

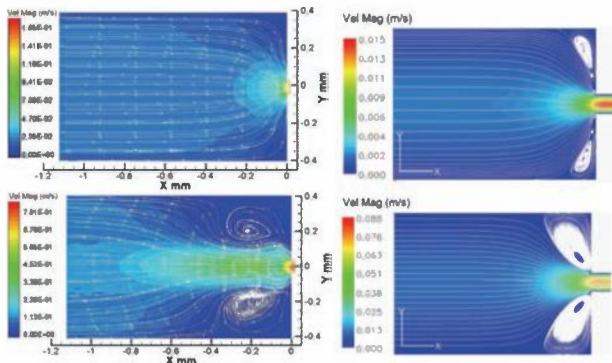


"The four areas we should be studying:

- 1) *Microrheology.*
- 2) *Experiment.*
- 3) *Formulation of rheological equations of state.*
- 4) *Prediction of flow behaviour by simultaneous solution of the rheological equations of state and the conservation equations.*

These headings represent the stages in the cycle of operations which in practice have to be performed repeatedly in order to achieve a reasonably complete statement of the rheological behaviour of a real material".

--- J.G. Oldroyd in the early 1960s



Rheology

Bulletin

THE BRITISH SOCIETY OF RHEOLOGY

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EDITORIAL

SUBMISSIONS TO THE BULLETIN

Submissions to the Bulletin may be made by any practical means – post, email, disk, fax, pigeon, donkey, guide dog, *et cetera* but electronically is preferred (saves typing...). Most packages supported (Word, TeX, LaTeX, WordPerfect, ASCII, RTF) but always provide a contact name, address, e-mail, or telephone number in case of problems. The next copy date will be in December 2008 and, as always, all contributions are gratefully received. Late copy can sometimes be accommodated, however the facilities of the BSR and ESR web sites may also be appropriate. Please contact the Editor (xue-feng.yuan@manchester.ac.uk) for details.

COVER ILLUSTRATION

The cover contains the vision of Professor J.G. Oldroyd (1921-1982) in the early 1960s (see the article by Prof. Walters), and the results of two young practitioners, Miss Zhuo Li and Mr Sunday Omowunmi - 1st year PhD students at the School of Chemical Engineering and Analytical Science, the University of Manchester. The two images on the left show the velocity field of 0.3 wt% poly(ethylene oxide) solution ($M_w=1.22\times 10^6$, $M_w/M_n= 4.14$) in microfluidics with 8:1 planar abrupt contraction flow geometry (40 micron in depth), obtained by micro-PIV measurements at flow rates: a) $Wi=35.3$ and $Re=2.48$; b) $Wi=84.8$ and $Re=5.96$. The two images on the right show the simulation results of the microfluidic experiments under the same elastic number ($El=14.2$) but lower flow rates: a) $Wi=1.00$ and $Re=0.07$; b) $Wi=5.53$ and $Re=0.39$, by using PTT model with a single relaxation time.

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

SUPPLEMENTAL INFORMATION

The cover picture in the previous issue of the Bulletin (Vol 49, No.1, 2008) was provided by Dr Robert J Poole (robpoole@liverpool.ac.uk). Further technical details can be found in *Physical Review Letters*, **Vol.99**, 164503, 2007, by R.J. Poole, M.A. Alves and P.J. Oliveira. We apologise for the above omission in the last issue.

The Life and Work of J.G. Oldroyd

By Ken Walters

Institute of Mathematical and Physical Sciences
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Professor J. G. Oldroyd
1921 - 1982

When Marcel Escudier and Rob Poole asked me to talk on the “Life and Work of J.G. Oldroyd” in BSR/INNFM spring meeting on the theme of *Complex Flows of Complex Fluids* at the University of Liverpool in March 2008, I responded with enthusiasm. I saw it as a further opportunity to express my deep gratitude to my Ph.D. research supervisor and subsequent mentor and friend.

It is so appropriate that this lecture is being given at the University of Liverpool at a meeting co-sponsored by the British Society of Rheology (BSR). In his early years, Oldroyd was a very active member of the BSR. He joined what was then the British Rheologists’ Club in 1947. He subsequently served the BSR as Membership Secretary and Treasurer, and he was the President of the Society between 1955 and 1957. John Hutton tells me that, while he was President, Oldroyd was responsible for the “Rheology Abstracts” initiative.

Now I must admit to a feeling of *deja vu* this afternoon. Following Jim’s sudden death in 1982, the BSR invited me to give an “Oldroyd Memorial Lecture” at each of the three Universities that Jim had been associated with, namely Cambridge, Swansea and Liverpool. These took place in 1983 and I recall that all three lectures were very well attended.

In 1984, i.e. the year following the memorial lectures, the *Journal of non-Newtonian Fluid Mechanics* put out a Special Issue, which was dedicated to the memory of Professor Oldroyd. That volume contained an Appreciation written jointly by Professor R.B. Bird of the University of Wisconsin and myself. This is a part of what we wrote:

“Two years ago, we were both invited to write articles for the *British Society of Rheology Bulletin* on the occasion of Professor Oldroyd’s 60th birthday. This we were happy to do...

Little did we realize at that time that we would be called upon so soon to prepare this Introduction to a special issue to our mutual friend. But Professor Oldroyd died suddenly on his way to his office at the University of Liverpool on Monday, November 22nd, 1982, and Science as a whole and our specific field of research in particular had lost an outstanding researcher”.

More on that special JNNFM issue later, but let me first spend a moment or two on my own association with Jim Oldroyd.

I went up to the University of Swansea in 1953, the same year that Professor Oldroyd took up the Chair of Applied Mathematics there. In my third year, I recall sitting through 40 hours of lectures on “Continuum Mechanics” given by Professor Oldroyd. The lectures must have had a deep impression on me, since, on completion of my first degree in 1956, I decided I wanted to do research in the field. However, at the time, Professor Oldroyd was encouraging **all** his staff to be active in research and I was assigned to my namesake, Trevor Walters, to work in the field of “Atmospheric Diffusion”. One interesting year in that field was sufficient to convince me that a Masters degree would be sufficient and that I should try again to twist Professor Oldroyd’s arm.

I was successful and, in 1957, I joined Professor Oldroyd’s small research group and spent two exciting years as his Ph.D. student. The supervision had that superb combination of freedom of action coupled with general guidance and helpful advice when requested. Those two years instilled in me an affection for the fields of Rheology and non-Newtonian Fluid Mechanics and I am still as excited about these subjects now as I was then.

After 1959, I went my own way, first to the United States and then to Aberystwyth. As the years went by, I got to know Jim Oldroyd as a friend and advisor. I regarded him as a giant in the research field I had embraced and I felt privileged to call him a friend.

Little wonder then that I jumped at the chance to give the memorial lectures in 1983 and also today’s lecture, which is appropriately again in the University of Liverpool, where Jim spent his last years.

But enough of these myopic reflections. Let’s turn to the man himself.

James Gardner Oldroyd was born in Bradford, Yorkshire, in 1921. He attended Bradford Grammar School, where he matriculated in 9 subjects at the early age of 14. Due to his age, he was required to spend 4 years in the 6th form, where he excelled in Mathematics. He also became proficient in the French and German languages.

In due course, he was awarded a State Scholarship and he went up to Trinity College, Cambridge, in October, 1939. There followed a distinguished undergraduate career. He was awarded the Rouse Ball prize in 1941 and the Mayhew prize in 1942.

His professional career began at the Ministry of Supply at Aberporth, a small village not too far south of Aberystwyth on the West Wales coast. He was there from 1942 to 1945, involved I believe in Rocket Research. It was at Aberporth that Jim met Katryn, who was to become his devoted wife and mother of their three sons.

After the Second World War, Jim moved to the Courtaulds Fundamental Laboratory in Maidenhead, near London, where he remained until 1953. He left to take up the Chair of Applied Mathematics at what was then the University College of Swansea at the early age of 32. He moved to the University of Liverpool in 1965 and remained here until his death in 1982.

Professor Oldroyd won many honours during his illustrious career. He was a Fellow of Trinity College, Cambridge, from 1947 to 1951. He was awarded the Adams Prize by the University of Cambridge in 1964 and he received a Gold Medal from the British Society of Rheology in 1980. Some of us feel that other honours should have come his way.

What is clear is that during the years from the end of the Second World War to his untimely death in 1982, James Gardner Oldroyd had an enormous influence on the field of Rheology.

His own perception of the field in the early 1960s is contained in one of the popular general papers he wrote at the time. In this, he listed the four areas he thought we should be studying:

- (1) Microrheology.
- (2) Experiment.
- (3) Formulation of rheological equations of state.
- (4) Prediction of flow behaviour by simultaneous solution of the rheological equations of state and the conservation equations.

These are the areas, he said, with which we must be concerned. He then added:

“These headings represent the stages in the cycle of operations which in practice have to be performed repeatedly in order to achieve a reasonably complete statement of the rheological behaviour of a real material”.

I believe this remains an excellent statement of the programme that many of us are engaged in today.

So, I thought that I should spend some time discussing Professor Oldroyd's own contribution to the field under these four headings, especially since he himself worked in all four areas at various stages of his career. Incidentally, a complete set of Professor Oldroyd's papers is housed in the Scott Blair Library, which is located at Aberystwyth University.

So first to area (1) – Microrheology.

In 1946, Frohlich and Sack published an influential paper in the Proceedings of the Royal Society. Under conditions of small strain, they derived the rheological equations for a very dilute suspension of Hookean spheres in a Newtonian viscous liquid. It turned out to be the same equation as one discussed by Jeffreys some

years earlier, and the three constant model has since become known as the Jeffreys' model, although I've also seen it referred to as the Oldroyd 3 constant model, for reasons I'll mention in due course.

Professor Oldroyd was clearly impressed by the work of Frohlich and Sack and he extended it in 1953 to include interfacial slipping between the spheres and the surrounding liquid. More importantly perhaps, he adapted the ideas to the case of a dilute emulsion of one incompressible liquid in another. The equation so derived had the same form as that found by Frohlich and Sack, and this had an important influence on Professor Oldroyd's perception of the necessary complexity involved in describing real behaviour.

$$\sigma + \lambda_1 \frac{d\sigma}{dt} = \eta_0 \left[\frac{d\gamma}{dt} + \lambda_2 \frac{d^2\gamma}{dt^2} \right],$$

The relevant equation involves three material constants- a viscosity η_0 and two time constants λ_1 and λ_2 . When $\lambda_2 = 0$, we have the Maxwell model, which was the first to be developed for an elastic liquid, or should I say "elastico-viscous liquid", since this was Jim's preferred terminology. λ_1 is usually called the "relaxation time" and λ_2 the "retardation time".

So much for Microrheology; what about area (2) – Experiment?

Now Professor Oldroyd was an Applied Mathematician and proud of it. If you want confirmation of that fact, I suggest you read the printed version of his Swansea Inaugural lecture of 1953.

In the most eloquent way, he built up an argument **commencing** with the existence of a "Mathematics for its own sake", which we call Pure Mathematics; **continuing** with an acknowledgment that all mathematical developments, however they may have arisen must be regarded as being potentially useful as a means of describing natural phenomena; and **culminating** in a strong defence of Applied Mathematics per se, calling on the words of the late C.A.Coulson: "Applied Mathematics is an intellectual adventure in which are combined creative imagination and authentic canons of beauty and fitness; they combine to give insight into the nature of the world of which we ourselves and our minds are part".

So, there was no doubting the commitment of Professor Oldroyd to Mathematics, especially Applied Mathematics. However, during his years at Courtaulds, he also became involved in **experimental** work. He had a productive association with Drs. B.A. Toms and D.J Strawbridge, working with the former on "turbulent drag reduction" and with Toms and Strawbridge together on a new coaxial-cylinder rheometer for investigating the linear viscoelastic behaviour of polymer solutions. At the time, this OST apparatus was an important development in the Rheometry field.

Interestingly, to interpret the experimental results coming from the apparatus, Oldroyd appealed to the Jeffreys model. So, he practiced what he preached. He had regard for the microstructure of the complex fluids he was studying in the laboratory and he attempted to marry the mathematical description of that microstructure to the experimental data he and his colleagues were collecting.

However, we do not look to areas (1) and (2) to explain Professor Oldroyd's massive reputation in the field of Rheology. For that, we must turn to area (3) and the difficult subject of formulating equations of state for non-Newtonian liquids like polymer solutions under all conditions of motion and stress.

I believe it is true to say that Professor Oldroyd will be remembered most for a series of papers on the subject of Formulation. These were published in the Proceedings of the Royal Society. The famous 1950 paper is arguably the most important theoretical paper ever published in Rheology. It appeared years before its time and it contained a complete and all embracing study of "the formulation of rheological equations of state", including a discussion of the basic principles and the procedures involved in writing down equations which satisfy them. Professor Oldroyd's skillful organization enabled him, in a mere 12 pages, to capture and unify an entire field of science with clarity, style and economy of words. Personally, I view Professor Oldroyd's 1950 paper on Formulation as a unique event – in the same category as Beman's long jump in the 1968 Mexico Olympics. It was cited in the literature over a thousand times between 1965 and his death in 1982.

Incidentally, in the Special 1984 Issue of the Journal of non-Newtonian Fluid Mechanics, which was dedicated to Professor Oldroyd's memory, you will find what is essentially an expanded version of his 1950 paper. You may be interested to listen to some words of explanation I offered in my Editorial to that Volume:

"Many of you will know that, in 1964, Professor Oldroyd shared the Adams prize for an essay entitled "An approach to non-Newtonian Fluid Mechanics". Through the kindness of Professor Oldroyd's widow, Katryn, I was privileged to be given a copy of the essay and was allowed to decide whether a part or whole of it should be published.

I doubt whether it would ever be right to publish without change in 1983 something that was written in 1964... and publishing the whole of the essay seemed inappropriate.

On the other hand, the first two chapters provide an insight into Professor Oldroyd's attitude to the important area of the "formulation of equations of state" some fifteen years after the publication of his very influential 1950 paper. This I believed would be of real interest to many workers in non-Newtonian Fluid

Mechanics and I decided therefore to include these chapters, and only these, in this special issue of the journal”.

So, I recommend to you the relevant article in Volume 14 of the Journal of non-Newtonian Fluid Mechanics, which was published in 1984.

I have often thought how difficult it must have been to follow the 1950 paper. Follow it he did of course, by illustrating the general formulation principles by considering simple examples. You will not be surprised if I tell you that the simple examples he chose were all generalizations of the Jeffrey’s model that were valid under all conditions of motion and stress. This was clearly not a random choice, but guided by Jim’s perception of the scientific method.

Now it must be said that Professor Oldroyd’s work on Formulation did not receive the credit it deserved. Influential papers written by other workers in the field in the middle to late 1950s failed to stress adequately the relationship between the formulation principles they were developing and those already introduced by Oldroyd some five and more years earlier. As a result, the mistaken impression arose that the two approaches were different, perhaps inconsistent. Many of us mortals must take some of the blame for not reasoning the issues through for ourselves at the time, but it must be said that our task would have been made so much easier by a little help from the new generation of workers.

The fact that Professor Oldroyd chose to illustrate his general formulation principles by considering simple examples (like the famous Liquid B) led to the mistaken impression in some quarters that the work in the 1950 paper applied only to these special cases and was therefore in a certain sense “less general” than the later work of other authors. Nothing could be further from the truth, and the passage of time, and bridge building attempts by others, have combined to remove this incorrect impression and to emphasise the massive contribution embodied in the 1950 paper.

Having said that, there is no doubt that a grave injustice was done at the time. Let me give you one personal example, which is still fresh in my memory, even though it took place 46 years ago!

In 1962, Professor Oldroyd and I attended an influential IUTAM meeting in Haifa, Israel, on “Second-order effects in Elasticity, Plasticity and Fluid Dynamics”. The proceedings of the meeting were published by Pergamon in 1964, so you can confirm that what I say is true.

A very well known U.S. worker in Continuum Mechanics gave the opening Plenary lecture on “Second-order effects in the mechanics of materials”. He took us through the early developments in Continuum Mechanics, right through the years to the important work of Coleman and Noll in the late 50s and early 60s. Now there was no mention, not one word, of Professor Oldroyd’s work. To say that a grave injustice was done that day would be an understatement. It was almost

unforgivable. As a young scientist, I was perplexed and lost my faith in Scientific History, or at least Scientific Historians at a stroke.

Professor Oldroyd wasn't too pleased either and we took the afternoon off, at his suggestion, to visit Acre, the old Crusader port.

All this was on the first day, the Monday, and Jim had the week to ponder the situation. He had been asked to give the last lecture on the Friday morning entitled "Survey lecture on second-order fluid dynamics". You will see from the published Proceedings that he had been deeply affected by the injustice. Indeed, he modified his prepared lecture to include a precis of his 1950 paper, (in case anyone had missed it!) The lecture also contains some excellent examples of Jim's wry sense of humour. Let me give you one example: "We may take comfort from the point that ... the sequence of physical principles and mathematical ideas that are required for a completely general discussion of equations that describe rheological behaviour need be no more complicated in, say, America in 1955 than it was in Europe in 1950".

Interestingly, there was a slow, if grudging evolution in the thought processes of the Haifa historian, beginning with comments like "A general solution was given in 1950 by Oldroyd, who however did not state the problem he had solved clearly enough for other students to see what it was, until they found it out for themselves", (which was clearly a case of 'damming with faint praise'). However, a little later that same pen wrote words that were more complementary: "The 1950 paper of Oldroyd reached a level of generality and grasp of the subject as a whole not to be shown by other workers until some five years later. The 1950 paper was the first to recognise the general programme of Rational Continuum Mechanics and to give a prescription for carrying it through".

So looking back, damage was done, by the 'cult of personality' as much as anything, but the passage of time has given to the field objectivity and balance, and, of course, the rightful appreciation of Professor Oldroyd's pioneering work. Let me give you a classic expression of all this, by quoting some words of the late Art Metzner of Delaware. He was present at the 1980 meeting of the British Society of Rheology at which Professor Oldroyd received a gold medal.

After Neil Cogswell had read the relevant citation, Metzner added his own congratulations to Professor Oldroyd and referred to the fact that, "like many a novel, rheology appeared to have a beginning, a muddle, and an end, and that now that we were emerging from the muddle, the value of the early contributions of Professor Oldroyd was becoming more and more clear."

Interestingly, the simple examples chosen for illustration purposes in Professor Oldroyd's earlier papers had a strong influence on developments in non-Newtonian fluid mechanics in the latter decades of the 20th century. Engineers, particularly those from the United States, popularized the use of the simple Oldroyd models in the solution of practical problems. Furthermore, the introduction of the constant-

viscosity highly-elastic Boger fluids in the mid 1970s certainly gave a prominence to the so-called Oldroyd B model.

The dramatic growth of interest in **Computational** Rheology from the late 1970s onward is yet another reason for the continuing popularity of the Oldroyd B model, which belies its simplicity and the fact that it was introduced nearly 60 years ago!

As if to keep a proper balance between simplicity and generality, in 1965 Professor Oldroyd published a paper on “Some steady flows of the general elastico-viscous liquid”. Here, there is no mention of *simple* rheological models. Rather, an attempt is made to see how far one can proceed without postulating a specific response between stress and deformation. In the process, Professor Oldroyd exposed a possible shortcoming in the general (notoriously misnamed) “Simple Fluid” of Coleman and Noll. He pointed out that the Newtonian fluid was not a special case of the Simple Fluid, neither were any of the popular generalizations of the Jeffrey’s model for that matter. He was correct for the Hilbert and Banach spaces chosen by Coleman and Noll in their development. However, some years later in 1983, Saut and Joseph overcame the difficulty by recasting Simple Fluid theory in a Sobolev-space setting.

Now, if Professor Oldroyd had written only the papers I’ve discussed so far, his name would have gone down in the annals of rheological history as one of the pioneers of continuum physics. But he did much more. He later considered what he called “fluids with high elasticity” and he also attempted to place the formulation of rheological equation within a proper relativistic framework.

But enough of area (3). What of area (4) – “Prediction of flow behaviour”?

Well, in the late 1940s, Professor Oldroyd published an impressive series of papers on plastic materials. These papers extended enormously the range of problem-solving capability for materials with a yield stress. He showed how to solve problems with more than one velocity component and more than one independent variable. It is my recollection that Professor Oldroyd bound the published Proc. Cambridge Phil. Soc. papers together and simply submitted them to the University of Cambridge as his Ph.D. thesis.

Professor Oldroyd was also involved in more problem solving during his time at Courtauld. The OST apparatus that I’ve already referred to needed a supporting theory and, in 1951, he provided the necessary analysis for the Jeffreys model in a paper published in the Quarterly Journal of Mechanics and Applied Mathematics. He called that paper “The motion of an elastico-viscous liquid contained between coaxial cylinders. **Part 1**”. He left it to me, as one of his research students, to write **Parts 2 and 3** a decade later. With very few exceptions, it wasn’t Jim’s custom to add his name to papers written by his research students!

I’ve already mentioned that during his Courtauld days, Professor Oldroyd also interacted with Brian Toms on the problem of “turbulent drag reduction”. You will know that the phenomenon of drag reduction is associated with the effect of adding

very small concentrations of high molecular weight polymers on turbulent-flow characteristics. Interestingly, the phenomenon is often referred to as the “Toms effect”. In 1948, Professor Oldroyd made attempts to interpret the phenomenon in terms of “wall effects”. Things have progressed a long way since 1948, but it is interesting to note that “wall effects in polymer flow” are still regarded as important some sixty years after Professor Oldroyd published his paper on “A suggested method of detecting wall effects in turbulent flow through tubes”.

I don’t know whether the pre 1950 work drained Jim’s enthusiasm for problem solving. All I do know from personal experience is that, from that time on, he delegated most of the problem solving to his research students.

So, I’ve covered all the areas that Professor Oldroyd said were important, and it only remains for me to add one or two personal reflections. First, by modern standards, Jim Oldroyd was not an enthusiastic globetrotter. I can only recall him making one visit each to Germany, Belgium, Israel and the United States. There may have been others, but, by modern standards, he could hardly be regarded as a world traveller. Secondly, I believe it is true to say that Jim had little interest in sport. So, it was ironic that three of his Ph.D students at Swansea (R.H. Thomas, J.R. Jones and K. Walters) were captains of the University cricket team in successive years. On one occasion, one of my fellow research students was even taken to task for taking time off to play cricket!

Concerning personality, Jim was at first meeting quiet and reserved, but as we’ve seen that innate shyness did not prevent him from occasionally expressing his views in a forthright manner. He was an accomplished after-dinner speaker and he possessed a keen, subtle sense of humour.

But I must end and I do so by saying again that Jim is still sorely missed and will never be replaced. However, his written works will be a legacy to several more generations of rheologists and will remain an inspiration to us all.

Professor T. E. R. (Eirian) Jones (1945-2008)

Eirian was born and brought up in Llandovery, in West Wales. He entered the University of Wales, Aberystwyth in 1964, originally to study Physics, but switched to Applied Mathematics – a move that set in course a train of events that shaped the rest of his life. After graduating in 1967 Eirian undertook a PhD entitled “Theoretical and Experimental Studies in the Rheological Characterisation of Elastico-viscous Liquids”, under the supervision of Professor (then Dr) Ken Walters, who was in the early stages of establishing rheological research as a major activity at Aberystwyth. Eirian’s membership of the BSR also commenced in October 1967, no doubt encouraged by his supervisor. It was during the four years from 1967-1971, three as a research student and one as a research officer, that Eirian developed his enthusiasm for, and expertise in, experimental work in rheology. He also made some lifelong friends, particularly Ken, for whom he had deep and lasting respect and affection. And it was during this period that he met his future wife Glenys.

Rather than take the conventional route of applying for post-doctoral appointments leading to a lectureship, Eirian followed his instinct for applied work and joined Plymouth Polytechnic, later to become the University of Plymouth. He was the first member of staff appointed in Mathematics and Statistics with a specific responsibility to develop research, a task he undertook vigorously, making contacts with industrialists and building up a rheology laboratory from scratch. Promotion to a readership followed and the arrival of another Aberystwyth rheologist, Mansel Davies, in 1977 strengthened the team. Plymouth gained a reputation both inside and outside the UK as a centre of expertise in applied rheology. The range of Eirian’s interests was very broad: cement paste, clays, vulcanised rubber, pharmaceutical capsules, oil drilling muds, cohesive sediments, sewerage (treated!), liquid foodstuffs as well as more conventional polymeric liquids were all analysed at various times in the rheology laboratory. The rheology group also undertook theoretical work and instrument development which was subsequently incorporated into Carri-Med controlled stress rheometers. Research grants, research students, research fellows and consultancy work accumulated, culminating in Eirian’s promotion to full professor in 1992.

The broader rheology community got to know Eirian through his frequent attendance at conferences and meetings and a measure of the esteem in which he was held can be seen from his election to President of the BSR from 2000-2002.

He was an associate member of the University of Wales Institute for Non-Newtonian Fluid Mechanics, which held its first meeting outside Wales at the University of Plymouth in 2001. Eirian's reputation as a rheologist with particular expertise in industrial applications was firmly established and he was a regular contributor to the rheology courses held at Ross Priory.

Around 1985 Eirian developed an interest in a wall shear stress measurement technique that could be applied in small scale laboratory flows of non-Newtonian liquids and larger scale sediment flows. His first application of the technique, in collaboration with HR Wallingford, involved the erosion of cohesive sediments but grew to encompass applications in the rotary processing of liquid foodstuffs and heat recovery in tubular heat exchangers. Eirian wasn't afraid to leave the safety of the laboratory and literally get knee-deep in estuarine mud in order to deploy the shear-stress probes in the river Tamar, the Gironde and the Humber estuary, leading one well-known rheologist to dub him "Lord Jones of Humber Bridge".

But the technical skills involved in the research work weren't the main reason why people were happy to seek out Eirian's advice and collaborate with him. Above all he was an enthusiast – he didn't look for reasons why something wouldn't work or may not be possible. He enjoyed new problems and collaborating with new people and got things to work by a combination of his energy and technical skill. He put people at ease by being easy to talk to and approachable, especially people working in industry who might have been intimidated by the thought of dealing with a Professor of Rheology. He was always ready to help anyone who was interested in learning about rheology and the many visitors who passed through the rheology laboratories invariably left enthused by his explanations of the various pieces of apparatus.

The first conference I attended with Eirian was in 1984, in Belgium, and several of the leading rheologists of the time were present. Through Eirian I met quite a few of them but more often outside than inside the lecture rooms – on the tennis court, playing inter-varsity snooker tournaments or table tennis matches. Eirian enjoyed all aspects of conference life to the full and people were always pleased to see him.

Eirian's enthusiasm for rheological work and the associated communal events was matched by his love of sport. He was a talented tennis and squash player, at which he represented the University of Wales when a student, a fine golfer with, I'm told, an elusive handicap, and a very proficient skier. In any form of sporting competition Eirian played hard to win but would willingly spend time helping anyone, especially beginners, to learn the basic skills. There are quite a few rheologists, and their family members, who mastered the intricacies of the snow plough and parallel turn thanks to Eirian.

Although Eirian enjoyed meeting people at conferences, in the laboratory or in sporting contexts, he was never keen on being the centre of attention at formal gatherings and so, in spite of the high regard in which he was held by colleagues at Plymouth, it proved very difficult to convene a gathering at which he could be formally congratulated on his 35 years full-time contribution to the University of Plymouth. Instead, a group of his tennis playing apprentices, friends from the School of Mathematics and Statistics, enticed him to a meal where he was presented with a wooden engraved platter and model of a concentric cylinder rheometer cell.



Eirian (on the left) with David Wilton (Head of School of Mathematics and Statistics, University of Plymouth)

In 2006 Eirian decided to relinquish his full-time post and continued to work on a part-time basis. He dropped in for a chat with his Head of School, David Wilton, and described how much he'd enjoyed his working life - the environment at the University, the science, the collaboration with industry, the people he'd met and worked with, and the friends he had made. I distinctly remember him saying that he'd had a marvellous time. Add to that his love of sport, travel and, most important of all, his family, and it's clear that he lived a very fulfilled and happy life. For those of us who worked with him and came to know him well, he added much enjoyment to our lives too.

Eirian died suddenly on 18th March, 2008 at his home in Cargreen, Cornwall. He is survived by his wife, Glenys, sons Mark and Simon, and grandson Oliver.

Phil James

May 2008

President's Report to AGM, March 18th 2008

I would like to welcome you all to this AGM, which marks the halfway point in my two year term of office as President. The British Society of Rheology is first and foremost a scientific society, so I am very pleased to be able to note how we fulfil that role, through scientific meetings, awards to recognise achievement and give encouragement to scientists, sponsorship and financial support to conferences, and publications to foster and serve the community. Just focusing on the scientific meetings, I am pleased by our continuing collaboration with the Institute of Non-Newtonian Fluid Mechanics, confirmed by the present meeting on complex flows, and I would like to thank Marcel Escudier, Rob Poole and their team of assistants for making all the arrangements here in Liverpool. Looking back, we had a successful meeting on foams and emulsions at Imperial College in December 2007, and would like to thank Simon Cox who made the arrangements. Looking forward, we have meeting on microstructure and rheology scheduled for Leeds in December 2008. Finally, we have been successful in our bid to host the European conference in Cardiff in April 2009. The Non-Newtonian Club has been revived by Jason Stokes, with meetings having been held in Oxford in June 2007 and Port Sunlight in November 2007. I would also like to express our appreciation of the involvement of the rheometer manufacturers, through sponsorship, advertising and exhibiting their systems at the meetings.

I will leave others to report on our awards and publications, and simply conclude by thanking all the members of Council, who serve in a voluntary capacity to keep the affairs of the society ticking over. I would particularly mention Derek Bell, who leaves Council after having been our liaison with those companies who advertise in the Bulletin and on the website, and Bogdan Dobraszczyk, who completes his term of office as Bulletin Editor and is nominated as an ordinary member for election later in this meeting. Thank you all for your work, and I look forward to another successful year.

Phil Banfill

March 2008



**British Society of Rheology
Midwinter Meeting 15th/16th December 2008**

“Microstructure and Rheology”

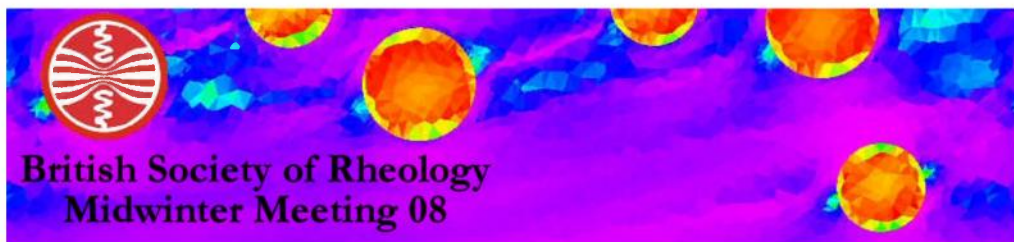
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University of Leeds**



UNIVERSITY OF LEEDS

**Registration Form is on the separate flyer,
or on the BSR website**

Please complete and send to Dr John Embury at
The Polymer IRC, University of Leeds, LS2 9JT



British Society of Rheology (BSR)

Midwinter Meeting 15th/16th December 2008

School of Mathematics

University of Leeds



UNIVERSITY OF LEEDS

“Microstructure and Rheology”

The 2008 BSR Midwinter meeting will provide an excellent opportunity to explore the latest theoretical and experimental research on crystallising, transitional and multiphase materials.

Keynote Speakers:

Wilson Poon, University of Edinburgh – Rheology of Suspensions

Han Meijer, TUE Netherlands – Multiphase Flow

Alexei Likhtman, University of Reading – Reptation Physics

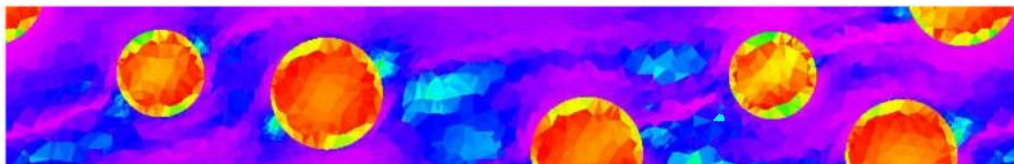
Sébastien Manneville, ENS Lyon – Flow Induced Transitions

Registration details at: www.bsr.org.uk

Special rate for IOP/PPG members. FREE BSR annual membership.

Submission for oral presentations and posters: j.embery@leeds.ac.uk

(Deadline October 1st. Poster Prize offered)



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BSR NEWS

British Society of Rheology Newsletter 2008

The British Society of Rheology continues another successful year, with a strong active and membership. It has held a series of successful national meetings, including a successful Winter Meeting: *The Rheology of Foams and Emulsions*, held on 10-11 December 2007 at Imperial College London's Royal School of Mines, which had a full programme of excellent talks, along with the prizewinners' lectures for both the Annual Award (Gerry Meeten) and the Vernon Harrison PhD Award (Tim Reis) for his work on The Lattice Boltzmann Model for Complex Flows. There were some excellent posters: the BSR-TA Instruments poster prize was awarded to Line Do from the University of Nottingham. Abstracts of her poster on "The impact of some formulation and structural parameters on the viscosity of reduced fat chocolate" and the other presentations are given in the Rheology Bulletin. (<http://innfm.swan.ac.uk/bsr/frontend/publications.asp>)

In March 2008 The BSR/INNFM held a spring meeting on the theme of *Complex Flows of Complex Fluids* at the University of Liverpool. The conference was held in Liverpool to coincide with the city being awarded the title European City of Culture 2008. Distinguished scientists who gave plenary lectures include: A N Beris (Delaware, USA), J Cooper-White (Queensland, Australia), G G Fuller (Stanford, USA), O G Harlen (Leeds, UK), R Keunings (Leuven, Belgium), G H McKinley (MIT, USA), S J Muller (UC Berkeley, USA), J R A Pearson (Cambridge, UK), R I Tanner (Sydney, Australia), M H Wagner (Berlin, Germany). Sessions were devoted to, amongst others, micro-fluidic flows, purely-elastic and inertio-elastic instabilities and turbulence in non-Newtonian liquids. Professor Ken Walters FRS gave a talk about the life and work of J. G. Oldroyd who held the Chair of Applied Mathematics at Liverpool from 1965 until 1982. The BSR Presidential address was delivered at the conference by Professor Phil Banfill of Heriot-Watt University, Edinburgh, both of which will appear in the Society's website (<http://innfm.swan.ac.uk/bsr/frontend/home.asp>)

The BSR has taken on responsibility for the Non Newtonian Club, which is a forum for informal presentations of rheological topics of interest academic and industry-based scientists, as well as young scientists, presenting on a range of topics that involve rheology in a relatively informal and friendly environment. The last meeting of the Non-Newtonian Club was hosted by the Unilever Research and Development centre in Port Sunlight on the 23rd November 2007. This one-day event consisted of a series of lectures by recognised rheologists as well as post-graduate students, with a wide range of subjects and interests represented. <http://innfm.swan.ac.uk/bsr/frontend/nonnewtonianclub.asp>

The BSR website continues to be very successful (<http://www.bsr.org.uk>) and contains news of forthcoming meetings and reports from past meetings, on-line Rheology Reviews and Rheology Abstracts, past issues of the Rheology Bulletin, and the popular 80th Birthday Celebration Essays of Karl Weissenberg.

Bogdan Dobraszczyk

School of Food Biosciences

University of Reading

Whiteknights

Reading RG6 6AP

AIMS OF THE SOCIETY

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

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

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

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

A Report on BSR Mid-winter Meeting December 2007

The 2007 Mid-winter meeting of the British Society of Rheology (BSR) was held at the Department of Earth Science & Engineering, in the Royal School of Mines, Imperial College London on the 10th and 11th of December. The subject of the meeting was the rheology of foams and emulsions, with two aims: to provide a forum for the discussion of new results in the field and to introduce the subject to rheologists used to working with rather more “traditional” materials.

The programme attracted over 50 delegates from a range of academic disciplines and industries. Although the number of people who study the rheology of these highly structured fluids is perhaps small compared to those working with materials of a polymeric nature, it is clear that foams and emulsions are of interest to mathematicians, physicists, chemical engineers and food and materials scientists, among many others, and industries such as mining, petroleum and personal care.

A foam is a complex fluid with a rather precise internal structure: Plateau's rules indicate that soap films always meet three-fold in Plateau borders, the liquid-carrying channels that run between the bubbles. In turn, these borders meet tetrahedrally. The material, although *disordered*, is not *disorganized*. Before proceeding, we should also point out that concentrated emulsions have the same structure and behave in much the same way as foams, and for many purposes may even be preferable. This cellular structure gives an elastic response at low strain, and as strain, or strain-rate, increases, there is plastic yielding and then viscous flow. With the addition of surface chemistry, this is indeed a rich field for research.

The first lecture, given by Jan Cilliers (Imperial) on “How bubbles float the world economy”, emphasized the importance of foams for ore-separation, and thus the effect that foam research can have on wealth creation. Cilliers described model experiments and simulations of the combined liquid, solid and gas motion in a flotation froth as the gangue flows up and over a weir to collect and purify the mineral particles. Although it is difficult to persuade mining companies to implement even the small changes to processes suggested by research, slight increases in efficiency have a remarkable effect on profit. Such improvements are even more worthwhile in the current climate, where the cost of minerals such as copper is becoming ever higher.

The following talk was partly motivated by another industrial application in which foam plays an important role: the use of foams for enhanced oil recovery. Sylvie Cohen-Addad (Paris Est) described the viscoelastic response of aqueous foams containing a proportion of solid particles. Even in the linear regime, the particles increase the shear modulus of the foam, and she described this in terms of a rigidity percolation model. The effect is confirmed by Surface Evolver (SE) simulations on ordered dry foams with solid inclusions.

A related presentation by Tudur Davies (Aberystwyth) described SE simulations of the interaction of circular particles descending through a foam under gravity. As well as stimulating discussion about what the forces are on a particle in a foam, he showed that the discs re-orient their line of centres to be parallel to the direction of gravity, as in elastic fluids.

Another reminder of industrial interest was Pete Wilde's work at the Institute of Food Research in Norwich on the stability of emulsions in foods, motivated by the desire to offer a lower fat product with the same taste. References to the growing obesity problem in the UK led a few of us to regret taking biscuits with our coffee. Wilde demonstrated that the rheology of the interface where the surfactant lies has a significant effect on sensory perception. This is reflected in the change in stability and creaming behaviour of emulsions as surface elasticity varies, although the mechanism for these changes is still not fully understood.

The theme of Richard Buscall's (MSACT Consulting) talk was similar: it is clear that the delay time for the collapse of emulsions and colloidal gels can be controlled, but those who say that the process is fully understood are surely mistaken. Buscall described how weakly attractive systems show a large range of delay times, dependent upon more than just the strength of the interaction.

In a similar manner, as the liquid content of a foam is increased, there comes a point at which the foam yields under its own weight. Ben Embley (Manchester) presented an analysis of what might be called a slump test, based upon the shape of a single Plateau border. The results should be useful in improved predictions of a convective instability, in which wet foams experiencing a constant liquid flow spontaneously undergo circulatory motion.

Two-dimensional (2D) foams, such as can be made by squeezing a foam between parallel glass plates until each bubble touches both plates, are usually considered objects of only academic curiosity. However, there is a great advantage to be gained by being able to see how each bubble is deforming during an experiment, and it is also the case that many 2D effects scale naturally to 3D. Nowhere is the beautiful microstructure of the material more apparent: films meet in threes and are curved in such a way as to indicate the pressure difference between neighbouring bubbles. Moreover, the internal strain can be "read" from an image. That is not to say, however, that 2D experiments are easy to perform.

Philippe Marmottant (Grenoble) showed us that foams and emulsions confined within microfluidic channels have not only high rheological reproducibility but offer a means to develop lab-on-a-chip type testing of small samples of gas or liquid. With applications in the pharmaceutical industry and in the detection of contaminants, this promises to be a growth area of research. Marmottant presented a study of instabilities between two possible bubble structures in a microfluidic device, in which the transition can be controlled with the liquid flow-rate and gas pressure.

For larger samples of 2D foams, further presentations can be divided loosely into shear and expansion. Many studies of this nature rely on foams as a model system for a large range of soft glassy materials. With this in mind, Alexandre Kabla (Cambridge) discussed the fluctuations in bubble velocity in a foam in a wide-gap Couette viscometer. In this geometry the topological changes, known as T1s, are localized close to the moving wall, in what is referred to as a shear band. Kabla presented a model that aims to describe the variation in shear stress for a given velocity profile. Aled Wyn (Aberystwyth) used SE simulations to show that in the linear Couette case, the width of the localized T1 region is proportional to the square root of bubble area disorder, measured through the second moment. Thus, in narrow foams with high disorder the T1s occur throughout the sample and the foam no longer exhibits shear banding. It remains to be seen whether these results apply to foams in a cylindrical geometry.

Kapil Krishan (UC Irvine) suggested that a proportion of these T1s may in some sense be reversible. That is, on reversing the direction of shear in his bubble raft experiment, parts of the foam structure returns to their initial state. This appears to conflict with the idea of topological changes being a manifestation of plasticity in a material, so that there are many avenues still to explore such as the extent to which a so-called plastic event changes the energy landscape of the foam.

Foams are used for explosion suppression, which perhaps inspired the work of Marco Mancini (Rennes): he described simulations and experiments where the area of a bubble in the centre of a large 2D cluster is varied cyclically. The response passes through a transient before reaching a periodic regime in which, as for Krishan, the topological changes are “reversible”. The work also allows a prediction of the length-scale over which perturbations of the foam are dissipated.

The last part of the meeting was an opportunity for the BSR President, Phil Banfill, to award a number of the BSR's prizes. Foremost among these was the BSR Annual Award, given this year to Gerry Meeten of Schlumberger. Meeten gave an entertaining acceptance speech, reflecting on his career as an industrial rheologist (often considered a *rara avis*). He talked about his extension of Maxwell's work on birefringence, and squeeze flow experiments on a number of household products including foams, indicating the importance of micro-structure and wall slip to the interpretation of experimental results.

Another annual prize is the Vernon Harrison award, given to the best PhD thesis in rheology during the year. This year's winner was Tim Reis, who worked with Tim Phillips (Cardiff) on modelling multiphase flow with the lattice Boltzmann method. His prize-winner's address consisted of an extensive demonstration that the method is mathematically rigorous and in good agreement with existing results in a number of areas such as flow past a cylinder and coalescence in two-phase flow.

There were a number of excellent posters exhibited at the meeting, and TA Instruments generously offered a prize for the best. The judges were unanimous in

awarding this to Line Do (Nottingham) for her work on the viscosity of reduced fat chocolate. She gets a travel bursary to attend a conference of her choice.

In conclusion, we thank all the speakers, poster presenters, and the sponsors for making this such an excellent meeting. Finally, we thank Denis Weaire (Dublin) for his entertaining words during the conference dinner, and offer our sincere hope that he didn't leave without his hat!

S.J. Cox, foams@aber.ac.uk

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S. Neethling

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Department of Mathematics

University College London

Gower Street, London WC1E 6BT



The Non-Newtonian Club is an informal rheology discussion group which provides low-cost, informal, one-day meetings which provide an excellent forum for industrial and academic rheologists to meet together informally to present work in progress, raising key needs and concerns, and discussing unresolved practical and modelling issues that may be inhibited at more formal conferences.

The NEXT meeting is to be held at University of Edinburgh on the 3rd of July, 2008, hosted by Job Thijssen (j.h.j.thijssen@ed.ac.uk). If anyone (including PhD students) would like present at this meeting please contact either Job or myself (jason.stokes@unilever.com) as soon as possible.

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

Jason Stokes

XVth International Congress on Rheology

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

The Society of Rheology invites you to participate in the XVth International Congress on Rheology, which will take place in Monterey, California from August 3 to August 8, 2008. The Congress convenes every four years and brings together the world's leading rheologists to present the latest advances and developments in this field. The Congress will include opening and closing plenary lectures, fourteen keynote lectures (including the Bingham lecture) by eminent rheologists, contributed oral presentations organized into sixteen mini-symposia, and a poster session. Two short courses will be offered on the weekend before the Congress, August 2-3, 2008.

In addition to the technical programme, an active social programme is planned which will introduce the participants to the wonderful attractions of the coastal environs of Northern California. <http://www.rheology.org/ICR2008/>

Workshop on Polyelectrolytes

September 17th, 2008

We will be holding a one day polyelectrolyte workshop at Manchester on Wednesday 17 September, 2008. The CCP5 invited speaker is Dr Christian Holm (University of Frankfurt) who is an acknowledged expert on the simulation of polyelectrolyte. As well as dealing with simulation issues we also welcome contributions from theoreticians and experimentalists. We would like to solicit abstracts for talks (approximately 30 minutes) and, on the basis of these, we will compose a program. We aim to start with coffee at 10.0 am and for the workshop to start properly at 10.30 am, finishing around 17.00. Numbers will be limited to around 30 and there will be no registration fee.

If you are interested, please contact:

Dr A.J. Masters (andrew.masters@manchester.ac.uk), School of Chemical Engineering and Analytical Science, the University of Manchester. The list of speakers includes Dr Christian Holm, Dr Xue-Feng Yuan (Manchester), Dr Leo Lue (Manchester) and Dr Aline Miller (Manchester).

INDUSTRY NEWS

Anton Paar

1. Free Copy of Rheology Handbook

Anton Paar are keen to promote the science of rheology, and in the first 6 months of 2008 we have installed an MCR rheometer in at least one University in the UK every month. In order to celebrate this achievement we are offering several copies of "The Rheology Handbook" to BSR members and their colleagues free of charge. This book is written by our own Thomas Mezger and is an ideal reference book for budding rheologists. In order to be entered into the draw for a free book please email: steve.goodyer@anton-paar.com with a brief description of your interests in rheology along with your University / Business address.

2. Strong Rheometer Sales at Anton Paar Leads to New Staff in UK

In order to cope with the increase in orders for rheometers and accessories from the UK marketplace Anton Paar Ltd. have employed Suzanne Darlaston to assist our existing office staff. Angela Meringolo has also joined the marketing department at our Hertford office in order to sustain this growth. Last but not least we welcome Graham Josey in the service department. Graham has attended an extensive training course for servicing Anton Paar rheometers and along with our existing service team will ensure that Anton Paar customers receive excellent support at a reasonable price.

Celsum Technologies

Celsum Technologies now offer Dynisco's range of materials testing instruments, including the LCR7000 Series of Capillary Extrusion Rheometers, the LMI 4000 Series of Melt Flow Indexers, and a range of proven On-Line Rheometers. Also available are Dynisco's HDT/Vicat Test, Limiting Oxygen Indexers, Instrumented Pendulum Impact Testers, and Laboratory Mixing Extruders and Moulders. Said Roy Carter, Celsum Technologies' MD, "We are delighted to have formed a liaison with Dynisco, and the added products greatly extends the scope of solutions that we are able to offer our customers".

Celsum has also formed a liaison with Triton Technology Ltd, and offers Triton's **Humidity Generator and Controller**. This instrument, which is computer controlled via a Microsoft Excel-based program, allows the humidity within a chamber up to approximately 2,000 ml capacity to be controlled to 85% RH at temperatures up to 85°C. This is extremely useful for rheological testing and sample conditioning for a wide range of applications.

Celsum is adding Triton's innovative **identipolQA** instrument, which is described as a hybrid thermal analysis technique developed as a simple, rapid and cost-effective QA test to check product constancy. The instrument is taught to recognise "good" product, and applies an especially-developed algorithm to derive a quotient known as the QIS, or Quality Index Score, which aids statistical process control of product quality, and for speedy evaluation of received raw materials. The **identipolQA** will run a test on just one pellet of sample.

Additionally, Celsum has added some products to their range of strain gauge conditioning instrumentation and strain gauge based sensors. The Zymax IPU 40 lightning protection barrier protects external load cell installations and associated electronics from damage by electromagnetic pulses caused by lightning strikes. Also Mantracourt Electronics new T24 2.4GHz range of radio telemetry instrumentation for strain gauge based devices is now available.

Thermo Fisher Scientific

1. HAAKE MARS - the Most Flexible Rheometer - Once More Proven!

With the 1000s of different research tasks in mind, Thermo Fisher Scientific designed one of the most modular rheometer. There are many reasons why customers need a tailor-made rheometer, for instance to combine very specific research equipment such as special optics, sensors, measurement in original bins and customized research tools and test set ups.

The design of the HAAKE MARS rheometer offers already an inherent flexibility to respond to the daily needs of research departments. Just to name a few examples, a 2 column rheometer design with the chance to mount and implement additional tools as well as all application related components incl. measuring head and the control electronics are interchangeable thus customized solutions can be achieved to meet even the most complex demands.

However Thermo Scientific is also known for very special solution when it comes to high end research applications and offers solutions like the upside-down version of measuring geometry placement of sample and geometry in one radiation Axis,- as part of a Synchrotron set up. One of the latest examples is an individual frame extension by 20 cm for the integration of a customer specific module. Only a few examples where research institutes decided that the flexibility of the HAAKE MARS rheometer is outstanding. Talk to our application specialist team and learn what else is possible!

2. Combined Measuring System

For HAAKE Mars and RheoStress 6000 a user friendly tribology cell is now available to determine the tribology of bearing materials with and without lubricants. The tool is very easy to handle and comes a separate module thus allows the supplement of existing rheometers with the function for tribology measurements.

The Thermo Scientific RheoScope module simultaneously records rheological properties and changes in the microscopic structure of the tested sample at a macroscopic level. Now the RheoScope module is available in two versions. The temperature range of the standard version is -5°C to 120°C. In the high-temperature option the temperature is extended to 300°C. Additional info is provided in the attached data sheet.

More information about HAAKE MARS rheometer, its accessories and application reports can be found from

<http://www.thermo.com/com/cda/article/general/0,2259,1083,00.html>

TA Instruments

1. ARES-G2 Rheometer European Launch

A special gathering of some of the top European rheologists was present at the European launch of the new ARES-G2 rheometer from TA Instruments. The launch, hosted by Professor Jan Vermant and his esteemed team from the highly respected rheology centre of the Katholieke Universiteit Leuven, was a full day introduction to the many technological breakthroughs involved in the development of the very latest in a long line of controlled strain instrumentation.

Chris Macosko kindly started the proceedings and it was fitting that one of the people so fundamental in the first evolution of the Rheometric Scientific history was guest of honour for the unveiling of the very latest generation in the form of the ARES-G2. After five years of redevelopment, updating or indeed redesigning many of the key components, the very latest addition to TA's rheology product line sits at the very highest pinnacle of both performance and technology.

More details about this latest addition to a very successful story can be seen on our website : www.tainstruments.com or at the forthcoming BSR meetings.

2. Small Angle Light Scattering (SALS) Accessory

TA Instruments are proud to announce yet another specialist accessory to our product line in the form a Small Angle Light Scattering (SALS) system.

When electromagnetic radiation such as visible light encounters an object, interference between the radiation and the electrons of the object occurs. The result is a change in the direction of the radiation. The effect is most noticeable when the size of the object is similar in scale to the wavelength of the radiation, in which case the effect is called diffraction, or scattering. The pattern produced by the scattered radiation can be used to gain information on the size, shape, orientation and spatial distribution of the objects responsible for the scattering. Many of the structures produced by surfactant molecules, for example vesicles and wormlike micelles, have at least one dimension in the range that will scatter visible light, and the technique is well suited to their study. The AR SALS option enables scientists to simultaneously observe rheological properties and structural material

characteristics while deforming the sample under precise shearing conditions. This allows one to gain a better understanding of the rheological behaviour of a material.

The system features a patent pending Peltier temperature control system and will enable studies over a q vector range $\sim 1.38\mu\text{m}^{-1}$ to $6.11\mu\text{m}^{-1}$, a scattering angle $\sim 6^\circ$ to 26.8° , whilst the factory aligned laser and compact upper assembly requires minimal adjustment during use. The class 2 laser has an adjustable intensity and can be used with neutral density filters. The camera has variable focus depth and allows the focal point to be adjusted for different geometry gaps, whilst using adjustable polarizer for analysing scattering in parallel or perpendicular to the incident light. Due to the image being focused directly onto camera chip the user environment does not require screening or a darkened room.

Another benefit of this system is that as it utilises the unique SmartSwap™ capabilities of the AR rheometers its compact nature means it can mount directly onto the rheometer without the need to make any other modifications or use of stages or platforms.

Potential applications exist within the personal care products; paints and coatings; pharmaceuticals; polymer solutions; liquid crystalline polymers, biopolymers and foods.

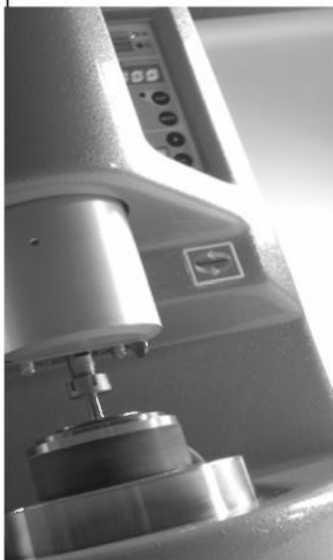
CONFERENCE DIARY

2008		CONFERENCES & MEETINGS
3-8 August Monterey California USA	XVth International Congress on Rheology and 80th Annual Meeting of the Society of Rheology Conference Website: http://www.rheology.org/ICR2008/	
25-29 August Dresden Germany	The 11th Conference on Electrorheological Fluids and Magnetorheological Suspensions Dr S. Odenbach - +49-351-463-32062 +49-351-463-33384 - stefan.odenbach@tu-dresden.de - www.tu-dresden.de/ERMR08	
17 Sept Manchester	Manchester Polyelectrolyte Workshop Dr Andrew Master , School of Chemical Engineering and Analytical Science, The University of Manchester, PO Box 88, Sackville Street, Manchester, M60 1QD. Email: Andrew.masters@manchester.ac.uk	
21-24 Sept Ischia Italy	4th International Conference on Times of Polymers – TOP and Composites Luigi Grassia , Fax: +39 0815010291; E-mail: top2008@unina2.it Conference Web Site: http://www.unina2.it/top	
15-16 Dec Leeds	Microstructure and Rheology - BSR Midwinter Meeting Dr John Embery , School of Physics & Astronomy, University of Leeds, West Yorkshire LS2 9JT. Email: J.Embery@leeds.ac.uk	
2009		CONFERENCES & MEETINGS
15-17 April Cardiff	5th Annual European Rheology Conference (AERC 2009) Prof Timothy N. Phillips , Cardiff School of Mathematics, Cardiff University, Senghennydd Road, Cardiff CF24 4AG. Tel: 02920 874194 ; Fax: 02920 874199 ; PhillipsTN@cardiff.ac.uk http://www.rheology-esr.org/AERC/2009/	
15-18 June Zurich Switzerland	5th International Symposium on Food Rheology and Structure Zurich, Switzerland - Peter Fischer - x41-44-6325349 x41-44- 6321155 - secretary@isfrs.ethz.ch - www.isfrs.ethz.ch	
18-22 October Madison Wisconsin USA	81st Annual Meeting of The Society of Rheology Professor A. Jeffrey Giacomin , Rheology Research Centre, the University of Wisconsin-Madison, Mechanical Engineering Building, 1513 University Avenue, Madison, Wisconsin 53706-1572, USA. Email: giacomin@wisc.edu . Conference website: http://rrc.engr.wisc.edu/sor2009.html	
2010		CONFERENCES & MEETINGS
29-31 March Lake Vyrnwy Wales	Institute of Non-Newtonian Fluid Mechanics Easter Meeting	
11-16 July 2010 Glasgow	IUPAC 2010 World Polymer Congress (Macro2010) Contact: Professor Peter A. Lovell, School of Materials, the University of Manchester, email: pete.lovell@manchester.ac.uk ; Tel: +44(0)161 306 3568; Fax: +44(0)161 306 3586.	

2008		COURSES
October Nottingham University	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	
2009		COURSES
13-16 Jan Glasgow Scotland	Process Rheology: For further information, contact Dr N E Hudson, Dept of Pure & Applied Chemistry, University of Strathclyde, 295 Cathedral Street, Glasgow G1 1XL. Tel: +44 141 5482162; Fax: +44 141 5484822; e-mail: n.e.hudson@strath.ac.uk	
2-5 Jun Glasgow Scotland	Process Rheology: For further information, contact Dr N E Hudson, Dept of Pure & Applied Chemistry, University of Strathclyde, 295 Cathedral Street, Glasgow G1 1XL. Tel: +44 141 5482162; Fax: +44 141 5484822; e-mail: n.e.hudson@strath.ac.uk	



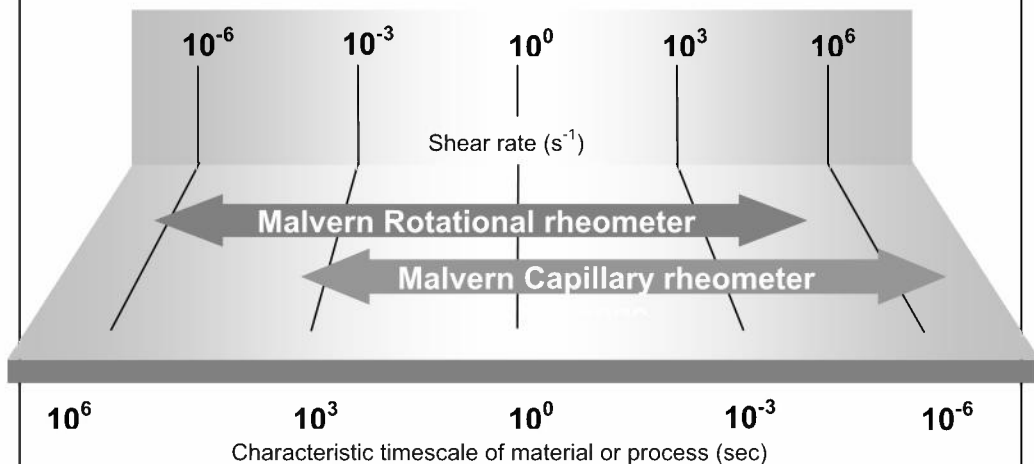
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