSR President, Malcolm Mackley gave a lecture on the “High shear rate rheology of microstructured fluids” and gave examples relating to aqueous suspensions in printing ink resins, ice cream and carbon nano tube suspensions. Prof. Kiyohito Koyama (Yamagata ,Japan) talked about the

extensional behaviour of polymer melts and Prof Yoshiaki Takahashi (Kyushu, Japan) spoke about coalescence of polymer blends. There were also excellent Korean presentations that covered topics such as nano composites, blood flow and macro economics! The Korean economy as a whole is vibrant, as too is the Applied Rheology community. Companies such as LG and Samsung are investing heavily in both Universities and Technology and one can only hope that European based International Companies can match this challenge.

Malcolm Mackley

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.

FRACTURE

John F.Hutton

Proposition.

There is a limit to the amount of elastic strain a material can withstand. On the other hand there is no limit to the amount of viscous strain.

Micro-structural view,

An elastic material is held together by strong inter-particle, (inter-molecular, inter-atomic) forces. If the applied stress is sufficiently high to break one of these bonds, a similar bond may form elsewhere in the material to restore the status quo, and any permanent strain would be undetected by current instruments, and the material would appear to be elastically (hence reversibly) deformed.

A higher stress would break a number of bonds and, in consequence the remaining bonds would suffer even higher stress. Two possibilities then arise: there would be a significant redistribution of the particles, during which process new bonds would form, and the specimen would be recognised as having a permanent strain (or set); or, in a more brittle material, there would be an avalanche of bond-breaking and the specimen would separate into one or more pieces before new bonds could form. It would be fractured. So we see that time, as well as stress (or strain) may come into it.

Phenomenological (macro) view.

A small stress applied for a short time to certain materials (we call them solids) will result in a strain which (as far as can be measured), is 100% recoverable. The same stress applied for a long time or, a larger stress applied for a short time, results in a strain which is not 100% recoverable. As the stress is increased further, there arises a situation where a crack opens and eventually breakage occurs --- such a stress cannot be applied for a long time.

There are cases observed in practice which are special cases (or variants) of this general scheme. For example, metal fatigue in which, after many cycles of loading and unloading, at a stress level which is apparently in the elastic region, a specimen breaks. Actually, each cycle causes a subtle change in microstructure of the metal but the change is irreversible. After millions of cycles the metal is quite different from the original and unable to sustain the final cycle of loading.

Viscosity and Plasticity.

A rheologist interested in viscoelasticity would perhaps recognise the permanent deformation effect as a manifestation of viscosity. On the other hand an engineer or metal-physicist would call it plasticity. Whether or not these phenomena are the same is a moot point. Viscosity is a property of a continuum, hence strictly

there can be no reference to structural detail. As a result of this, viscosity can be measured only in a viscometric flow. There are, no doubt, plasticity numbers representing scales of permanent deformation (e.g. penetration number for greases). Although they are carefully specified they are ill-defined and are certainly not invariant properties. Yet on the basis of the above micro-structural model, the origins of plasticity (which, by definition, is a property of solids) are localised and hence not treatable by a continuum model. What the micro-structural model says, in effect, is that the material bonds are not equally loaded (particularly in real materials) and their breakdown, followed by permanent deformation, is localised. If you then say that you can imagine materials in which the bonds are equally loaded then they will all fail together and fracture will be explosive.

Specifying a fracture limit.

Bearing in mind the above arguments it is easy to specify a limit beyond which fracture will occur, but difficult to measure it. Fracture is not flow; it is the (rapid) disruption of the structure to form new surface. In other words it is a limit to the elastic component of stress or strain. It follows that if a substantial component of the applied stress is causing plastic (or viscous) deformation, a substantial correction is needed to the applied stress in order to determine the component that reaches the elastic limit.

(This lack of discrimination between elastic and plastic stress led to the odd conclusion drawn from Griffith's basic studies of fracture (1). Fracture energy theory relates the fracture stress to a surface energy, or tension, of the specimen. Griffith derived enormously high surface energies for the metals he studied because so much of the applied stress was causing plastic flow, and only a small fraction corresponded to elastic disruption. In an analogous way, my own work (2) led to more realistic surface energies because, since the specimens were relatively mobile liquids, there was a much smaller fraction of the applied stress used in viscous flow. Anyway, only the stress of elastic origin (the normal stress) was used in the calculation).

Observations and suggestions.

As far as I am aware Marcus Reiner first discussed fracture in viscoelastic liquids. (I think this was mentioned in his book entitled "Ten Lectures on Rheology"). This was from a purely theoretical point of view, in the discussion of Maxwell and Kelvin models. Clearly, in his mind, fracture was something associated with elasticity, whether in solids or liquids.

The next significant step was made by John Tordella of du Pont (3), who carried out experiments on the flow of molten polymer through short capillaries as part of a study of extrusion. At slow flow rates the extrudate was a smooth rod, but as the rate increased the rod distorted, first as a waviness but ultimately as slugs of highly distorted polymer. The gross distortion was accompanied by a noise as of

something tearing or fracturing, so he called it fracture. It is now called melt fracture.

Shortly after Tordella's work I did my experiments with silicones. It seemed to me that flow in a cone-and-plate rheometer could also lead to fracture. The observed formation of new surface was certainly not a consequence of secondary flow or of high viscosity. My analysis in terms of the energetics (following Griffith) did not please everybody. Some talked about "action at a distance" as a damning criticism. It would probably have pleased such critics when Roger Tanner (4) found that the second normal stress correlated with fracture behaviour better than the first. (Actually, it occurred to me when first trying to explain my results that the second normal stress seemed to be more likely to open up the liquid sample, but I had no means of measuring it; the shear stress certainly would not come into it (except perhaps the elastic part of it?)). My present reaction would be to ask whether or not the critical second normal stress at the onset of fracture is related to any other physical property (such as surface energy) of the material.

Whatever the interpretation, I recall John Dealy saying to me that in the (roughly) twenty years that had then elapsed no one had come up with a better explanation of the instability in cone-plate flow. My claim is that I introduced the concept of fracture in these fluid materials in this type of flow, as well as supplying a good approximation to a quantitative measure. The extension made by Tanner implies that he too agrees it is fracture.

I have mentioned in publications that the same effect is observable with greases (5). What I have not mentioned is an observation made some 50 years ago by a colleague who sheared, at about 90°C, a grease based on an aluminium stearate soap in a MacMichael (concentric cylinders) viscometer. The observed torque continually, and slowly, decreased. What we had also noticed was that a gap, centred on the axis of rotation, was forming in the sample roughly midway between the cylinder surfaces. I later came to believe that this was an example of fracture in a concentric cylinder viscometer. The aluminium soap grease was elastic, particularly at 90°C, a temperature near the melting point.

A unique feature of the fracture of a grease in a cone-plate rheometer (5) is that it doesn't heal when the rotation is stopped. I published work in which I tried to measure normal stresses in greases and it was necessary to apply high rotational speeds to get the grease into its "liquid" state to avoid the fracture. Having done that it transpired that the normal stress was quite small --- with one or two exceptions.

What I was unable to do was to get meaningful normal stress measurements at low speeds, before fracture became excessive. I recall observing substantial "negative" normal stress responses which I could not explain. It is interesting to

note that not so long ago I saw reference to negative normal stress. It may have been in BSR literature, but I am not sure.

I know greases are elastic at small deformations. I know that some of them (but not the aluminium stearate grease) have micro-structures of highly elongated ribbon-like crystals of soap. The scale of these ribbons is much, much bigger than that of polymer molecules. Hence, the elasticity is not likely to be the same as the so-called rubber elasticity. For a liquid to fracture in a cone-plate viscometer it must (?) have a measureable high elasticity. But greases fracture, but they have a negative normal stress effect. In addition, I feel that other gel-like soft solids will behave like greases. (I once had a grease made with added polymer so that I could measure a normal stress. Unfortunately I didn't investigate whether it fractured).

I think there is an interesting field of research here, certainly from a "materials" point of view. Whether or not there is a technological prospect I don't know. On the other hand one of the reasons why a grease is a useful lubricant in its special applications is that when impacted at high speed by a ball in a rolling bearing it fractures and gets thrown out of the path of the balls, leaving behind a smidgeon of lubricant to do the necessary job of lubrication. A grease that is churned continually by the moving parts wastes energy and possibly will melt. The grease that is thrown aside slowly feeds back to the balls where it leaves another smidgeon, and so on.

It seems to me that the fracture effect is one of a number of instabilities, and I am aware that a great deal of research has been geared to studying them in polymers in view of the importance of the polymer industry. Perhaps it would be worth studying in a more general context.

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- (3) Tordella, J. P., J. Applied Physics 27, 454, (1956).
- (4) Tanner, R. I. and Keentock, M., J. Rheology 27, 47, (1983).
- (5) Hutton, J. F., "The Rheology of Lubricants", Editor T.Davenport, Applied Science Publishers, p.108, (1973).

Letter to the Editor

Rheology in the next ten years

In the past, UK rheology has been mainly led from Universities and instrument manufacturers. ICI was an exception where forty years ago there was both drive and relevance for in house rheology expertise. Things have changed and are continuing to change. Universities are no longer a haven of academic excellence in subjects such as Rheology; the subject on its own could almost be Theology and no one would notice. Rheology is not alone in this position, Fluid Mechanics, Heat and Mass Transfer, even Physics and Chemistry are all subjects under threat and certainly under appreciated. Unless there is a quick and significant return to "Back to Basics" I personally see little hope in academic growth of fundamental aspects of Rheology from a science discovery point of view.

Hopefully all readers of this article will already appreciate the importance and relevance of rheology to so many aspects of life and it would seem difficult to believe that the subject could fade away and or die. A recent trip to Korea focused my own mind in relation to the way the subject will go. It is an oversimplification, but there are elements of truth in the notion, that Europe is discovery led and Asia is product led. Korea in particular has put an immense effort into flat screen displays and devices and a key element in their fabrication is the rheology of various semi liquid components. The Display manufacturers need rheological



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insight and this feeds back to Universities both in terms of research and graduate recruitment. Providing Europe can maintain a manufacturing base, this could happen here although companies involved may not be the traditional giants, as at present many seem to have lost confidence in scientific research. Projects with risk have now been transferred to Small Manufacturing Enterprises (SME) and start ups and it is here that many will experience genuine technical rheological difficulties. It is here that organisations such as the BSR must hope that they will want to engage with rheological problem solving.

The next decade will not necessarily be an easy one for Rheology and also the BSR, however both the subject and the BSR must adapt to the current conditions and help carry over some of the practical and theoretical common sense that rheologists have built up over the past decades. Newton and Hooke started it all off, we must carry the message forward!

Malcolm Mackley, mrm5@cam.ac.uk

New Fellow of The Royal Society
Professor Anthony Pearson



The Royal Society has recently announced the new Fellows for 2005 and we are delighted to report that Professor Anthony Pearson has been made a Fellow.

Anthony is very well known within the rheology and polymer processing community and he is a past recipient of the BSR Gold medal. He has also obtained many other awards particularly in the USA. Anthony has had a deep lifelong involvement with rheology and industrial processing problems and he is continuing this interest as a consultant to Schlumberger, working mainly at the SCR laboratory in Cambridge. The BSR has done particularly well from members securing an FRS, and this includes members such as Prof Ken Walters, Sir Sam Edwards and Prof John Hinch.

Death of Arthur S Lodge (1922-2005)

Arthur Scott Lodge, aged 82, passed away unexpectedly early Friday morning, June 24, 2005, at his home, in Fitchburg. He was born on Nov. 20, 1922, in Liverpool, England, the son of Wilfred and Jean (Scott) Lodge. He was educated at Merchant Taylors' Grammar School, and earned baccalaureate (1945) and doctoral degrees (1948) from Oxford University in mathematics and physics, respectively. His doctoral dissertation was completed under the guidance of Maurice Pryce, whose father-in-law, Max Born, became an inspiration for much of Arthur Lodge's subsequent work. On July 18, 1945, he married Helen Catherine Bannatyne at All Saints Church, Lindfield, Sussex. In 1949, he took a position at the British Rayon Research Association, before joining the faculty of the University of Manchester Institute of Science and Technology (UMIST) in 1961. From there he emigrated to Madison in 1968, where he taught at the University of Wisconsin for 23 years, as professor of rheology. He was a world-renowned expert in the field of rheology, the study of the flow and deformation of matter. He authored many scholarly papers and three landmark monographs in this field. He invented a device for measuring normal stresses in flowing polymer liquids, which gives unique insight into the remarkable elastic properties of these important materials. His work was recognized by the British Society of Rheology with its Gold Medal in 1983, and by the Society of Rheology (US) through its Bingham Medal in 1971. In 1992, he was elected to the National Academy of Engineering. Outside of the laboratory he had an abiding passion for classical music, and especially chamber music. He was an accomplished pianist, practising diligently and studying regularly with Lydia Seifter. He participated enthusiastically in the performances and activities of Euterpe, a local chamber music group. He was a great devotee of the works of P.G. Wodehouse, and never relinquished his quest to own a copy of every one of this author's books. His sense of humour delighted friends and colleagues, with witty limericks a particular speciality.

He is survived by his wife of almost 60 years, Helen; a sister, Mary Goodwin of Aughton, UK; sons, Keith (Stephanie) of Duluth, Minn., and Timothy (Susanna) of Minneapolis, Minn.; daughter, Alison (Peter) Shambrook, of Durham, UK; and grandchildren, Fiona, Jean, Hannah and Samuel Lodge, Patrick, Teresa and Anthony Shambrook.



As I'm sure you know, the British Society of Rheology has taken on the responsibility of supporting the Non Newtonian Club and it's my task to look after this on behalf of the BSR. I've spoken with Steve Beckett and several people who have attended or spoken at recent NNC meetings to get a feel for the best way to proceed.

Ideally, the meetings would be hosted at industrial, rather than academic, venues and would provide a contrast to the more academically research oriented meetings, of which there are several. A good mix of speakers from industry and academia would be the norm but the meetings would also be suitable for research students working on industrially related projects to present their results.

Dr Kevin Golden has offered to host the next meeting at the University of the West of England, Bristol, and the date has been set for Wednesday 2nd November 2005. The format of the meeting will follow the usual pattern of two talks before lunch, two after. No speakers have been approached yet as I thought it would be better seek volunteers from the current membership. So, if you would like to give a talk at the above meeting, could you let me know in the next 3-4 weeks?

As a newcomer to the NNC scene, I'd very much welcome your views and advice on the best way to take the Club forward. Some time at the next meeting could be set aside to discuss this but please get in touch in the meantime if you wish - especially if you'd like to give a talk.

I look forward to hearing from you.

Dr Phil James
School of Mathematics and Statistics
University of Plymouth
Tel: 01752 232777
phil.james@plymouth.ac.uk

MEMBERSHIP NEWS

Proposed members of the British Society of Rheology for (2005):

Mr Mirdash Bakalli, Laboratory of Corrosion Protection, University of Applied Sciences, Iserlohn, Germany

Dr Ahsanullah Baloch, Department of Basic Sciences, Mehran University of Engineering and Technology, Pakistan

Mr David Matthew Banaszek, Aberystwyth, Wales

Prof Simon Biggs, Institute of Particle Science. & Technology, Leeds University, UK

Dr Justin John Cooper-White, Division of Chemical Engineering, School of Engineering, Univ. of Queensland, Brisbane, Australia

Mr Micheál Cosgrove, Glanbia PLC, Central Laboratory, Dungarvan, Co. Waterford, Ireland

Miss Isabelle Couillet, Schlumberger Cambridge Research, UK

Dr Simon Cox, Institute of Mathematical and Physical Sciences, University of Wales, Aberystwyth, UK

Miss Manuela R. Duxenneuner, Laboratory of Food Process Engineering ETH Center, Zürich - Switzerland

Dr Simon Gibbon, ICI PLC, Redcar, UK

Dr David Geraint Hassell, Department of Chemical Engineering University of Cambridge, UK.

Mr Chris A. Holland, Jesus College, Oxford University, UK

Prof Chongyoun Kim, Dept. Chemical & Biological Engineering, Korea University, Seoul, SOUTH KOREA

Dr Simon Lawson, Industrial Centre of Particle Science & Engineering, Leeds, UK

Mr Sabuj Mallik, University of Greenwich at Medway, Kent, UK

Mr Salvatore Mascia, Department of Chemical Engineering, University of Cambridge, UK

Dr Howell Grant Simpkins, Cardiff, UK

Dr Keith Damon Smith, Departamento de Matematica, Instituto Superior Tecnico, Lisboa, Portugal

Dr Jason R Stokes, Unilever R&D Colworth, UK

Mr Hao Xu, Glacier Vandervell Technology Centre, Rugby, UK

Opening of new UWS-NHS-EPSRC Laboratory for blood clot research

The Engineering and Physical Sciences Research Council (EPSRC) visited the Portfolio Partnership *in Complex Fluids and Complex Flows* at the School of Engineering on 7th July. A highlight of the visit was the inauguration of a new collaboration between EPSRC, the School of Engineering, the Medical School and the Swansea NHS Trust. This collaboration sees the opening this summer of a Laboratory at Morriston Hospital for blood clot research.

EPSRC Programme Managers Dr Alicia Greated and Dr Elizabeth Hylton, together with Portfolio Lead Investigator Professor Rhodri Williams and the Vice-Chancellor Professor Richard Davies, presented a plaque to Mr Hugh Thomas, Chair of the Swansea NHS Trust, and Dr Adrian Evans, Consultant in Emergency Medicine, to formally establish the collaboration as the EPSRC Portfolio Partnership *Division of Clinical Haemorheology*.

The significance of haemorheology (the science of blood flow) in coagulation is that it has particular prominence in terms of changes in clot elasticity associated with myocardial infarction, peripheral vascular disease, cancer and diabetes. The new collaboration, in which Dr Adrian Evans acts as Clinical Director with Professor Williams as Scientific Director of research, will seek to establish new methods for studying blood clot formation and structure. This is one of 25 research projects supported by the £3.1M Portfolio Partnership grant, one of only 3 of its kind awarded to Engineering in the UK, and the only one in Wales.



Left to Right: Professor Richard Davies (Vice-Chancellor), Mr Hugh Thomas (Chair Swansea NHS Trust), Dr Adrian Evans (Medical School), Professor Rhodri Williams (School of Engineering), Dr Elizabeth Hylton (EPSRC Programme Manager for Lifesciences Interface), Dr Alicia Greated (EPSRC Programme Manager for Engineering)

CONFERENCE ANNOUNCEMENTS

The 4th Pacific Rim Conference on Rheology (PRCR4)
Purple Mountain Hotel, Shanghai, China, August 7-11, 2005
<http://www.prcr4.org.cn>

Organized by Chinese Society of Rheology (CSR)

TOPICS

1. Constitutive Theory, New Theoretical Approaches
2. Multi-level Structural Modeling and Numerical Methods of Complex Fluids
3. Non-Newtonian Fluid Mechanics and Computational Rheology
4. Rheometry, Optical Methods and Novel Techniques.
5. Polymer Melts, Multi-phase Polymer, Composite and Nanocomposite Melts
6. Polymer solution & Gels
7. Suspensions, Emulsions & Foams
8. Electro-magneto-rheology , High-tech Materials, Micro Fluidics
9. Rheology of Solids, Composites and Bodies with Defects
10. Systems with Sub-micron Structuring and Liquid Crystals
11. Rheology in Material Processing
12. Rheology for Mining, Rock, Soil and the Other Engineering Fields
13. Food, Cosmetics and Biomaterials Rheology
14. Other topics on Rheology

CALL FOR PAPERS

Authors are invited to submit abstracts (each not exceeding 300 words) to Conference Secretariat to arrive not late than January 15, 2005.

FOR MORE INFORMATION

Please visit the Conference Website <http://www.prcr4.org.cn> or contact
Conference Chair: Prof. Yingshe Luo via ysluo@prcr4.org.cn or
mysluo@xtu.edu.cn

**BSR 2005
Winter Meeting**

Multiscale Rheology

Cambridge University

Thursday 8th / Friday 9th December 2005

An opportunity to explore and make connections with
rheology at all length scales!

Invited speakers

Macro scale	Professor Ken Walters
Micro scale	Professor John Hinch
Nano scale	Professor Malcolm Mackley
Molecular scale	Professor Tom McLeish

Addition contributions requested;

Please submit abstract by 1st October 2005 to

Prof Malcolm.Mackley
Department of Chemical Engineering
University of Cambridge
Cambridge
CB2 3RA
Or send by email mrm5@cam.ac.uk

**UNIVERSITY OF WALES
INSTITUTE OF NON-NEWTONIAN FLUID MECHANICS**

The LODGE COMMEMORATIVE MEETING ON RHEOMETRY

Miskin Manor Country House Hotel, Cardiff, Wales U.K.

April 10 – 12, 2006

Programme

The meeting, which will commemorate the contributions made to the field of rheometry by Professor Arthur S. Lodge, will commence at 12 noon on Monday April 10th and finish at lunchtime on Wednesday April 12th, 2006.

The emphasis will be on advances in rheometrical theory, experimentation, instrumentation and interpretation of data. The meeting will include an instrument exhibition and a dedicated poster session. A **Special Commemorative Issue of the *Journal of Non-Newtonian Fluid Mechanics*** will be devoted to the Proceedings. It is planned to begin the meeting with a filmed lecture by Professor Lodge, the lecture having been recorded earlier this year. Other Plenary Speakers will include D.Baird (Virginia, USA), H.A.Barnes (UW Aberystwyth), R. Eley (ICI, USA), G.Fuller (Stanford,USA), C.Gallegos (Huelva, Spain), I.Emri (Ljubljana, Slo.), C.Kim (Seoul, Korea), O. Kulikov (Muenchen, Germany), H.M.Laun (BASF, Germany), J.Maia (Minho, Portugal), G.H.McKinley (MIT, USA), J.R.A. Pearson (Schlumberger, U.K.), J-M. Piau (Grenoble, France), M.H.Wagner (Berlin, Germany) and X-F. Yuan (Manchester, UK).

Venue

The meeting will be held at the Miskin Manor Country House Hotel, which is set in 22 acres of countryside, 15 minutes from Cardiff and 25 minutes from Cardiff (Wales) Airport. The hotel offers excellent dining, accommodation and conference facilities. The conference fee includes access to the hotel's health club. Early registration for accommodation at Miskin Manor is advised due to high anticipated demand. Alternative accommodation (with local transport to and from the conference) will be provided at the nearby Copthorne Hotel.

Costs

The total cost of £350 includes full-board accommodation from Monday lunch to Wednesday breakfast. An accompanying person, sharing a room with a conference delegate, will be required to pay £100.

UNIVERSITY OF WALES
INSTITUTE OF NON-NEWTONIAN FLUID MECHANICS
The LODGE COMMEMORATIVE MEETING ON RHEOMETRY
Miskin Manor Country House Hotel, Cardiff, Wales U.K.
April 10 – 12, 2006

Prospective speakers should return this form, together with a 200 word Abstract, no later than February 1st, 2006. Full manuscripts of papers will be required at the Meeting.

Block letters throughout please

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Surname

Forename(s)

Organization

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☐ I wish to attend the conference and I enclose a cheque for £350 made payable to the University of Wales Institute of Non-Newtonian Fluid Mechanics.

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☐ I wish to present a paper and I enclose an Abstract.

Please return this form to:

Professor P. Rhodri Williams,
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University of Wales Swansea
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Tel: 01792 295673
Fax: 01792 295701
Email: p.r.williams@swansea.ac.uk

**The 4th International Symposium on Food Rheology and
Structure (ISFRS 2006)
February 19-23 2006, Zurich**

The International Symposium on Food Rheology and Structure (ISFRS) has been hosted by the Institute of Food Science and Nutrition at the Swiss Federal Institute of Technology (ETH Zürich) in Zürich/Switzerland every three years.

The 4th International Symposium on Food Rheology and Structure - ISFRS 2006 addresses the needs of food rheology and structure researchers. The symposium is devoted to rheology of food and related systems, to food structure and structure analysis, and to the complex relationship between food processing, structure, rheology and resulting food quality.

An overview of the state of the art and a detailed focus on recent problem areas are given by the opening lecture and several keynote lectures that are presented by well-known scientists. Oral and poster contributions are organized in individual symposium sessions grouped around the introduced research topics in food rheology and structure. An overview of the 2000 and 2003 session including free pdf downloads of the proceedings contributions can be found at our [*Proceedings*](#) link.

All papers presented during **ISFRS 2006** will be published in the conference proceedings that will be available at the opening of the symposium in print and CD formats.

Special issues of the **International Journal of Food Science & Technology** and **Applied Rheology** are devoted to the 2006 symposium. Proposed contributions are subject to evaluation by the Scientific Committee and completed manuscripts are subject to peer review.
www.isfrs.ethz.ch

**AERC 2006 Hersonisos, Crete, Greece
27-29th April 2006**

It is our pleasure to announce that the third Annual European Rheology Conference (AERC 2006) will be held in Hersonisos, Crete, Greece. The aim of AERC 2006 is to contribute to the advancement of Rheology by bringing together interested researchers from Europe and the rest of the world, and bridging traditional themes with modern trends.

Following the tradition of European Rheology meetings, AERC 2006 will be a

3-day conference split into symposia that reflect mainstream or emerging areas of Rheology. In addition, the following short courses will also take place prior to AERC 2006 (25-26 April):

- Multi-scale modelling methodologies
- Interfacial rheology and applications

The 1st circular can be found at this address : <http://www.rheology-esr.org/AERC/2006/files/afisa2.pdf>

NEW BOOKS

Important New Monograph Applied Thixotropy & Allied Phenomena

Henry Warson, BSc., PhD., C.Chem., FRSC

132pp +viii;(A4 Times 12 type); £85; Euro 140 post free; rest of world: US\$145 (postage \$4 Europe; \$8 elsewhere. ISBN 0-9544724-0-3. Academic/non-profit organizations 10% discount

Thixotropy is the scientific term for a large number of phenomena observed in everyday life. It is part of a broader subject, the science of the deformation of materials under load, the science of rheology.

A simple example is a tin of paint. The paint may be of high viscosity, and if the paint is stirred very slowly this high viscosity may be maintained. With rapid stirring the viscosity drops continuously with time, but if stirring stops the viscosity is restored with time. Allied to thixotropy there are a number of phenomena such as shear thickening as opposed to the more conventional shear thinning. There are many papers and volumes which describe this branch of rheology in much mathematical detail. However, for the scientist and technologist who wishes to follow the technology without too much mathematical involvement, there is little if anything published in a single volume, and I have attempted to do so in this monograph.

Part One, Chapter One describes fundamentals. It is followed in Part Two by chapters 2, 3, and 4 describing materials which induce thixotropy. They include cellulosic derivatives and polymeric organic acids, inorganic compounds, such as the swellable (smectic) clays, and organometallic derivatives as the titanium chelates. Part 3, Chapters 5, 6, 7 are devoted to thixotropy in aqueous emulsions including aqueous latices, the relatively new associative thickeners and emulsion paints. Chapter 8 includes a surprising number of applications depending on

thixotropy, including detergents for washing machines, printing inks for textiles, paper coating, writing inks, adhesives, cement and building materials and even de-icing fluids for the wings of aeroplanes. Part 4, chapter 9 describes non-aqueous thixotropic compositions, partly under the materials such as alkyds, polyurethanes and epoxides, and partly under specific applications such as PVC compositions, inks, sealants and adhesives and electronic applications.

Whilst many food applications involve viscosity phenomena, they are not included in this volume, as they are best described in volumes devoted to the chemistry of foods.

Each chapter is well referenced, and there is an extensive index.

Please order directly from the author, Dr. Henry Warson at: 26 Blythe Court, 4 Grange Rd., Solihull, B91 1BL, England with the appropriate remittance. Phone/Fax (44)(0) 121- 706-0904

Viscosimetry of Polymers and Polyelectrolytes

Werner-Michael Kulicke & Christian Clasen, University of Hamburg,
Germany

2004. XVIII, 121 p. 71 illus., 20 tabs. Springer-Verlag, Heidelberg
Hardcover. EUR 59.95 (net price), £ 46.00, SFR 106.00, \$ 59.95
ISBN 3-540-40760-X

Viscometry is an easy, accessible, but at the same time significant, analytical method for the characterization of polymers in solution. Widely used in pharmaceutical, medical and polymer processing industries as well as in research, viscometry allows for a quick and inexpensive determination of relevant parameters such as solution structure, viscosity and molar mass. This **laboratory handbook** offers clear guidelines and tips for the practical everyday application of viscosimetry, as well as supplying a comprehensive companion for the interpretation of viscosimetric data from simple to complex polymer solutions. It is written with the premise that general knowledge of the broad behavioral spectrum of polymer solutions is of utmost importance for the correct handling of viscometric equipment and the interpretation of data. Originating from the author's experience supervising analytical polymer chemistry lab courses, it shows readers how to tackle key practical problems through detailed examples.

contents:

Fundamentals.- Solutions.- Viscosity Number.- Viscosimetric Molar Mass Determination.- The Fox-Flory-Theory.- Application of Viscosimetric Measurements.

INDUSTRY NEWS

Anton Paar New MCR Rheometer

The new MCR series from Anton Paar has seen the company establish itself as market leaders in the world of rotational rheometers. Previously strong sales have been boosted by an amazing 80% in 2005 and a new production centre was opened in April in order to cope with the demand.

The new instruments combine several unique innovations such as Toolmaster™ (geometry recognition) and TruGap™ (independent gap validation and adjustment). A refined motor and air bearing system further enhances the new MCR which also incorporates the widest range of accessories in the marketplace.

Historically some rheometer manufacturers have shunned the independent measurement of gaps since it reveals errors caused by automatic gap setting systems. No independent system is offered to check that the gap is zeroed correctly, and once the gap has been set it is never measured. TruGap™ guarantees rheometer users greater accuracy by continuously measuring the gap and adjusting it to the required value should it change.

The latest range of accessories from Anton Paar includes a full suite of RheoOptical add-ons which include the following :

Flow Visualisation

Video Tack Testing

RheoMicroscopy

Small Angle Light Scattering (SALS)

Small Angle, Wide Angle X-ray scattering (SAXS / WAXS)

Small Angle Neutron Scattering (SANS)

Particle Image Velocimetry (PIV)

Simultaneous measurement of Birefringence and Dichroism (DORA)

Anton Paar Ltd. are actively seeking Universities and Companies in the UK with a need for high level rheological measurements.

New Service Engineers

In order to cope with the growth of rheometer sales in the UK Anton Paar have employed 2 additional service engineers, Michael Mabbut and Jim Joannou. Michael and Jim bring many years experience to our service team, having previously worked for Rheometrics.

Consultancy for Rheology and Viscosity Measurements

Anton Paar UK are now offering consultancy services for people that cannot justify the cost of an instrument or have too much throughput to handle on a daily basis. Samples will be run on the latest instrumentation and the results accompanied by a detailed report.

AMVn Viscometer for Low Viscosity Samples

Can you measure water at 20°C and obtain a viscosity of 1.00 mPas every time ? The AMVn (automated microviscometer) produces extremely accurate viscosity measurements for low viscosity materials such as ink jet inks, solvent mixtures, polymer solutions, beverages etc. Less than 0.5ml of sample is required to make a measurement and the samples are measured in a sealed environment to prevent solvent loss. The AMVn can be supplied with an autosampler if required.

For further information relating to any of the above information please contact Steve Goodyer on 01992 514730.

On-Line Training for Rheology and Colloid Science

Anton Paar have secured an exclusive deal to distribute the online training package developed by IMPACT Faraday Ltd. The modular package is highly engaging and interactive, allowing the user to develop ideas and concepts in a way that is not normally available in traditional face-to-face training or through text books. The package offers:

- A training product that has been approved by the RSC and IChemE
- Online training that is accessible any time, day or night
- Text, audio, images, videos and animations to provide a varied learning experience
- Online self assessment questions and exercises with full feedback
- Interactive calculators to help understand the maths
- Technology that works on a standard PC
- 12 modules introducing fundamental aspects of colloid science
- An extensive module that develops ideas around how formulations can be refined based on rheological measurements
- A module focused on the coatings industry and how to understand and improve coatings formulations
- A module which explores aspects of shelf life stability of dispersions and emulsions, how it is affected and how it can be controlled
- And more...

Registration can be arranged through any of our sales team. Options available for individuals or groups. Previews and examples of the interactive content can be accessed on the website <http://www.impactfaraday.org/learning>
Please call Steve Goodyer on 07971 972502 for exclusive pricing and access options.

RheolabQC – the new rotational rheometer for Quality Control from Anton Paar

Anton Paar presents the RheolabQC, a new rheometer specially designed for quality assurance. From quick single-point checks to complex rheological investigations – the RheolabQC is versatile and outstanding value for money, setting new standards in quality control.

The RheolabQC is a rotational rheometer which works according to the Searle principle. It consists of a high-precision encoder and a highly dynamic EC motor. The wide speed and torque ranges and very short motor response times allow conventional flow and viscosity curves and also make the RheolabQC ideal for investigations into the mixing and stirring behavior of emulsions and dispersions, tests on the sagging and leveling behavior of coatings and determining the yield point of gels and pastes. The user can select between controlled shear rate (CR) and controlled shear stress (CS) test settings.

The RheolabQC has numerous advantages for quick and easy work in quality control:

It can be operated manually or using the new RheoPlus software. The software includes a special quality control module, numerous analysis models and an integrated 21 CFR Part 11 function. The RheolabQC can either be connected via the conventional RS232 interface or via a LAN-Ethernet interface directly to the company or laboratory network.

From yoghurt pots to paint tins – to check the quality of products rapidly during production, the RheolabQC has a new measuring cup holder which fixes and centers vessels of different heights, materials and diameters quickly and easily. Time-consuming sample preparation is no longer required.

ToolmasterTM is the first automatic component recognition and configuration system and ensures error-free selection of the measuring geometries. All measuring systems are automatically recognized by the rheometer. This information is taken into consideration when carrying out manual measurements. With computer-controlled measurements, the information is read into the software as soon as the geometry is connected to the instrument.

There is a wide range of accessories available for the RheolabQC:

Measuring geometries such as concentric cylinder systems, double gap measuring systems, vane geometries and spindles. The quick coupling allows the

measuring system to be inserted into the rheometer with a simple hand movement.

Two liquid-heated/liquid-cooled temperature control systems for rapid and accurate temperature control from -20 to 80 °C and -20 to 180 °C.

Measuring cup holder for individual sample vessels

Keyboard and bar code reader

For further information contact steve.goodyer@anton-paar.com or tel: 01992 514730

Thermo Electron Corporation new managing director of its Karlsruhe site

Thermo Electron Corporation, the world leader in analytical instruments, announced that Markus Schreyer has been promoted to managing director of the company's Karlsruhe facility, effective immediately. He assumes responsibilities for site management from Dr. Hartmut Braun, who announced to employees earlier this month that he was leaving the company for personal reasons.

Greg Tucker, President of Thermo's Control Technologies Business, commented, "In his role as managing director and president of the Material Characterization business, Dr. Braun consolidated a fragmented business and positioned it for future growth with the launch of two key rheology platforms." Tucker continued, "Dr. Braun decisively helped to stabilize our market share and to strengthen our strategic position. We regret his departure, but respect his decision and appreciate his dedication and commitment to the business."

In addition to Schreyer's responsibilities as managing director, his role of Vice President of Global Sales now encompasses Material Characterization products. Tucker stated, "Control Technologies is consolidating the business one step further by creating a unified functional leadership team. Our goal is to better serve customers across the entire business." Tucker continued, "With his diverse, global experience, I'm confident Schreyer will address customer needs for both Material Characterization and Temperature Control products."

In his past 15 years with Thermo, Schreyer has held a variety of positions, including Business Unit Manager, Polymer Technologies. Schreyer has been based in the US for the past four years during his tenure as Vice President. Said Schreyer, "Our customer base comprises global, worldclass companies that demand world-class suppliers. My team and I are looking forward to the challenge of helping Control Technologies achieve this goal."

For more information about Thermo Electron Corporation, please visit www.thermo.com.

Malvern Instruments – New Web-based Rheology Focus

Malvern Instruments, leading supplier of particle characterization and rheological instrumentation, is pleased to offer an exciting program that enables SOR members to share their work with a large audience. The "Rheology Focus" meeting will allow people to present their work for free in a live web-based presentation held once a month. If you are working on a novel or a growing field in rheology, this forum is a great opportunity to get more exposure and recognition, and we welcome users of all rheometer brands

Rheology Focus meetings will be promoted widely and viewers can join and participate free of charge. Malvern has been offering technical seminars via the web for 5 years, with over 1500 people having attended seminars on a variety of subjects, from over 40 countries, and we therefore expect that these meetings will be well attended.

In short, Malvern will provide the infrastructure and handle the marketing, enabling you to focus on what matters most - the content of your work and your presentation.

If you are proud of your work and want increased exposure, we look forward to hearing from you. If you have any questions or want to know more about this innovative program, please call our Applications Manager, Phil Rolfe, at 001-508-480-0200 Ext. 244

New downloadable brochures for Malvern rheometers range

New brochures for instruments in the Malvern Bohlin rheometers range can now be freely downloaded from the Malvern Instruments web site at <http://www.malvern.co.uk/bohlin> . These provide the latest information about the features and applications of the Gemini, C-VOR, CVO, and Visco 88 systems.

The Gemini is a modular, high specification, research grade rheometer which can be used with a wide range of measurement geometries, temperature controllers and accessories. Malvern's patented DSP Rotonetic drive technology at the heart of this system is specifically optimized for rheological testing and enables users to carry out strain controlled as well as stress controlled tests. The drive delivers control with exceptional range and sensitivity across all steady, dynamic and transient modes.

A high resolution, modular rheometer and dynamic spectrometer system, the C-VOR has many accessories in common with the Gemini. Triple motor control provides an advanced instrument also suitable for product development and research grade applications.

The CVO rheometer is a practical, compact unit which is easy to set up and control, making it suitable for high use QC applications, and offering the flexibility of bespoke user-defined measurement procedures.

The Visco 88 is a portable, dependable and versatile viscometer for use either in the field or in the lab. www.malvern.co.uk

Malvern opens new offices, customer support and training facilities in Shanghai

Malvern Instruments has opened a new head office in Shanghai for all its sales and marketing activities in China. Malvern began direct operations in China in April 2004 in order to provide more direct support to customers in this market and was initially based in temporary offices. Now housed in the new Spectris headquarters, Malvern's new offices include a unique state-of-the-art customer demonstration and training facility. This will provide sample analysis, customer training, contract and consultation services for the whole of China. A full customer support center has also been established, offering in-house repairs and service engineer training for China and Asia. Satellite offices in Chengdu, Guangzhou, Beijing and Xian will provide customer support personnel for local access, dedicated to delivering a fast response.

Malvern's well equipped laboratory facilities in Shanghai house a complete range of Malvern particle characterization and rheology systems, together with a full suite of ancillary particle characterization equipment and materials. As the Asia center of excellence, it will host regular particle size training schools, which in future will be extended to cover all instrumentation and technology types. Not only does this facility enable Malvern to provide services directly to customers in China, it also allows the company to extend its training and support facilities to the wider Asia Pacific region. Further support is provided through Malvern's website, which, in addition to product and applications information, features 'on demand' audiovisual presentations that can be downloaded and run at the viewer's convenience www.malvern.com.cn.

Currently 20 Malvern personnel work in the company's offices in China. This includes the applications-focused salesforce and two dedicated applications specialists. As well as marketing its own materials characterization systems, Malvern is also the exclusive distributor in China for Quantachrome, providing instruments for further characterizing the properties of powders and porous materials.

Reference material tests validate measurements with Freeman's new automated shear cell for FT4 Powder Rheometer

Freeman Technology recently introduced a fully automated shear cell accessory for use on its FT4 Powder Rheometer. Now, work performed by an independent laboratory using BCR reference material CRM-116 (Community Bureau of Reference: BCR, Belgium), has confirmed the new shear cell's ability to perform verifiable and highly repeatable shear tests. This reference material has been developed to allow verification of shear tests and experimental technique. As part of their overall evaluation of the FT4 Powder Rheometer, researchers at the LGPSD-CNRS laboratory at the École des Mines d'Albi in France have been working in conjunction with Freeman Technology's Powder Applications Laboratory in the UK. Results from the work at the École des Mines d'Albi showed that measurements made on CRM-116 using the FT4 shear cell gave excellent agreement with the shear parameters specified for the standard.

The FT4 is a universal powder rheometer that is used to conduct an array of powder flowability tests that provide a means to characterise the flow properties of powder materials and relate these to performance in process. Where shear testing is required to complement flowability data, the new automated shear cell accessory offers significant advantages over conventional methods.

Shear testing using the FT4 is fully automated, minimizing operator involvement for greater repeatability and reproducibility of results. And it is fast, with tests completed in around 40 minutes. Measurements can be made at low levels of material compaction, thanks to the system's high sensitivity, and over a wide range of stresses up to 23 kPa, allowing simulation of many different packing conditions. Conditioning of material before testing ensures homogeneity and a high degree of repeatability. As little as 35ml of material is needed to perform the measurement.

The shear test involves simply selecting a test programme, preparing the sample, then starting the fully automated test sequence. The shear cell utilizes the FT4 powder rheometer's inherent ability to control force, the rate of application of force and strain rate as part of the automated shear test.

For more details please visit www.freemantech.co.uk

Freeman Technology to introduce new small volume shear cell for FT4 at Powtech 2005

At Powtech 2005 (11-13 October 2005; Nürnberg, Germany), Freeman Technology will introduce a new accessory for the company's FT4 Powder Rheometer. The fully automated, small volume shear cell is a completely new module that will enable users to extend the range of shear testing applications on the FT4 to include those for which only very small amounts of sample are available. This includes many pharmaceutical actives, and materials such as early stage formulations where a wide range of tests must be carried out on limited supplies. Managing director Reg Freeman will also make a presentation at the Bulk Days seminar (12/13 October; www.bulkdays.com) on *Methods of determining powder flow properties*.

If you would like to arrange a meeting at POWTECH to discuss your powder processing challenges, simply contact Freeman Technology on 01684 310860 or email info@freemantech.co.uk

New viscometer accessory adds to Malvern Zetasizer Nano capabilities

Malvern has added the SV-10 Vibro viscometer to its range of material characterization instruments for use with its Zetasizer Nano particle characterization systems. The SV-10 is exceptionally easy to use and clean, is relatively low cost and gives rapid, highly accurate viscosity measurements in the range 0.3 to 10,000 mPa.s. With 1% accuracy across the whole measurement range, the data it generates can be used to enhance the accuracy of particle size measurements by dynamic light scattering. Used together, the SV-10 and the Zetasizer Nano provide an excellent option for the study of emulsions and dispersions, and more particularly for the characterization of proteins in solution prior to crystallization.

The technique of dynamic light scattering determines particle size by observing the random movement of particles undergoing Brownian motion. As this behaviour is directly related to the viscosity of the fluid in which the particles are moving, inaccuracies in the measurement of viscosity translate directly into inaccuracies in particle size measurement. The very high accuracy of the SV-10, even at the low viscosities typical of aqueous media, therefore makes it an invaluable accessory for dynamic light scattering systems.

The SV-10 determines viscosity by measuring the current required by an electromagnetic drive to vibrate two gold paddles immersed in the sample at

constant amplitude. The damping effect on the vibration due to the sample is related to its viscosity. The system takes around 15 seconds to stabilize, after which a continuous reading of viscosity is produced. The use of gold plated sensors makes the unit compatible with all fluids and it is suitable for measurements in the temperature range 0 to 100°C. Further details at www.malvern.co.uk/viscometer

New temperature control options for Malvern Rosand capillary rheometers

Malvern Instruments has introduced a new range of low temperature control options for the Malvern Rosand range of capillary rheometers. High-pressure capillary rheometry is a well-established method for simulating the processing conditions of molten polymers at high temperatures. These two new low temperature control options, which are designed for the RH7-D/RH10-D and RH2000 rheometers, enable capillary rheometry to be applied to an extended range of materials. They comprise cooling coils with fluids circulator for measurements from 5°C to 50°C and an option for cryogenic cooling using liquid nitrogen for measurements to minus 40°C.

The new low temperature options are compatible with the full range of capillary dies for the Malvern Rosand rheometers and offer the possibility of measuring materials over a wide range of shear rates.

Temperature control at ambient or below is ideal for low viscosity materials (such as inks, paints, paper coating emulsions, plastisols and foods) when extension of the accessible range of shear rates to more than 100,000 s⁻¹ may be necessary to simulate processing conditions, such as pumping or extrusion. A conventional rotational rheometer would not normally allow measurements at such high shear rates.

Malvern Rosand capillary rheometers RH7-D and RH10-D are research grade, floor standing twin bore systems that enable the widest range of shear rates to be tested, as well as complex rheological properties such as die swell and melt tension. These rheometers are used extensively for a range of applications including polymers, foods, coatings and ceramics. Malvern Rosand capillary rheometers are also available as bench top systems (the RH2000 series) for more routine measurement of shear viscosity for QC purposes. These compact systems, capable of most testing requirements encountered in capillary rheometry, are available in both single (RH2100) or twin bore (RH2200) configurations. www.malvern.co.uk

CONFERENCE DIARY

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

2005	
7-11 August Shanghai China	The 4th Pacific Rim Conference on Rheology (PRCR4) Purple Mountain Hotel, Shanghai, China, August 7-11, 2005 http://www.prcr4.org.cn/
23-26 August Zielona Gora Poland	3rd International Conference on Engineering Rheology Anna Walicka (fax) 0048.68.3247446 A.Walicka@ijame.uz.zgora.pl www.ijame.uz.zgora.pl/ijame_files/icer05/index.htm
19 September Leoben, Austria	Neues aus der Polymer-Rheologie Leoben, Austria - 0043.732.6981.5914 - Markus Gahleitner - markus.gahleitner@borealisgroup.com - chemietage2005.chemit.at/
16-20 Oct Vancouver Canada	77th Annual Meeting of The Society of Rheology ; Website: www.rheology.org
12-14 Oct Lyon, France	Structure and rheology of self-assembling and aggregating colloidal suspensions: theory, simulation and experiment Lyon, France - x44(0)1223.325222 - Edo Boek - boek@cambridge.oilfield.slb.com
5-11 Nov Orlando, United States	ASME - Rheology and Fluid Mechanics of Nonlinear Materials Orlando, Florida, United States - x1.316.978.3236 - Dennis A. Siginer - dennis.siginer@wichita.edu - www.asmeconferences.org
2006	
20-23 Feb Zurich	4th International Symposium on Food Rheology and Structure (ISFRS 2006) Zurich, Switzerland - Peter Fischer - 0041.1.6321155 - secretary@isfrs.ethz.ch - www.isfrs.ethz.ch
10-12 April Cardiff UK	The Lodge Commemorative Meeting On Rheometry Miskin Manor Country House Hotel, Cardiff, Wales U.K. Professor P. Rhodri Williams, p.r.williams@swansea.ac.uk
9-13 April Kerkrade, The Netherlands	DYFP2006, The triannual meeting on Deformation, Yield and Fracture of Polymers Rolduc Abbey, Kerkrade, The Netherlands - Marleen Rieken m.h.w.rieken@tue.nl - www.dyfp2006.tue.nl
23-26 April Montreux, Switzerland	Food Colloids 2006 Montreux, Switzerland - - Martin Leser foodcolloids2006@rdls.nestle.com - www.research.nestle.com/foodcolloids2006/
27-29 April Hersonissos, Crete, Greece	3rd Annual European Rheology Conference, AERC 2006 Hersonissos, Crete, Greece - x30.81.391305 - Dimitris Vlassopoulos - dvlasso@iesl.forth.gr - www.rheology-esr.org/AERC/2006/

COURSES

2005	
March 3, Sept 8, Dec 1 Crawley UK	Basic Rheology , TA Instruments rheology training courses, olivia.alsford@taeurope.co.uk
12-16 Sept Leuven Belgium	10th European School on Rheology : Rheological Measurements, applications to polymers, suspensions and processing. K.U.Leuven, Department of Chemical Engineering. Prof. Peter van Puyvelde, peter.vanpuuyvelde@cit.kuleuven.ac.be
Nov 16th – 17th Warwickshire 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
2006	
9-13 Jan Glasgow UK	Process Rheology Dr Nick Hudson, Dept P&A Chemistry, University of Strathclyde, 295 Cathedral St, Glasgow, UK. T: +44 (0) 141 5482162; F: +44 (0) 141 5484822. E: n.e.hudson@strath.ac.uk
1-2 June Amherst USA	Amherst Rheology Course (ARC2006): Merging Experiment with Theory in Rheology Amherst, Massachusetts, United States - Henning Winter winter@ecs.umass.edu - rheology.tripod.com/ARC.htm