

THE BRITISH SOCIETY OF RHEOLOGY

BULLETIN



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CONTENTS

Officers & Members of Council	i
Editorial	ii
Rheology at Birmingham Univ.	14
Membership News	19
Notice of AGM	21
Meetings	22
BSR Tie	23
Advertisements	

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EDITORIAL

As this is the last Bulletin I shall be responsible for, may I take the opportunity to thank all those who have helped me during the last four years. First, those officers and members of the Society who have produced material (usually "camera ready") for inclusion in the Bulletin. Secondly those viscometer and rheometer manufacturers whose advertising copy has brightened the back pages. Lastly to my employer, Unilever Research, who have allowed me the time and facilities necessary to do the job. It has been a very rewarding experience that has brought me into contact with many interesting people in the world of rheology.

My successor is Dr Peter Townsend of the Computing Dept. at Swansea University. This carries on the tradition of ex-Aberystwyth rheologists being active in the Society. Peter and I spent a number of years together in Prof. Ken Walters' research group. I hope he finds the job as interesting as I did. I look forward to seeing a new style of Bulletin with all the latest in computer aided publishing! I wish him every success!

This issue sees the inclusion of an article in the occasional series on rheology groups around the country. This time it's the turn of Birmingham University's Chemical Engineering Dept. Our thanks to Ralph Oliver for putting it together. Future Bulletin issues will carry news of other academic and industrial groups. If you have an interesting story, why not write it up and send it to the new editor (with photographs please)?

Once again thanks to all my helpers,

Pob hwyl,

Howard Barnes

Howard Barnes



BIRMINGHAM UNIVERSITY CHEMICAL ENGINEERING DEPT., RHEOLOGY GROUP

PROF. ALVIN NIENOW*, DR KISHOR PATEL, DR JOHN BENBOW*,
PROF. JOHN BRIDGWATER, MR BOB BADHAM*, DR RALPH OLIVER*,
DR IAIN MOORE.

*BSR MEMBERS

RHEOLOGY AT BIRMINGHAM UNIVERSITY

Rheology research in the Chemical Engineering Department at Birmingham University goes back to the pioneering work of the late Prof. F H Garner (with Nissan and Wood) on flame thrower fuels, just after the last war. More recently, Dr R Schnurmann carried out a whole series of research programmes associated with tribology and lubrication.

The work of Dr D R Oliver (member, ex-treasurer and Abstracts editor) spans three decades and began with work on idealised suspensions in association with Prof. S G Ward (ex-Abstracts indexer). Jet thrust measurements on dilute polymer solutions followed, leading to work on extensional flow using contoured nozzles (for uniaxial, biaxial and planar extensional flows) and the "triple jet" system, in which two high-speed jets impinged on a slower-moving central jet in order to accelerate it. Another novel system which was devised was the continuous-flow squeeze film apparatus, in which the squeezing motion of two surfaces was simulated by having the liquid exuding through many fine holes located in one of the surfaces.

This work showed that elastic polymer solutions gave greater normal loads than their shear viscosities suggested. Later, multigrade motor oils were also shown to give enhanced load-bearing.

The move towards the rheology of lubricants continued when both load and friction were measured in a device in which a rotating cylinder almost touched the outside of a fixed cylinder (axes parallel) with lubricant filling the gap. Again, the presence of polymeric additives was shown to result in load enhancement, in this case with a reduction of fluid friction. The same conclusion applied to multigrade motor oils, with important consequences for fuel saving. Later devices include internally-contacting rotating cylinders (journal bearing geometry), with the internal cylinder in a fixed eccentric position of even eccentric on its own shaft! The latter geometry simulates the main bearing of a two-stroke engine.

Mixing in mechanically-agitated vessels is a topic of considerable interest to Prof. A W Nienow (member) and the Mixing Research Group. One of the major areas of importance is air dispersion in non-Newtonian fermentation broths. For a greater understanding, bulk flow patterns and gas dispersion from rotating agitators are being studied in simulated broths of corn syrup (Newtonian), Boger fluids (Newtonian in viscosity but viscoelastic), Carbopol (shear thinning, plastic and inelastic) and CMC solutions (shear thinning, elastic). All these fluids are transparent and a series of video films have been made. Power is also measured with a wide range of agitators (Rushton, pitch blade turbines, Intermig, Prochem etc.) in transparent Perspex vessels from 0.22 to 0.72m diameter. Scale-up rules are being established. Apparent viscosities up to about 10 Pas are used and the work is related to Department's strong biochemical engineering activity.

To service this work, a temperature and humidity controlled laboratory with instruments measuring rheological properties are available. It is under the supervision of Mr Bob Badham (member). It contains a Weissenberg R19 rheogoniometer with the oscillatory attachment, a Contraves Rheomat 30 and a Deer Series III controlled stress rheometer. Bob also provides a service to others working in the department. The mixing equipment and rheological property measurement facilities are also available from time to time for contact work.

Prof. J Bridgwater, assisted by Dr J Benbow (Secretary, ex-President) runs an active research programme in paste extrusion.

The aim is to determine the mechanics of paste extrusion from measurements on pastes made from powders having selected particle size distributions and rheologically well characterised liquids. Extrudate strength and porous structure are related to paste formulation variables.

The two relevant flow mechanisms, (i.e. plastic flow near the die entry and plug flow in the die-head) are characterised by extrusion parameters. These parameters

can be interpreted in terms of powder properties and liquid-phase rheology. The influence of system variables on extrusion defects such as surface fracture, dog's tooth or sharkskin is being examined.

Ceramic pastes are being studied, the work being of interest to several industries including those making engineering ceramics, catalyst supports, biochemical materials, pharmaceuticals and foods.

Dr Iain Moore has recently set up research programmes dealing with the break-up of droplets of Newtonian and non-Newtonian fluids in controlled extensional flow in stirred tanks; the influence of fluid elasticity on aeration is of particular interest.

Extensional viscosities have been measured by the inverted (Fano) syphon method; this provides data for the droplet break-up work. Further studies involve the development of model fluids for experimental purposes, including complex suspensions containing flexible particles.

The flow behaviour of dilute polymer solutions and surfactant-polymer complexes in well defined porous media is being studied by Dr K Patel. Emphasis is being placed on the study of elongational flow and the effects of polymer adsorption and surfactant-polymer separation on apparent viscosity. The work is unusual in concentrating on low shear rates, which are of great importance in polymer flooding (oilfield) operations.

Another important area studied has been turbulent drag reduction, where for several years the discoverer of the phenomenon, Dr Brian Toms (Indexer, Rheology Abstracts) worked in the Department. This research showed that changing the side branches of vinyl-type copolymers with identical backbones could markedly affect their drag reducing properties. It was also found that certain polymers worked well in salt water, which is significant in drilling operations at sea.

Turning to the topic of "solids", a team led by Dr A J Barker has for many years studied the deformation of

composite materials, which are now being widely used in airframe structures and in the rocket motor industry.

The influence of environmental conditions (temperature and humidity) on the compressive strength of carbon fibre (reinforced plastics (CFRP) is being investigated. The work involves long term environmental exposure, mechanical tests, analysis of stress distributions within layers of the laminate and an examination of the fracture processes.

It is found that the presence of moisture in the resin matrix reduces its glass transition temperature, increases its free volume and detrimentally influences its mechanical properties. Consequently both the compressive strength of the CFRP and its mode of failure are determined by the quantity of absorbed moisture in the matrix.

Thus Rheology research in the Chemical Engineering Department is in a remarkably healthy state despite having been something of a "Cinderella" of research topics!

D R OLIVER

A SAD RHEOLOGICAL FOOTNOTE

The reason given for the Challenger's failure is that the normally resilient O-rings in the booster rocket did not regain their shape. This does not sit easily beside the cynical comment attributed to Henry Ford that "an expert is a person who can tell me six ways something won't work".

MEMBERSHIP NEWS

The following applications for Membership of the British Society of Rheology were approved at the Council Meeting on the 4th April 1986.

Dr Sumana CHAKRABARTI Drilling and Completions Branch BP Research Centre Chertsey Road Sunbury on Thames Middlesex TW16 7LN	Ph.D. fetsa DEFGLM
Sabah Aziz DHAHIR Dept. of Applied Mathematics University College of Wales Aberystwyth Dyfed, WALES	M.Sc. fetsa DFGJKL
Mr Kevin GOLDEN Dept. of Maths & Stats Plymouth Polytechnic Drake Circus Plymouth, PL4 BAA	B.Sc. (Hons) fetsa N
Mrs Attia HASNAIN The School of Pharmacy 29/39 Brunswick Square London, WC1N 1AX	B.Sc. (Hons), Cert. HSM petsa FG
Prof. David F JAMES Dept. of Mechanical Engineering University of Toronto Toronto, Ontario CANADA M5S 1A4	Ph.D. fesa DM
Mr Ahmad Ismail JOMHA School of Chemical Engineering University of Bradford Bradford West Yorkshire	B.Sc. (Hons), Ph.D. fea DG
Dr Mohammed Zubair KALAM Applied Physics Branch BP Research Centre Chertsey Road Sunbury on Thames Middlesex, TW16 7LN	B.Sc. (Hons), Ph.D. feta DGJ
Mr David M LAYCOCK Cavendish Laboratory University of Cambridge Cambridge	B.A. ptsa DN
Efstratia LELI Dept. of Applied Mathematics University College of Wales Aberystwyth Dyfed, Wales	B.Sc., M.Sc.
Dr Christopher LOCKYEAR Drilling and Completions Branch BP Research Centre Chertsey Road Sunbury on Thames Middlesex, TW16 7LN	B.Sc., Ph.D. peta G

Mr Andrew Christopher MACKIE Department of Chemistry University of Nottingham Nottingham	B.Sc. (Hons) fetsa GJL
Miss Alison NEWBERRY Carri-Med Ltd. Glebelands Centre Vincent Lane Dorking, Surrey, RH4 3YX	B.Sc. fea DFGJKLM
Mr Grant John PRIVETT Royal Ordnance Sewardstone Road Waltham Abbey Essex, EN9 1AY	B.Sc. petsa EG
Mr Graham TRUDINGER Carri-Med Ltd Glebelands Centre Vincent Lane Dorking, Surrey, RH4 3YX	GRSC Pt.1 fea DFGJKLM
Mr Andrew WHITTAKER Royal Ordnance Explosives Div Stewardstone Road Waltham Abbey Essex, EN9 1BP	GRSC feta E

RESIGNATIONS

Dr K F Poulter, NPL, Teddington	Joined in 1981
Dr J A Slipper, Wyeth Labs., Maidenhead	Joined in 1984
Mr J M Strand, Raisio National, Finland	Joined in 1979

MEMBERSHIPS DELETED UNDER RULE 4D

The following members have had their names deleted from the Society's membership list under rule 4d for arrears in subscriptions of over one year.

Joined Society in

Mr K R Bolt, Johnson Wax, Egham	1983
Mr E J Carter, Plymouth Polytechnic	1981
Dr C J Coleman, University of Nottingham	1976
Mr F Courtman, Oldham, Lancashire	1981
Mrs B Dew, British Gas Midlands Research Station, Solihull	1983
Mr A Graham, Farnham Surrey	1949
Mr A G Guy, University of Liverpool	1968
Dr D G Hare, Bradbury Wilkinson plc, Crawley, Sussex	1984
Mr J Huxtable, Stevenage, Herts	1980
Prof. G Capriz, University of Pisa, Italy	1960
Dr P B Kulkarni, Loctite (Ireland) Ltd., Dublin	1980
Dr V V Chavan, Bombay, India	1981
Mr J B Jansma, G E Lamp Division, Cleveland, Ohio, USA	1980

NOTICE OF THE ANNUAL GENERAL MEETING

The 42nd Annual General Meeting of the British Society of Rheology will be held on Wednesday 10th September 1986 in the Devonshire Hall, Leeds University, Leeds at 5.15 pm.

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

- (i) The election of a President for 1986-1988
- (ii) The election of other officers and members of Council, 1986-1987
- (iii) The receipt of a report and audited accounts from Council.
- (iv) Dealing with matters raised by Council or by any member, and receiving suggestions from members for consideration by Council.

Nominations received to date are as follows:

President	:	Mr F N Cogswell
Secretary	:	Mr R Carter
Treasurer	:	Dr A Evans
Membership Secretary	:	Mr P C Anderson
Editor (Abstracts)	:	Mr S T E Aldhouse
Editor (Bulletin)	:	Dr P Townsend
Ordinary Members	:	Dr F S Baker Dr J J Benbow Dr M Folkes Dr D R Oliver Mr H Schimanski Mr T A Strivens

Nominations for Council or for any of the offices are invited. Nominations should be sent to the Secretary or may be made at the meeting (see rule 5(b)).

The Secretary would be pleased to receive notice of any matter that any member wishes to raise.

"RHEOLOGY OF DISPERSIONS AND PARTICULATE SOLIDS"

A JOINT MEETING BETWEEN THE BRITISH SOCIETY OF RHEOLOGY
AND THE COLLOID AND INTERFACE SCIENCE GROUP

9th and 10th of April 1987

at Bath University

Papers are still needed for this meeting. Would
intending participants please contact the secretary

Dr J Benbow

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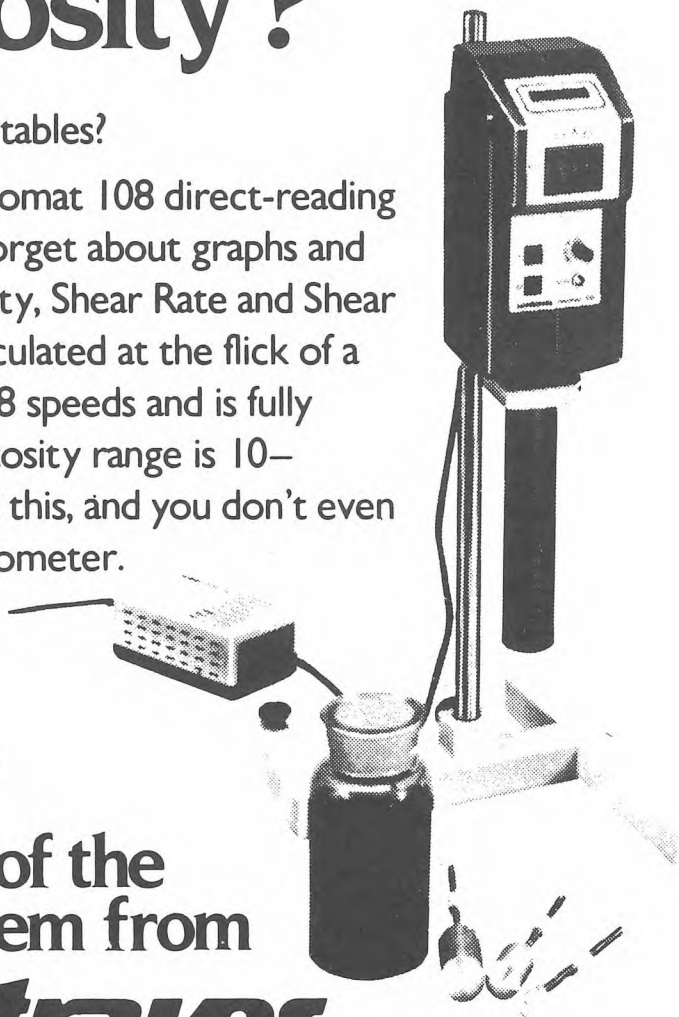
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