
THE BRITISH SOCIETY OF RHEOLOGY



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CONTENTS

Editorial	99
BSR News	
BSR Annual Award Citation 2005: Russell Davies	101
The Vernon Harrison Annual Doctoral Prize 2005: Roel van Os	104
The Vernon Harrison Annual Doctoral Prize 2006: Call for Entries	105
Commentary on 313 th BSR Council Meeting, University of Wales Swansea on 15 th December 2004	106
BSR Midwinter Meeting, University of Cambridge, 8/9 th December 2005	108
Aims of the Society	110
Karl Weissenberg - The 80th Birthday Celebration Essays	111
Non-Newtonian Club News	117
Book Review: Introduction to Polymer Viscoelasticity 3 rd Edition, Montgomery T. Shaw & William J. MacKnight	120
Rheology Reviews 2005	121
Conference Announcements	123
Industry News	135
Conference & Course Dairy	144

Hon Editor:

Dr Bogdan Dobraszczyk
School of Food Biosciences
The University of Reading
Whiteknights, Reading RG6 6AP, UK
b.dobraszczyk@reading.ac.uk

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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, *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 April 2006 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 a splash of liquid generated when a droplet of a fluid impinges on a sea of the same fluid. This was named “crown of thorns” when the phenomenon was first photographed by Edgerton in 1954.

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

BSR Annual Award Citation 2005

Russell Davies

Russell Davies has been identified by the BSR as someone who has made a significant contribution to the development of computational and theoretical rheology, particularly inverse problems in linear viscoelasticity.

After graduating from the University of London (Kings College), Russell went on to Cambridge to study Part III of the Mathematical Tripos at DAMTP. His postgraduate career was spent at Balliol College, Oxford where he studied Numerical Analysis. In 1973 he was elected to the Atlas Research Fellowship in Mathematics at Oxford, which was a joint appointment at Pembroke College and the Rutherford Appleton Laboratory. During this period he developed novel resolution enhancement methods in the imaging of crystallographic structure in proteins and other macromolecules.

He returned to Wales in 1976 taking up a Lecturership in Applied Mathematics at Aberystwyth and joining the Non-Newtonian Fluid Mechanics Research Group of Ken Walters. While maintaining his interests in inverse problems and the mathematics of imaging, he collaborated with Ken Walters and Marcel Crochet to write a research monograph in the nascent area of Numerical Simulation of Non-Newtonian Flows. He was promoted to a Personal Chair at Aberystwyth in 1990.

His most significant contributions have been in the area of inverse problems in linear viscoelasticity. His ground-breaking work with Bob Anderssen on the determination of the relaxation spectrum of a fluid highlighted the limitations imposed by measurements of the dynamic moduli over a limited range of frequencies. This work discredited the popular rheological folklore that information about the dynamic moduli over a prescribed frequency range yielded information about the spectrum over the reciprocal frequency range. In a result that has become known colloquially as the ' $\pi/2$ theorem', he showed that the relaxation spectrum is determined on a shorter interval of relaxation times, the end points of which are functions of $\pi/2$ and the limits of the frequency window. He championed sampling localization using moving average formulae to determine the relaxation spectrum as an alternative to the standard regression strategies employed.



Russell receives the Annual Award from the President

In work with Rhodri Williams a dimensionless wave number was proposed as an alternative measure of relaxation properties of a viscoelastic medium. The wave

number and its derivatives are easily calculated from direct measurement of the phase and group velocities in a Virtual Gap Rheometer. Russell established new mathematical relationships which connected the traditional relaxation spectrum to the wave number and its derivatives. The use of the VGR as a differential spectrometer in this context is advantageous in collecting highly accurate data.

Russell has also made contributions to the analysis of the corner singularity for viscoelastic flows of corotational Maxwell and Oldroyd B fluids.

Russell moves to Cardiff University in February to take up the Headship of the School of Mathematics. Therefore, as we celebrate, with the BSR Annual Award, Russell's past scientific achievements we look forward with anticipation to his future contributions.

Tim Phillips



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Vernon Harrison Doctoral Prize 2005

Dr Roel van Os (University of Wales Aberystwyth)

Roel van Os is a graduate of the Technical University of Delft and the University of Wales Aberystwyth. He completed his thesis on 'Spectral Element Methods for Predicting the Flow of Polymer Solutions and Melts' in the Complex Fluids Group at Aberystwyth under the supervision of Professor Tim Phillips in 2004.

His thesis was concerned with the use of spectral element techniques to solve the equations of viscoelastic fluid mechanics for two-dimensional time-dependent flows. The thesis concentrated on developing the numerical methods required to solve the equations and compared a number of different strategies. The novelty in the numerical development was in the construction of a new set of basis functions for problems with an axis of symmetry, the stabilization of the spectral element method for large values of the Weissenberg number using a locally upwinded scheme and the development of the first high-order approximations to both single and multi-mode versions of the XPP model for branched polymer melts.



Dr van Os receives the Award from the President

The major achievement of the thesis is that it succeeds in its aim of using spectral elements to solve the flow of a polymer melt described by a new class of constitutive equations called "pom-pom" models. While some calculations using the pom-pom model have been reported in the literature, this thesis is the first to

use the spectral element technique to solve these equations. In addition, this thesis focuses on the issues of how the equations should be solved numerically.

The major conclusions of the thesis have recently been published in a series of papers in the Journal of Non-Newtonian Fluid Mechanics and the Journal of Computational Physics. The Adjudicating Committee believed this is a high quality piece of work in computational non-Newtonian fluid mechanics that Dr Roe van Os is worthy of the Vernon Harrison Doctoral Prize.

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.

Entries are now invited for the 2006 award. The prize will be £500, an illuminated certificate and a copy of Rheology Reviews 2006. 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 2005 and 31st August 2006 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 2006** 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*

Commentary on the 313rd Meeting of the Council of the British Society of Rheology

School of Engineering, University of Wales Swansea on 15th December 2004

The 313rd Meeting of Council was held on the morning of 15th December 2004. With the Winter Meeting of the Society scheduled to start that afternoon and with lunch planned for 12.30pm an early start was essential if all the business was to be completed.

Two items have dominated discussions at recent Council Meetings, these being the inauguration and future of Annual Rheology Reviews and the development of the Society's website. The overriding concerns of Council are to support the development of Rheology in the UK and to offer something of value to the membership of the Society.

Rheology Reviews has been an unqualified success in terms of the quality of the articles that have appeared in the first two issues. Yet, despite its moderate price tag sales so far have not been sufficiently high to offset the publication costs. This issue was of some concern to Council. Council affirmed its support for the venture since it provided a service to the membership and the rheological community at large. However, it was also conscious of the potential financial drain on the Society's reserves. After a lengthy discussion, Council made a commitment to support Rheology Reviews for at least a further two issues (2006 and 2007) but that the publication would have to operate within a tighter budget to ensure its future viability. It is important that all concerned with the Society should market the publication as best as possible and bring it to the attention of colleagues at home and abroad.

Those who have visited the Society's website recently will have noticed the major improvements that have taken place. The website provides a service to members by showcasing its activities and providing links to other rheological websites that may be of interest to members. Council is always looking for ways of improving this aspect of the Society's work so if you have any suggestions please pass them on to a member of Council. You will find a list of these on the website.

Council is keen to support the younger members of the UK rheological community. Part of the Vernon Harrison Bequest was used by the Society to inaugurate a Doctoral Prize Competition in 2003. The prize for 2004 was awarded to Dr Sally Everitt from the University of Leeds. New procedures for applications for student travel bursaries to allow students to attend relevant rheological conferences to present their work were agreed and details of these now appear on the website.

With the decision on the venue of AERC 2007 to be made in Grenoble in April 2005 plans were moving ahead with the Society's bid to host the meeting in Cardiff. The European Rheology Conference takes place on an annual basis except that it does not take place in 'Olympic' years so as not to coincide with the International Congress. Whilst on European matters, it was reported that Mike Webster had been proposed as the next Treasurer of the ESR and that Roland Keunings had been chosen as the recipient of the next Weissenberg Medal.

Our Membership Secretary, Mike Webster, reported that the Society's preferred method of payment for subscriptions was now by Standing Order – this was thought to be more efficient than payment by credit card or PayPal – and this method of payment would be given greater prominence on the Society's website. The President, Geoff Maitland, made a strong case for the appointment of a Marketing Manager to meet the targets we have set ourselves for generating income from advertising and Rheology Reviews, etc. and a job description for a marketing co-ordinator would be brought before the next Council. With reluctance Council accepted Gary Tucker's decision to stand down as Abstracts Editor and he was thanked for his sterling efforts over the last few years. Nick Hudson volunteered to takeover from Gary and Council gave its rapid and enthusiastic endorsement.

With the clock ticking on and lunch having started, Council found little appetite for Any Other Business and adjourned its business until its next meeting in Wales in March.

Tim Phillips

The 316th Council meeting was held at Pembroke College, Cambridge, on 8th December 2005. Most of the Council took dinner together on the previous evening, as seen below.



**BSR Midwinter Meeting.
Multiscale Rheology
Department of Chemical Engineering
University of Cambridge
8/9th December 2005**

Over fifty delegates attended a lively meeting at Cambridge where rheology at all levels of length scales was examined and in addition, more by accident than design, there was a good blend of modelling and experimental papers. Professor Ken Walters, (Aberystwyth University) started proceedings with a interesting lecture on “The demise of Continuum Mechanics?” This was a thought provoking starter and raised questions as to whether we can expect future breakthroughs in this field of rheology. Prof David Hayes (Surrey University) then described suspension rheology as being controlled by the interparticle potential and his modelling explored the effect of different interparticle force fields. Dr Gerry Meeton then brought us into the laboratory framework with a

description of his nice squeeze flow experiments on a range of household fluids. His model worked well for most of his yield stress fluids, but when gap length scale reached the 10 of micron scale, strange things happened to the observed experimental results.

Prof Sir Sam Edwards (Cambridge) treated us to one of his great lectures starting by saying “that before you do rheology you need to understand the equilibrium state”! He then went on to describe how he and others are applying statistical mechanics to the interparticle forces between granular materials. Jason Stokes (Unilever, Colworth House) then came racing back to experimental high shear rate rheology, where he too was experiencing unexpected results when rheometer gaps became small. Finally, on the first day of the meeting, Kris Coventry of the home team presented recent Cross Slot experimental results on different molecular architecture polymers including monodisperse and branched polyethylenes.



The second day started with a grand “Tom Mcleish” overview of the current state of the art relating to both the linear and non linear behaviour of flexible polymers with different molecular architecture. This was followed by a double act of Salvatore Mascia and Milan Patel (Chem Eng Cambridge) who described experimental paste squeeze flow work and matched some of the data with an analytic model developed some years ago by Petrie and Pearson. Prof Russell Davies (Aberystwyth) then received the BSR Annual award and gave a lecture on Linear Viscoelasticity and how one experimental procedure was capable of obtaining both the relaxation and retardation spectra. He gave a memorable

quote in the lecture “that all lectures should include at least one theorem”! This was followed by Prof Malcolm Mackley (Cambridge) where he described recent experimental results on carbon nanotube suspensions. He put forward a “belief” as to what was happening within the material and during questions it was suggested a “conjecture” would be a more appropriate term. Finally Dr Roel van Os, as the BSR recipient of the Vernon Harrison best PhD prize, gave an impressive lecture on his work of applying spectral element methods to viscoelastic flow problems. The meeting was held in a lively and positive spirit with many delegates actively engaging in discussion. Hopefully a future Midwinter meeting will be repeated at another venue in December 2006.

Malcolm Mackley 1 January 2006

AIMS OF THE SOCIETY

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

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

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

Karl Weissenberg - The 80th Birthday Celebration Essays

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



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

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

Preface

It is a fitting tribute to the extent of Karl Weissenberg's influence that this work to celebrate his eightieth birthday, which falls on the eleventh of June, nineteen hundred and seventy three, should emanate from a Department of Mechanical Engineering in a University in Africa, which is at once physically remote from his own working environment and scientifically removed from his academic training.

Karl Weissenberg has had two distinct lives in the scientific world and in each he has made far-reaching contributions to different branches of science as the various authors in this volume make clear.

The idea of celebrating his birthday in this way came to me whilst working in Britain, and it was born out of the realisation that some of those who had been intimately connected with him in professional life and understood at least in part the extent and nature of his contributions were passing into retirement. It seemed an opportune moment in time to obtain their first-hand impressions, and indeed if a record of them was to be compiled at all, then no time should be lost in drawing suitable work from the pens of these authors. The majority of the authors have been selected on the principle that they have worked at first hand with Weissenberg and are therefore in a special privileged position to comment on the extent and nature of his work. The remaining authors have a particular interest in his work.

A peculiar problem associated with obtaining a comprehensive survey for this volume has been that even those who have worked with Karl Weissenberg, or who have a particular interest in his work are, for the most part, unaware of the full extent of his contributions in science. A particular example may be quoted; in good faith an acquaintance of Weissenberg's of many years standing and who

is especially interested in his work in Rheology wrote offering a list of his publications with the message that it might well constitute a complete list of his publications in this field: there were seventeen items in it altogether. This number may be compared with the list contained in this volume, which is authoritative. No doubt many will learn for the first time the range of work covered and it may well come as a surprise that the list in Crystallography is longer than that in Rheology.

Weissenberg, the last person who would show an imposing or inaccessible front to the world, has often been completely underestimated both in the range and importance of his work. It is unfortunately true at the present time that to present a moderate attitude is to ask to be brushed aside in the struggle for plaudits even in the supposed impartial world of science. Therefore, it is not possible to record that the support which a subject merits, such as the present, is always forthcoming. Weissenberg has always had time and patience to answer with courtesy and at length, the letter on a scientific subject from an unknown and insignificant person. There is no doubt that his high standards in science are matched by equally high moral standards. Perhaps that list of publications would be even longer were this not the case. He is notable in scientific achievements and noble in personal qualities.

During the last three decades the name of Weissenberg has become familiar in Rheology, although like an iceberg only a part of the presence is explicit, the remainder is not visible to the casual observer's unaided eye. There are fundamental ideas, of which he is the source, that are pervasive and implicit in most of the published work on visco-elastic liquids. For example, the occurrence of finite elastic strain in flowing liquids and the corresponding tensile stress in simple shear flow for which the present author found unmistakable and direct evidence (Nature, Lond., 1961, 190, 993).

In his paper entitled "Abnormal Substances and Abnormal Phenomena of Flow" presented to the International Congress on Rheology in Holland, 1948, Weissenberg explicitly introduced the concept of a coordinate system embedded in the deforming material, a theme taken up at a later date by J. G. Oldroyd and termed a convected coordinate system. In the same paper Weissenberg showed experiments in which sheet rubber material samples were subjected to an initial deformation (and therefore boundary stress), fixed in space, whilst the rubber sheet was subsequently rotated inside the fixed boundary. This was an experimental demonstration of the rotational part of the motion undergone by the convected coordinate system.

The authors of papers on Rheology who have contributed to this volume wish to record other facts than those mentioned above which verify that Weissenberg

has a deep and sensitive appreciation of the essence of a range of natural phenomena. Certainly, in the field of Rheology his contributions have been of a pioneering nature and are more influential than many might suppose.

Prior to his work in Rheology, Weissenberg had made contributions in a distinctly different field of science. In Crystallography the Weissenberg Goniometer is known and used throughout the world and in itself would have been sufficient to secure fame for the originator. So distinct at the present time are the subjects of Rheology and Crystallography that I believe few Rheologists have even a remote idea of Weissenberg's contributions in Crystallography. No doubt the same applies to Crystallographers in relation to Rheology. This work is intended to elucidate and confirm his place in the founding era of both these branches of science. His dual role has indeed been exceptional.

A debt is due to all the authors represented in this volume for their generous and esteemed contributions. Also to the East African Literature Bureau, especially in the person of Mrs. R. Mwangi, for the kind help given in publishing and distributing this work. For my own part, nothing could have given greater pleasure than to assist in paying tribute to a man who will no doubt be remembered long after many of us have been forgotten.

John Harris, University of Nairobi, April, 1973.

Biographical Notes on Karl Weissenberg

Karl Weissenberg was born in Vienna (Austria) on the 11th of June 1893 and he has lived a long life under varied conditions. Already before his University studies he attended 14 different schools in Austria, Germany and France. He took his matriculation in Frankfurt a / Main at the age of 16 ½ years.

He studied at the Universities of Vienna, Berlin and Jena, taking Mathematics as his main subject with Physics and Chemistry as subsidiaries and - for good measure - a little bit of Law and Medicine. In 1916 he got his Ph.D. (Mathematics) in Jena, and became a Privat-Dozent and later a Professor of Physics at the University of Berlin.

His teaching and research activities covered an unusually wide field. As a teacher he held professorships and guest professorships in four different sciences, viz, in Physics at the Universities of Berlin and Southampton, Physical-Chemistry at the University of Paris, Civil Engineering and Engineering Mechanics at the Columbia University in New York, and Human Anatomy at the Medical School in South Carolina.

As a research-worker he published over 70 original papers on the most varied subjects, including in his mathematical papers new ideas about the analysis of Symmetry-Groups and about Tensor and Matrix algebra, while in his medical papers he worked out new methods for the measurement of blood-circulation, for the dosimetry of X-rays in the treatment of cancer, and for the localisation by X-rays of foreign matter in human bodies. Particularly successful was his work in Physics. He used his mathematical theories about the analysis of Symmetry-Groups for a symmetry classification of polycrystalline solids, and for a molecular theory of single crystals. Combining theory with experiments he developed methods for the determination of the constitution and structure of solids of all kinds. The methods culminated in the design of an instrument, known in the literature as the 'Weissenberg X-ray Goniometer', and used all over the world in crystallographic research laboratories. This instrument allowed for the first time a unique determination of the structure in all three dimensions of space.

Parallel with all this work one finds his interest directed to the field of Rheology. Here his theories allowed him to predict various effects with a paradoxical appearance and to verify them experimentally. Best known here is the so-called 'Weissenberg Effect'. According to this effect one finds that elastic and visco-elastic materials subjected to torsional movements by a rotating rod develop radial forces which make them climb up on the rod. Before Weissenberg's work one knew only centrifugal forces generated by movements.

He designed a new type of measuring instrument, known in the literature as the Weissenberg Rheogoniometer, which allowed for the first time to measure in the flowing material the movements and forces and their developments in time in all three directions of space. It is widely used for the determination of the strength of materials with respect to their elasticity, viscosity, relaxation, etc. In order to account for the similarity in behaviour of visco-elastic materials he introduced a dimensionless constant, known as the "Weissenberg number".

He applied his research to diverse practical, technological and medical problems including on the one hand the working of metals in drawing of wires and in rolling of sheets, and on the other hand the manufacture of a new type of artificial silk, finer and stronger than natural silk. Of special importance was his application to the study of the changes of the flow properties of blood in various diseases.

The combination of his new theories with fascinating demonstration experiments made him a much sought-after lecturer, so much so that he was invited as Guest of Honour to give introductory lectures at many big international congresses including one on Textiles and some on Microcirculation of blood and on Technological Rheology.

Important though his activities were as research worker and teacher his main work was yet in another sphere in which he acted as administrator and scientific advisor. In Germany he acted in this capacity as a member of the Scientific Council of the Kaiser Wilhelm Gesellschaft and as an advisor to its various research institutes and to the big industries, including Siemens & Halske, I. G. Farben and Rhodiaceta. Later, in England, he was advisor to diverse Ministries, to the Atomic Research in Harwell, to the Royal South Hants Hospital, to Gillette Industries, Sangamo Controls Ltd., etc.

For many years he regularly travelled to the U.S.A. for several months to have short time consultancies with Hospitals, Universities, Government Departments and Industries including Shell, Dupont and American Oil.

He received many academic honours. In addition to the four professorships at the great Universities he was elected as:

- Scientific Member of the Kaiser Wilhelm Gesellschaft and to its Institute of Physics.¹
- Fellow of the Institute of Physics, London.
- Fellow of the Physical Society, London.
- Hon. Physicist Royal South Hants Hospital, Southampton.
- Duddell Medal² Phys. Soc., London.
- Life Member of the Royal Institution, London.
- Hon. Associate, University of Southampton.
- Fellow of the New York Academy of Science.
- Fellow of the World Academy of Arts and Science.
- Corresponding Member of the Puerto Rican Academy of Arts and Science.
- Life Governor of the Royal Hospital & Home for Incurables, London.
- Hon. Member of the British Society of Rheology.
- Hon. Member of the European Society of Microcirculation.
- Hon. Member of the British Society of Microcirculation.

1. This was a special honour which he shared only with A. Einstein and M. von Laue.

2. Highest British award for the design of a new type of scientific instrument.

Dr. H. B. Seebohm



The Non-Newtonian Club has met three times since the BSR took on responsibility for its organisation in 2004. A report on the most recent meeting is given below. As a result of comments made at that meeting and discussions at the last BSR Council, it was agreed that a 4-6 month interval between meetings was appropriate and that, if possible, meetings should take place at industrial venues but not exclusively so. It was felt that the format of the meetings and their informal nature should be maintained and that they should be seen as clearly distinct in style from other established meetings. It was also suggested that one of the sessions at each meeting could be used by 'young' rheologists to present their work. The next meeting is planned to take place in May and will be supported by Stable Micro Systems (thanks to Harry Schimanski for arranging this). Further details will appear on the NNC pages on the BSR website in due course.

Comments and suggestions on future venues and topics for the NNC are welcome and can be sent to either Jason Stokes or to me.

Report on the Meeting held at the University of the West of England, Bristol, Wednesday, 2nd November, 2005

This meeting was held in the Department of Mathematical Sciences at UWE and local arrangements, lunch and other refreshments were organised by Dr Kevin Golden. The usual pattern of two talks before lunch and two after was followed and the informal atmosphere led to lively interaction between speakers and members. The four talks are summarised below.

Prediction of the Shape of Viscoelastic Jets including the Inverted Siphon Dr Ralph Oliver University of Birmingham

Ralph began by explaining how viscoelastic jets may be formed by suction or by winding and described how the inverted siphon operated. The object of the talk was then to show how, by combining terms representing the momentum, flow

rate and stretching force, a simple mathematical model could be formed to describe the shape of the jet. Two key components in the force balance were the elastic term, which was modelled as a rubber-like solid, and a viscous term based on extensional viscosity. In the case where the jet is vertical a gravitational term must also be included.

Comparison of the model predictions with published data showed that different terms dominate at high and low jet velocities and that the model for the viscous contribution to the force balance required refinement. An expression for the viscous contribution to the force balance was proposed in which strain, rather than strain rate, was the dominant variable. Comparison of the subsequent predictions with Ralph's own data on polyisobutylene in dekalin and other data showed that the inclusion of this term led to very good agreement.

Rheology and Heat Transfer in Food Process Design
Professor Ulf Bolmstedt
Tetra Pak Processing Component (Sweden) & University of Lund

Ulf's broad ranging presentation described the effects of rheology in the food processing industry. He touched on the wide range of food products that are processed and the need to measure rheological properties in complex flows involving liquids containing particles and fibres was stressed. The heart of the talk focused on the food processing industry's use of a variety of heat exchangers and the information needed to produce the most efficient heating of the liquid food and the avoidance of, for example, stagnation areas in the flow. The use of CFD to improve design in these areas was also discussed and supported with results from a collaborative project involving Tetra Pak, CCFRA and the University of Plymouth. This was followed by a detailed review of the wide range of viscometers available for use with food products and their applicability to different cases. In particular, recent work using a mixer viscometer and the concept of an 'equivalent Couette viscometer' was described.

Rheological Aspects of Paper Coating
Dr John Husband
Paper Research Group, Imerys Minerals Ltd

This presentation was concerned with the coating of paper, describing the types of coating used and the various methods for applying the coating to the paper. Coating paper adds value to it as the quality is improved. The surface of uncoated paper consists of fibres with holes between them into which the ink disappears. Coated paper provides a much better surface on which to print, as the ink layer remains on the surface, leading to improved appearance and feel. The coating layer is typically 10 microns deep and the coating pigment is based on either kaolin or calcium carbonate. The pigment variables affecting the

rheology of the coating are the formulation, the particle size distribution the particle size distribution and the particle shape. The coatings are shear thinning over eight orders of magnitude and can be subjected to high shear rates in certain coating methods.

Four coating methods were described: i) Blade Metering, ii) Metering Size Press, iii) Spray Coating, iv) Curtain Coating. The physical impact of coating on the paper is reduced from (i) to (iv), leading to fewer breaks and allowing lower cost paper to be used. The operation of each of the methods and their effect on various factors such as coating evenness, coverage, smoothness, contact/non-contact application, production speed etc, were described. The relative benefits of each method were explained and conclusions drawn as to their suitability for industrial application. In particular, it was also noted that the price of printed paper is reducing due to technological changes leading to reduced production costs.

Texture Analysis for Rheologists

Mr Harry Schimanski

Stable Micro Systems

Harry gave a very entertaining and thought provoking talk which stimulated much discussion. He described an instrument which could be used to provide an analysis of the texture of a wide range of materials. This instrument could be used to give qualitative texture information which included gripping ability, hardness, fracture, adhesion, resilience, springiness, stringiness and gumminess. It was interesting to note that it could provide data on the firmness of TESCO chickens and could quantify the difference between butter and margarine! This instrument does not provide results in terms of the underlying rheology of the material but is a useful tool for comparing different materials but not necessarily the same product with different formulations. However, data was presented for both raw and coated Turkish delight and the results were shown to be significantly different. The instrument analysis is based on well documented sensory panel information and it was shown that the instrument could provide qualitative data for a wide range of materials. As an aside, the flow behaviour in this instrument could provide a wide range of complicated deformation problems for academics to get their teeth into.

Phil James
phil.james@plymouth.ac.uk

BOOK REVIEWS

Introduction to Polymer Viscoelasticity 3rd Edition

Montgomery T. Shaw & William J. MacKnight

2005. £57.50. 316 pages. John Wiley & Sons Inc., Hoboken, New Jersey, USA.
UK Publishing Office: The Atrium, Southern Gate, Chichester, West Sussex,
PO19 8SQ, UK. ISBN 13: 978-0-471-74045-2; ISBN 10: 0-471-74045-2.

Because viscoelasticity affects the properties, appearance, processing, and performance of polymers such as rubber, plastic, and adhesives, a proper utilization of such polymers requires a clear understanding of viscoelastic behaviour.

Now in its third edition, *Introduction to Polymer Viscoelasticity* remains a classic in the literature of molecular viscoelasticity, bridging the gap between primers on polymer science and advanced research-level monographs. Assuming a molecular, rather than a mechanical approach, the text provides a strong grounding in the fundamental concepts, detailed derivations, and particular attention to assumptions, simplifications, and limitations.

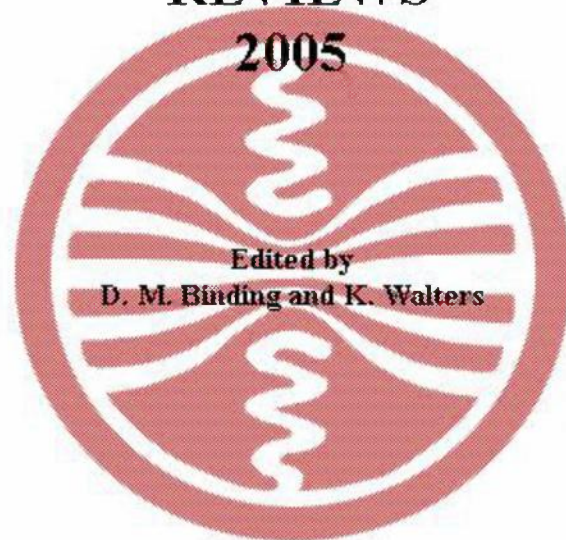
This *Third Edition* has been entirely revised and updated to reflect recent developments in the field. New chapters include:

- Phenomenological Treatment of Viscoelasticity
- Viscoelastic Models
- Time-Temperature Correspondence
- Transitions and Relaxation in Polymers
- Elasticity of Rubbery Networks
- Dielectric and NMR Methods

With detailed explanations, corresponding equations, and experimental methods, supported by real-life applications (as well as the inclusion of a CD-ROM with data to support the exercises), this *Third Edition* provides today's students and professionals with the tools they need to create polymers with more desirable qualities than ever.

RHEOLOGY REVIEWS

2005



THE BRITISH SOCIETY OF RHEOLOGY

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

The first issue (2003) contains 6 reviews in 233 pages covering over 560 references. It covers the following areas: the rheology of filled viscoelastic systems (Howard A Barnes); non-equilibrium thermodynamics (Anthony N Beris); the rheology of mobile interfaces (Gerald G Fuller); compressive rheology (Ross G de Kretser, David V Boger and Peter J Scales); finite element methods for integral viscoelastic fluids (Roland Keunings) and the modelling of entangled polymers (Tom C B McLeish).

The second issue (2004), containing 7 reviews in 223 pages and incorporating over 680 references, covers the following areas: Failure and recovery processes in polymer melts (Yogesh M Joshi and Morton M Denn), the rheology of food dispersions (Crispulo Gallegos, José M Franco and Pedro Partal), micro-macro simulation using models based on kinetic theory (Roland Keunings), the dynamics of liquid drops (Stefano Guido and Francesco Greco), drag reduction in turbulent flow of polymer solutions (Michael D Graham), breakup of non-Newtonian liquid jets (Michael Renardy) and flow past spheres and bubbles (Bruce Caswell, Octavio Manero and Baltasar Mena).

The 2005 issue contains 5 reviews in 240 pages and incorporates over 650 references. It covers the following areas: Visco-elasto-capillary thinning and break-up of complex fluids (Gareth H McKinley), rheology of solid polymers (Igor Emri), rheology and morphology development in immiscible polymer blends (Peter Van Puyvelde and Paula Moldenaers), bubble dynamics and cavitation in non-Newtonian liquids (Emil A Brujan and P. Rhodri Williams and applied rheology in the protective and decorative coatings industry (Richard R Eley).

Rheology Reviews cost £25 per copy (£5 discount for members of the BSR)

ORDER To: Dr. David M Binding, Institute of Mathematical and Physical Sciences, University of Wales Aberystwyth, Ceredigion, Wales, SY23 3BZ, UK Tel: 44 (0)1970 622775, Fax: 44 (0)1970 622777, E-mail: dmb@aber.ac.uk
Purchases may be made on-line. For details, please visit the BSR web site:
<http://www.bsr.org.uk/>

CONFERENCE ANNOUNCEMENTS

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 last 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

Title.....

Surname

Forename(s)

Organization

Full address

.....

Tel Fax Email

- ☐ 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.
- ☐ I shall be accompanied by and I enclose a cheque for £100 made payable to the University of Wales Institute of Non-Newtonian Fluid Mechanics.
- ☐ I wish to present a paper and I enclose an Abstract.

Please return this form to:

Professor P. Rhodri Williams,
Institute of Non-Newtonian Fluid Mechanics,
School of Engineering,
University of Wales Swansea
Singleton Park, Swansea SA2 8PP U.K.

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
-

Please submit your abstract by January 10 via the web: <http://www.rheology.esr.org/AERC/2006>

**22nd Annual Meeting of the Polymer Processing Society in
Yamagata, Japan**

22nd annual meeting of the Polymer Processing Society (PPS) is being cosponsored by the The Society of Rheology, Japan and Yamagata University. This important meeting will be held July 2-6th, 2006 in Yamagata, Japan. The conference will provide an opportunity to meet and interact with an influential global audience involved in polymer rheology and processing.

Details of the meeting can be found at <http://www.PPS-22.com/>

UK Polymer Users Meeting 2006

TA Instruments' remains committed to new technology innovation and highlighting new areas of application for Thermal Analysis and Rheology techniques and as a result are proud to announce details of a UK meeting for people interested in the characterisation of polymers. The meeting will cover latest techniques and methods for material's characterisation and will take place at the Hilton Hotel, Leicester on 7th & 8th March 2006.

Sessions will include:

- 'Smaller, Faster, Smarter - Use of Novel Techniques (e.g. Infra-Red TGA, Nano Rheology, DMA of Powders and Liquids) to Characterise Advanced Materials on the Micro and Nano Scale.'
- 'Process and Material Induced Properties - Characterisation by Thermal Analysis and Rheology.'
- 'Standards and Calibration - An Overview of Some of the Standards and Calibrants Available for the Characterisation of Polymers by Thermal Analysis and Rheology'

Presentations will be given by leading Academics and Industrialists, together with Applications Specialists from TA Instruments.

Registration, which will include accommodation on 7th March, all meals and full course materials, will be £160 (inc. VAT), with a 20% discount for students. Numbers of places are limited so please register your interest ASAP to avoid disappointment. To guarantee your place please email: info@taeurope.co.uk.

**The 11th New Industrial Chemistry and Engineering (NICHE)
Conference**

**Advanced Polymers: Developing High-Performance Polymeric
Materials for the Future**

February 5 - 8, 2006

**Yacht and Beach Club at Walt Disney World, Orlando, Florida,
USA.**

Don't miss this opportunity to participate in an intensive discussion among leading researchers at the intersection of bio-based polymers, blends, and nanocomposites technologies. You will learn about the current state of research in each of these important areas, and then discuss developments that will lead to new materials with the properties needed to meet tomorrow's challenging performance requirements in both civilian and defense sectors.

Join us as we explore this important field in a meeting format and setting with limited participation (80 to 100 participants) that will provide plenty of opportunities to get to know key industrial, government, and academic leaders. The single-session format, with morning and evening sessions, provides common ground for formal discussions during sessions and informal interactions during meals, poster sessions and free afternoons.

With the conference location within Walt Disney World, you can bring your family and take advantage of all the attractions, without missing out on any conference activities.

SPEAKERS AND TOPICS

Dr. Paul Andersen

Process Technology and New Development, Coperion Corporation

*Blends, Alloys and Nanocomposites: Enhancing Performance through the
Confluence of Chemistry and Compounding*

Professor Lawrence T. Drzal

Department of Chemical Engineering and Materials Science

*Composite Materials and Structures Center, Michigan State University Bio-
based Polymer Composites: Opportunities and Challenges*

Professor Richard Gross
Department of Chemical and Biological Sciences and Engineering
Polytechnic University
*New 'Green' Processes and Products by Enzyme-Catalyzed Polymer Synthesis
and Modification Reactions*

Professor Rakesh Gupta
Department of Chemical Engineering, West Virginia University
Wood/Plastic Composites

Dr. Barbara Karn
US EPA, ORD, NCER
Environmental Implications Of Nanotechnology

Professor Chris Macosko
Department of Chemical Engineering and Materials Science
University of Minnesota
Polymer Blends

Dr. Jim Murday
Naval Research Laboratory
Nanocomposites: S&T Challenge and Defense Applications

Professor Don Paul
Department of Chemical Engineering, University of Texas at Austin
Polyolefin Nanocomposites: Structure and Properties

Dr. Lloyd M. Robeson
Air Products and Chemicals, Inc
Polymer Blends for Emerging Technologies

Dr. Dietrich Scherzer
BASF Germany
Plastics from Renewable Sources

Dr. Suresh Shah
Delphi Thermal and Interior Systems
*Challenges and Opportunities of Polymer Nanocomposites and Blends for
Automotive Applications*

Professor Scott White
University of Illinois
Autonomic Healing Of Polymer Composites

ADDITIONAL INFORMATION

- Additional speakers, as well as topics and abstracts will be available as the meeting approaches.
- Attendees will be invited to bring posters for display during the meeting. More information will be provided on registration.
- Sponsorship opportunities, including tabletop exhibits will be available for companies who would like to reach this audience of decision makers.

MEETING LOCATION

The meeting will be held at the
Walt Disney Yacht and Beach Club Resort, Orlando, FL

Yacht Club:

<http://disneyworld.disney.go.com/wdw/resorts/resortLanding?id=YachtClubResortLandingPage&count=9>

Beach Club.

<http://disneyworld.disney.go.com/wdw/resorts/resortLanding?id=BeachClubResortLandingPage&count=2>

HOTEL INFORMATION

Rooms are being held at the Yacht and Beach Club at a rate of \$ 189.00 for single or double. If space is available, this rate will be made available to attendees for a period of three days before and after the meeting, to enable attendees to bring their families and take advantage of the activities Walt Disney World has to offer.

To make reservations, please call 407-934-3372 before JANUARY 5, 2006 and mention that the room is in the Council for Chemical Research Room block. When making your hotel reservations, be sure to inquire about how to reserve a seat on Walt Disney World's "Magical Express", complementary transportation to and from the hotel from the airport.

REGISTRATION INFORMATION

Registration is limited, and will be accepted on a first come, first-served basis. For applications to be accepted, a check or credit card information for the

following fees must be included. Fees are non-refundable after January 5, 2006, but substitutions are permitted.

Industrial \$1,200
Academic \$600

FOR MORE INFORMATION

The Council for Chemical Research
1730 Rhode Island Ave., NW
Suite 302
Washington, DC 20036
Phone: 202-429-3971
Fax: 202-429-3976
Email: ccrmail@ccrhq.org

ASME JOINT U.S.-EUROPEAN FLUIDS ENGINEERING CONFERENCE – MIAMI, FLORIDA, USA JULY 17-21, 2006.

The Symposium on Flows in Manufacturing Processes to be held at the ASME Joint U.S.-European Fluids Engineering Conference in Miami, Florida on July 17-21, 2006. Interested authors are requested to submit an abstract by January 16, 2006 using ASME web based tool box at <http://www.asmeconferences.org/FEDSM06>

Studies of all types of manufacturing processes involving Newtonian or non-Newtonian fluids under isothermal and non-isothermal conditions are welcomed. Studies involving combined numerical and experimental work are particularly encouraged. Topics of interest include but are not limited to:

<i>Process Modeling</i>	<i>Mechanics During Processing</i>
<i>Material Rheology During Processing</i>	<i>Process Automation and Control</i>
<i>Novel Processing Methodologies</i>	<i>Process Optimization</i>
<i>Thermal and Chemical Issues</i>	<i>Sensing During Processing</i>

A full manuscript is to be submitted for peer review. Final manuscripts will be published in the Proceedings in CD-ROM format, and have to be prepared according to the ASME standard format for a conference paper. Requested/selected papers will be considered for publication in a special issue of

the ASME Journal of Fluids Engineering subject to the peer review process of the Journal.

Dennis Siginer, PhD, ScD
Department of Mechanical Engineering
Wichita State University
1845 N. Fairmount
Wichita, KS 67269-00133

Tel: 316 978 6300
Fax: 316 978 3236
Email: dennis.siginer@wichita.edu

**International Workshop on Mesoscale and Multiscale
Description of Complex Fluids
July 5th - 8th, 2006
Monash University, Prato, Italy.**

We would like to invite you to participate in the upcoming International Workshop on Mesoscale and Multiscale Description of Complex Fluids scheduled for July 5th - 8th, 2006, at the campus of Monash University in Prato, Italy. The aim of the workshop is to provide a forum for discussing leading experimental and theoretical work on various aspects of complex fluids.

The conference program can be viewed at:
<http://users.monash.edu.au/~rprakash/Workshop/prato.htm>

Sessions are planned on:

- a. Coarse-Graining Issues
- b. Phase Behaviour and Equilibrium
- c. Linear and Non-Linear Rheology
- d. Multiscale Modelling.

There will no parallel sessions. Presentations will typically be held in the morning and afternoon, and terminate by 4.30 PM.

Confirmed Keynote Speakers:

1. D. Bonn, Universiteit van Amsterdam, The Netherlands.
2. P. Callaghan, Victoria University of Wellington, New Zealand.

3. R. M. L. Evans, University of Leeds, UK.
4. R. G. Larson, University of Michigan, USA.
5. M. Kröger, ETH-Zürich, Switzerland.
6. V. Mavrantzas, University of Patras, Greece.
7. F. C. McKintosh, Vrije Universiteit, The Netherlands.
8. M. Pasquali, Rice University, USA.
9. E. M. Sevick, Australian National University, Australia
10. P. Sollich, King's College London, UK.
11. A. K. Sood, Indian Institute of Science, India.
12. N. B. Wilding, University of Bath, UK.

Contributions are invited as oral or poster presentations. A special issue of the Journal of Non-Newtonian Fluid Mechanics will be published containing full-length, peer-reviewed articles presented at the workshop.

Conference Registration Fee:

AUD \$ 650 - Before 31 March 2006

AUD \$ 750 - After 31 March 2006

Important Dates:

15 Feb 2006: Submission of abstracts for talks & posters

31 Mar 2006: Deadline for early registration

5 Jul 2006: Submission of manuscripts for JNNFM special issue

Please register to attend. The website for registration is:

<http://www.conferences.monash.org/iwmcof06/index.cfm?p=262>

"Solutions, Suspensions, Slurries and Solids" **6-9th February Cranfield, Bedfordshire, UK.**

BHR Group is launching a series of Training Courses for 2006 covering the handling of "Solutions, Suspensions, Slurries and Solids" at Cranfield, Bedfordshire, UK. The dates for the first three courses have been changed from 23-26 January to 6-9 February as stated below. We have also added the Slurry Handling Course that we are hoping to run in Canada sometime during April/May. For further details of this course, please check the details on our website.

The courses and their dates are as follows:

6 February 2006 Slurry Viscosity: Measurement and Application

7-8 February 2006 Slurry Handling

9 February 2006 On-line Slurry Instrumentation

22-23 February 2006 Fundamentals of Rheology and its Application

23 March 2006 Suspension and Paste Rheology

April 2006 Solids Drying

April-May 2006 Slurry Handling - in Canada

10/11 May 2006 Wet and Dry Bulk Solids Handling

20 September 2006 Applying Rheology to Process Design

23 October 2006 Slurry Viscosity: Measurement and Application

24-25 October 2006 Slurry Handling

26 October 2006 On-line Slurry Instrumentation

16 November 2006 Suspension and Paste Rheology

7 December 2006 Wet Cake Handling

For more details of each of the courses, and for a booking form, please visit our website at

<http://bhrenews.c.topica.com/maaemicabne5KbqPGbpbaeQBf0/>

Dr N I Heywood CEng, FICHEME

Senior Consultant

BHR Group Ltd

The Fluid Engineering Centre

Cranfield

Bedfordshire

United Kingdom

MK43 0AJ

Tel: +44 1234 750422

Fax: +44 1234 750074

E-mail: solutions1@bhrgroup.co.uk

www.bhrgroup.co.uk

INDUSTRY NEWS

New Malvern rheometer optimized for nano-torque control

A new addition to the Bohlin Gemini family of rheometers from Malvern Instruments is optimized for the control of ultra-low torques, and opens up new opportunities to probe weak or sensitive material structures and low viscosity systems. The new instrument made its debut at the 77th Annual Meeting of the Society of Rheology (October 16-20, 2005; Vancouver, BC) for which Malvern is a primary sponsor.

Like all previous Bohlin High Resolution rheometers, the new **Bohlin Gemini HR nano** offers advanced technology with straightforward operation. While enabling the measurement and control of nano-torque levels, it retains a continuous working torque range to 200 mNm allowing complete rheological characterization. Allied to the most sensitive normal force measurement available, the Gemini HR nano offers the ultimate in instrument capabilities for weakly-structured systems.

Development of this new rheometer has been made possible through the continued advancement of Malvern's state-of-the-art air bearing design coupled with its patented Rotonetic™ 2 DSP drive system. The Bohlin Gemini HR nano's unsurpassed range and sensitivity allows torque and speed control across all steady, dynamic and transient test modes. Both strain controlled and stress controlled tests can be performed with ease.

As modular systems, the Bohlin Gemini rheometers offer a wide range of measurement geometries and accessories, with quick and easy configuration enabling their use for many different materials and applications. EasySwap™ temperature controllers include integrated Peltier devices, a forced gas oven with optional liquid nitrogen cooling, electrical heating and a variety of fluids circulators. Windows-based software allows easy programming for any test protocol and is equally suited to advanced research or routine QA/QC applications.

For information on the new system and its applications, view Malvern's audiovisual presentation at:

www.brainshark.com/malvern/gemini_hrnano_rheometer
or visit www.malvern.co.uk/gemini

New downloadable brochures for Malvern Rosand rheometers

New brochures are now available on-line for the market leading Rosand range of bench and floor standing capillary rheometers from Malvern Instruments. Freely downloadable from the Malvern website, the new brochures contain the latest technical and applications information for the Rosand RH2000 series and the Rosand RH7 and RH10 rheometers.

The Rosand RH-7 and RH10 are floor-standing research level instruments with an 'H' frame design that allows operation under high loading conditions. The RH2000 series rheometers are compact bench systems for research, product development and QC applications and are available in either single or twin bore configurations.

The exceptional performance of both ranges is underpinned by a new digital drive system with wide dynamic range, supported by the latest generation of Malvern's Windows™ based Flowmaster™ software.

Visit www.malvern.co.uk to download, or request by phone or email direct from Malvern Instruments

Malvern introduces new Particle Image Analyzer

Malvern have recently introduced the new Morphologi G2 high sensitivity particle image analyzer. Based upon digital image analysis and automated microscopy the Morphologi G2 is dedicated to measuring both particle size and particle shape.

Using the very latest Nikon CFI 60 optics and a high resolution, high pixel-density digital FireWire camera the Morphologi G2 provides the very highest quality, aberration-free images.

The Morphologi G2 image analysis system measures:

- **Particle size:** using different magnifications to ensure high resolution throughout the full particle size range (0.5µm – 1000µm) the image analysis system accurately measures particle size using the circle equivalent diameter parameter.

- **Particle shape:** a range of particle shape parameters such as elongation, circularity and convexity are calculated. These parameters allow subtle differences between samples that would be otherwise invisible to particle size-only techniques, to be identified and quantified.
- **Particle count and foreign particle detection:** the fact that each and every particle in the sample can be individually measured and recorded enables the image analysis system to count certain types of particles - for example for the purposes of foreign particle detection.

The Morphologi G2 particle image analyzer provides microscope-quality images and statistically significant histograms providing the user with the best of both worlds - both qualitative image analysis and quantitative image analysis.

Materials research consortium works with Malvern Zetasizer Nano systems

Malvern Instruments has become the primary supplier of systems for nanoparticle characterization to a consortium of 13 commercial companies and 12 academic research groups in Israel - Nano Functional Materials **NFM**. The NFM Consortium is supported by Israel's MAGNET program (Office of the Chief Scientist in the Ministry of Trade and Employment, Israel) led by Mr Ilan Peled. Dr. Fernando de la Vega, the consortium chairman, said, "The consortium is successfully developing new ways to fabricate and use nanoparticles in industrial processes and products and is now completing its third year of activity."

To date, twenty Malvern Zetasizer Nano systems have been purchased by members of the NFM Consortium for a variety of applications. The Zetasizer Nano is the most widely used system for the measurement of particle size, stability characterization using zeta potential, and molecular weight, both for routine measurements and those at the leading edge of materials research. These materials range from particle dispersions to emulsions and molecules in solution.

The unique technology in the Zetasizer Nano provides the sensitivity required for the measurement of highly dilute proteins and polymers, as well as the ability to measure inks, pigments and emulsions at high concentrations. It enables particle size measurement over the range 0.6 to 6000 nm, molecular weight measurement from 1×10^3 to 2×10^7 Daltons and the zeta potential of particles from 5 nm to 10 μm .

Commenting on the use of the Zetasizer Nano systems, Dr Eynat Matzner, NFM Consortium manager said, "The NFM consortium is developing nano structured functional materials, where nano particles are dispersed in a solid or liquid media. Measuring not just the prime particle size, but also the dispersion and agglomeration of particles in the matrix, is crucial for development. When measuring in liquid media, the Zetasizer is a very valuable tool."

For more information about the Zetasizer Nano please visit:
www.malvern.co.uk/zetasizer and for details of NFM www.nfm.org.il

Malvern appoints Director of Customer Services

Malvern Instruments has appointed Mr John Martin to the new role of Director of Customer Services. He joins Malvern having spent more than ten years in customer service management with Applied Biosystems and brings a wealth of experience. Mr Martin will be responsible for all customer services and support activities globally for Malvern Instruments.

Welcoming John to this new position, Malvern's Managing Director Paul Walker said: "Malvern's world-leading position in particle characterization and rheological measurements has been built not only on the quality and reputation of our instruments, but also on our high levels of customer service and support. Malvern's highest priority is to ensure that we meet the exact needs of our customers."

He went on to say: "Malvern must continually develop and enhance the support we provide, to ensure that we work with our customers in the most efficient and effective way and deliver the services that they want. The high-level international experience that John adds to the company will ensure that we continue to achieve these high standards."

Malvern Instruments is a leading supplier of analytical solutions for particle characterization and rheological applications. Advanced technologies are combined with robust mechanical designs and comprehensive software to provide systems that measure material characterization data (size distribution, particle shape, zeta potential, molecular weight) and bulk material properties.
www.malvern.co.uk

Launch of small volume shear cell for Freeman Technology's FT4 Powder Rheometer

The 2005 AAPS Annual Meeting & Exposition (November 6-10, 2005; Nashville, TN), saw the launch of new accessories for Freeman Technology's FT4 Powder Rheometer. Leading these is the fully automated, small volume shear cell which can be used to measure volumes down to 3 ml or less, depending on the characteristics of the powder. This completely new module enables 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 encompasses many pharmaceutical actives, and materials, such as early stage formulations, where a wide range of tests must be carried out on limited supplies.

The FT4 is a universal powder rheometer that is used to conduct an array of powder flowability tests. These provide a means to characterize the flow properties of powder materials and relate them to performance in process. Where shear testing is required to complement flowability data, both the new small volume shear cell and the existing standard shear cell accessory offer 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 consolidation, thanks to the system's high sensitivity, and over a wide range of stresses up to 100 kPa, allowing simulation of many different packing conditions. Conditioning of material before testing ensures homogeneity and a high degree of repeatability.

If you would like to arrange a meeting on the Freeman Technology booth to discuss your powder processing challenges, please contact Freeman Technology on Tel +44 1684 310860 or email info@freemantech.co.uk

New Aeration Control Unit for FT4 Powder Rheometer

The new Aeration Control Unit for Freeman Technology's FT4 Powder Rheometer allows fine control of air flow through a powder under test and enables the automated measurement of the powder's flow properties as a function of increasing levels of aeration. At maximum aeration - or for some powders, fluidisation - the energy required to make a powder flow is reduced by a measurable factor, known as the Aeration Ratio (AR). This varies from around 5 for cohesive powders to in excess of 1000 for fluidisable powders. It is therefore an important flow performance indicator.

The bulk properties of powders can be greatly affected by even small amounts of entrained air. The aeration control unit allows evaluation at very low air velocities down to 2mm/min. Aeration at higher velocities up to 2000 mm/min can examine the fluidisation behaviour that has important practical processing implications in many industries. These include toner production, powder coatings and pharmaceutical manufacturing.

The FT4 with the new aeration control unit can be used to determine the flow properties specification needed to optimise production and achieve the required product quality. In addition, the system can be used on a day-to-day basis to verify that powder flow properties meet the necessary specifications, for predictable and consistent processing performance.

Powders always contain air and the amount significantly alters the flowability of the powder bulk. Consolidation removes air and increases the friction between powder particles causing high resistance to flow. Aeration reduces flow resistance and can result in fluid-like behaviour. The rate of release of entrained air from a powder bulk is another important characteristic that can be determined using the FT4 with aeration control unit.

Full automation of the AR measurement on the FT4 Powder Rheometer enables its accurate and reproducible determination. The elimination of user variability allows confident discrimination of even small differences between powders, with data reproducibility typically better than 1%. Furthermore, unattended operation frees analyst time for other tasks.

In addition to its use in the laboratory, the FT4 Powder Rheometer with Aeration Control Unit can easily be set up close to a production line for routine QC measurements.

The Aeration Control Unit is one of a series of automated accessories for the FT4 Powder Rheometer, designed to fully automate powder testing procedures.

For further information please visit www.freemantech.co.uk

Thermo Electron Corporation introduces on-line quality control system for colour inspection in the polymer industry

Thermo Electron Corporation, the world leader in analytical instruments, has introduced a new measuring system for the polymer industry that features on-line quality control for colour inspection. The pioneering solution is integrated into the new HAAKE PolyLab OS torque rheometer platform, which was introduced to the US market this year at the national ANTEC technical conference.

The modular HAAKE PolyLab Open System (OS) unit is an innovative torque rheometer platform for polymer process engineering. The rheometer's system architecture has been designed on an open industry standard, allowing a number of standardized sensors and systems to be connected to it for optical, viscosity and spectroscopy measurements. Thermo's goal is to offer a wide range of new sensor applications for the HAAKE PolyLab OS system so that customers' varying needs can be met.

The PolyLab OS system's newest sensor allows on-line control of colour changes that occur either due to polymer degradation or can be used for colour compound production. The sensor is available through the company's cooperation with Equitech in New Ellenton, SC, which developed the sensor for real-time, on-line monitoring for colour in the melt stream. A fiber-optic probe is connected to the inside of the extruder die to a spectrophotometer with a CCD sensor to allow on-line monitoring of color changes in the melt stream. Two different probes are available, one for opaque materials, the other for clear and translucent melts. On-line control saves time for pellet sampling, and eliminates the need for off-line quality control in the laboratory.

If you would like to learn more about the new colour sensor, please contact us at info.mc.us@thermo.com

Anton Paar Doubles Rheometer Production Capacity

As a result of continuing increases in rheometer sales, Anton Paar have enlarged the department for Rheology at their headquarters' in Graz, Austria. The Rheology department now has double the space for instrument manufacture, assembly and testing. Further hi-tech engineering equipment has hit the ground running in the manufacturing plant in order to cope with demand for the versatile MCR series of rheometers. Since the demise of Rheometrics, Anton Paar are the

only rheometer manufacturer that perform all of the fine engineering work required when producing a rheometer.

Anton Paar SVM3000 Viscometer / Densitometer with Autosampler

Anton Paar are pleased to announce the launch of the SVM3000 viscometer with autosampler. The SVM utilises a unique measuring principle which eliminates the influence of bearing friction and yields a torque resolution of just 50 picoNm. The instrument can simultaneously measure density as well as viscosity and therefore also produce direct readings of kinematic viscosity.

For laboratories with a large sample throughput, the Xsample 460 enables the automatic handling of up to 48 samples. It can handle very different samples in a single magazine, even when they are measured at different temperatures or require different cleaning procedures.

Typical applications of the SVM3000 include the following :

- R&D tasks such as viscosity vs temperature.
- QC task such as viscosity and density of mineral oils.
- Measurement of viscosity index, VI.
- Low temperature measurement of fuels.
- Field measurements (e.g. measuring the degradation of oil)

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

Anton Paar: sale of ex- demonstration rheometers and accessories

Following on from a hectic year of sales activity Anton Paar now have quite a large number of items for sale from our demo stock, more specifically:

- An MCR301 rheometer plus accessories
- Complete set of accessories for an MCR series rheometer
- Accessories for MCxxx type instruments.
- Accessories for UDS type instruments.

These items will be sold with a discount dependant on the age and condition of the item. If you require further information on these items please reply to this message using the subject heading ex-demo items or call Steve Goodyer on 07971 972502.

Anton Paar Rheology Consultancy Services

Could rheology be useful to your company but the capital budget prevents the purchase of an instrument? Do you currently use your existing rheometer to it's full capacity and would benefit from a helping hand from time to time?

Is your existing rheometer bit of a dinosaur and incapable of making certain measurements that you require? If "yes" is the answer to any of these questions then the Anton Paar UK consultancy service could be for you. For further information please reply to this email using the subject heading "Rheology Consultancy Services" or call Steve Goodyer for an informal chat on 07971 97250.

State of the art Rheometer now available from Meritics Ltd

The brand new Reologica NOVA Rheometer is now available from Meritics Ltd. Featuring new bearing technology for nano torque and strain measurement control, the NOVA is the most advanced controlled stress, direct strain and controlled rate rheometer available.

All aspects of the NOVA feature improvements in nearly all rheometer specifications including "Auto-Detect" Measuring Systems, Video & Image Software, and High Performance Open-Source Instrument Control Software and a new innovative drag cup motor.

With the Beckman Coulter particle characterisation products, MTS On Line particle sizing and imaging range, and the Matec particle size and zeta potential systems and others, Meritics now have a comprehensive range of solutions to almost any particle characterisation problem.

Further information can be obtained from:

Graham Thomas - 01924 849990, Brian Miller - 01582 704807

info@meritics.com; www.meritics.com

CONFERENCE DIARY

2006	CONFERENCES
5-8 Feb Orlando, Florida, USA.	The 11th New Industrial Chemistry and Engineering (NICH) Conference: Advanced Polymers: Developing High-Performance Polymeric Materials for the Future. The Council for Chemical Research, 1730 Rhode Island Ave., NW Suite 302, Washington, DC 20036, USA.T: 001-202-429-3971 F: 001- 202-429-3976; E: ccrmail@ccrhq.org .
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
8-9 March Regensburg Germany	Conference and Workshop "Rheological Measurements of Building Materials" contact Markus Greim: greim@schleibinger.com ; http://www.schleibinger.com/usa/index.htm
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
10-13 April Kerkrade, The Netherlands	13th International Conference on Deformation, Yield and Fracture of Polymers , Rolduc Abbey, Kerkrade, The Netherlands. Marleen Rieken, Eindhoven University of Technology, Dept. Mechanical Engineering Materials Technology, P.O. Box 513, NL-5600 MB Eindhoven, The Netherlands. T:+31 40 2472851; F:+31 40 2447355 DYFP2006@tue.nl ; http://www.dyfp2006.tue.nl/
23-26 April Montreux, Switzerland	Food Colloids 2006: Self-Assembly and Material Science 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 Mrs. Ritsa Karali , AERC 2006 – Secretariat FORTH, Institute of Electronic Structure & Laser, PO Box 1527, 71110 Heraklion, Crete, GREECE T: +30 2810 391300; F: +30 2810 391305 E: aerc2006@rheology-esr.com http://www.rheology-esr.org/AERC/2006
5-8 July Monash University, Prato, Italy.	International Workshop on Mesoscale and Multiscale Description of Complex Fluids: Dr Ravi Jagadeeshan, Department of Chemical Engineering, Monash University, VIC 3800, Australia (ravi.jagadeeshan@eng.monash.edu.au). http://users.monash.edu.au/~rprakash/Workshop/prato.htm

17-21 July Miami, Florida, USA	ASME Joint U.S.-European Fluids Engineering Conference Dennis Siginer, Department of Mechanical Engineering, Wichita State University, 1845 N. Fairmount, Wichita, KS 67269-00133, USA. T: 001 316 978 6300, F: 001 316 978 3236, E: dennis.siginer@wichita.edu
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2006	COURSES
6-9 Feb Cranfield, Bedfordshire, UK.	Solutions, Suspensions, Slurries and Solids: Dr N I Heywood, BHR Group Ltd, The Fluid Engineering Centre Cranfield, Bedfordshire, MK43 0AJ, UK T: +44 1234 750422 F: +44 1234 750074, E-: solutions1@bhrgroup.co.uk www.bhrgroup.co.uk
7- 8 March Hilton Hotel Leicester, UK	TA Polymer Users Meeting: email: info@taeurope.co.uk .
3-7 April Limerick, Ireland	9th International Seminar on paste and Thickened Tailings: Dr Simon Lawson, Industrial Centre of Particle Science & Engineering , University of Leeds, Houldsworth Building, Leeds LS2 9JT. T: 0113 3432376; F: 0113 3432377; s.lawson@leeds.ac.uk Conference Website: www.paste06.com
10-12 April Reading UK	Science and Rheology of Breadmaking: BBSRC Modular Training for Industry Postgraduate Workshop. Bogdan Dobraszczyk, School of Food Biosciences, University of Reading, RG6 6AP, UK. T: 0118 3788714; F: 0118 9310080; E: b.dobraszczyk@reading.ac.uk
25-26 April Hersonisos, Crete, Greece	European Society of Rheology Short Course: Mrs. Ritsa Karali, karali@iesl.forth.gr http://www.iesl.forth.gr/ESR-course/2006
17-18 May 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
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

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