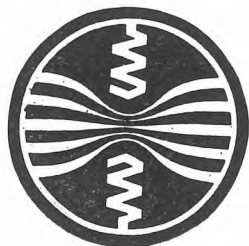


BULLETIN



**BRITISH SOCIETY
OF RHEOLOGY**

1970, No. 3, Vol. 13

Hon. Editor:

JOHN HARRIS,
Schools of Chemical Engineering
The University,
Bradford,
Yorks. U.K.



NOTICE TO INTENDING CONTRIBUTORS

The B.S.R. Bulletin is now available as a vehicle for several categories of communication by Members.

1. Technical papers (two copies required).
2. Descriptive papers of general interest.
3. Letters which may be either
 - (i) technical or
 - (ii) non-technical.

The technical papers will be refereed and so will technical letters but the latter only by one person. Descriptive and non-technical material will be published if it is of general interest.

In addition, project reports and computer information will be published.

It is hoped that B.S.R. members will find rapid publication sufficiently attractive to warrant submitting work.

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FOREWORD

Apart from the purely scientific aspects of rheology, two projects likely to arouse interest in members of the B.S.R. are the deliberations of The Institution of Chemical Engineers and British Society of Rheology Joint Working Party on non-Newtonian Flow and also the report of the British Society of Rheology Working Party on Publications.

The joint I. Chem. E.—B.S.R. working party on non-Newtonian flow has been in existence now for five years and during this time has been considering the various factors within its terms of reference culminating with production of a Draft Report. Consideration is now being given to the best way of circulating the report amongst members of the Society and it is hoped that a copy will be sent to each member before the New Year. It should also be possible for an open discussion of the report to occur at a later date and a joint I. Chem. E.—B.S.R. meeting would be a suitable forum.

The working party on publications is at present a much more youthful organisation, and it is to place a draft report before the council at its meeting on 13th August. An outline of the report was read to the A.G.M. in September at Shrivenham and a report will also be made in the Bulletin along these lines followed by a final report in due course.

COUNCIL 1970-71

President: PROFESSOR J. LAMB, Department of Electrical Engineering, University of Glasgow.

Hon. Secretary: DR. K. M. BEAZLEY, English China Clays, St. Austell.

Hon. Treasurer: MR. R. W. WHORLOW, Department of Physics, University of Surrey.

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Abstracts Editor: MR. A. EVANS, Department of Surgery, University of Newcastle-upon-Tyne.

Bulletin Editor: DR. J. HARRIS, Schools of Chemical Engineering, The University, Bradford.

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1970-71 COMMITTEE, VICTORIAN BRANCH (AUST.)

Chairman: MR. K. R. HALL, C.S.I.R.O., Division of Chemical Engineering.

Hon. Secretary: DR. D. V. BOGER, Department of Chemical Engineering, Monash University.

Hon. Treasurer: MR. K. G. MARTIN, C.S.I.R.O., Division of Building Research.

Committee: DR. E. J. DICKENSON, DR. D. H. MORTON, DR. J. STEARNE.

SYMPOSIUM ON VISCOELASTIC LIQUIDS

Melbourne, March 1970

D. V. Boger, Dept. of Chem. Eng., Monash University, Australia

The Victorian Branch of the British Society of Rheology held a one-day Symposium on Viscoelastic Liquids on March 11, 1970. The objects of this meeting were to give workers in this field an opportunity to exchange views and to demonstrate to non-specialists, by example of specific research and application, to what extent measurements and interpretation are affected by the more complex behaviour.

The Symposium, at Clunies Ross House, Melbourne, was attended by over forty participants from industry, teaching and research institutions in Victoria, with a sprinkling of visitors from other Australian States.

In order to provide a common background among the audience and to allow the speakers on specialist topics to take a basic familiarity with the subject for granted, the organisers had arranged two introductory lectures, one on theory and one on instrumentation. *Dr. P. U. A. Grossman* (C.S.I.R.O., Melbourne) reviewed the linear theory of viscoelasticity, and discussed phenomena observed in the viscometric flow of elastic liquids elaborating the concept of "normal stress" in this context. After introducing the three material functions that describe the state of stress of an incompressible material under the conditions of flow considered, he demonstrated that the memory of an elastic liquid under simple shear leads to a non-zero difference between normal stresses. It was briefly shown how phenomena such as Weissenberg effects, die swell, secondary flows, etc., arise. *Mr. H. P. Witt* (Australian Road Research Board) reviewed the principles and problems of measuring viscoelastic parameters. He pointed to the limitations on accuracy imposed by the geometry of the specimen and by the distribution of stresses and strains in it. After listing the features required in measuring instruments he described in more detail the instruments referred to in later talks. The introductory session concluded with a screening of the film "Rheological Behaviour of Fluids" of the U.S. National Committee of Fluid Mechanics (1964).

Mr. K. R. Hall (C.S.I.R.O., Melbourne) drew examples from the literature to illustrate some of the fields in which viscoelastic phenomena have been utilized or proved to be important, including polymer melt extrusion and the reduction of friction when small amounts of soluble polymer are added to a liquid in turbulent pipe flow. He also discussed scale-up of flow situations by the use of dimensionless groups based on equipment dimensions, characteristic deformation rate and residence time of the process fluid. *Dr. E. J. Dickinson* (Australian Road Research Board) discussed the behaviour of films confined between rigid surfaces, in particular the relation between

the shear modulus and the modulus measured in tension/compression in a direction normal to the plane of the film. The theoretical dependence of the ratio of moduli on the dimensions of the film was confirmed by experiments on paving bitumen, a silicone oil and water. This work has implications in the deformation and fracture of matrices of particles bound together by adhesives such as paving bitumen.

Finally, *Dr. D. V. Boger* (Monash University) spoke about flow of viscoelastic fluids in pipe lines. Once flow is fully developed in a long straight section of pipe the behaviour of elastic liquids is almost indistinguishable from that of purely viscous ones except for the transition from laminar to turbulent flow. However, the two types of liquid differ greatly during acceleration and deceleration occurring in sudden expansions, contractions, valves and fittings. Results of measurements of losses and of velocity profiles show that while a new velocity profile of a viscous liquid develops in the region of the pipe behind a contraction, that of the elastic liquid changes before the contraction is reached and may by then be fully developed. Dr. Boger concluded with recommending a method to predict the frictional losses in a pipe line during steady laminar flow of a viscoelastic liquid.

JOINT INSTITUTION OF CHEMICAL ENGINEERS—BRITISH SOCIETY OF RHEOLOGY WORKING PARTY ON NON- NEWTONIAN FLOW

In 1964 the Research Committee of The Institution of Chemical Engineers decided to establish a working party to consider applications involving fluids with non-Newtonian properties.

The first members of this working party included several who were also members of the British Society of Rheology. It was felt highly desirable that the group should be constituted as a Joint Working Party of the Research Committees of both organisations. This was agreed and the present study group reports to both parent bodies.

The terms of reference laid down were as follows:

- i. To provide facilities for exchange of information between workers in the field on non-Newtonian flow in industry, research establishments and universities.
- ii. To promote interchange of ideas between chemical engineers, rheologists, physicists, mathematicians and others who are interested in different aspects of the flow of non-Newtonian materials.
- iii. To identify areas of activity where further work should be actively encouraged.
- iv. To organise meetings and prepare reports for publication where it is considered that such activities are likely to be fruitful.

- v. To concentrate on problems of general interest rather than on those with a limited appeal.
- vi. To keep the Institution of Chemical Engineers and the British Society of Rheology fully informed of its activities through their respective Research Committees.

It is hoped to publish a report of this working party in the near future.

PRELIMINARY PROGRAMME

"Rheology in Industry"

A conference was held at the Royal Military College of Science, Shrivenham, SWINDON, Wilts., on Tuesday, Wednesday and Thursday, September 8-10, 1970, assembling on the Monday evening.

Introductory address by Dr. L. Grunberg (President).

"The prediction of time-dependent flow in polymer melts from dynamic viscoelastic data," by J. C. Weeks.

"Measurement of viscosity on an injection machine and its use in control," by L. W. Turner, R. Shah and D. Mugridge.

"There's life in the old dog yet!" by R. N. F. Pinfold.

"Sponsored research in applied rheology at Warren Spring Laboratory," by D. C.-H. Cheng.

"A generalisation of three integral models of non-linear viscoelastic fluids," by J. David.

"On the exploitation of non-Newtonian behaviour," by K. Walters.

"Viscoelastic properties of road binders," by D. K. H. Briggs.

"Rheology of polyurethane foams," by M. M. Cross.

"A technique for the measurement of hot melt viscosity during flow of thermosets," by G. H. Goulbourn.

"Preliminary investigation of some confectionary systems using a Weissenberg rheogoniometer," by C. A. Street and Miss A. C. Burnett.

Paper to be given by R. R. Zannger, Contraves, Zurich.

"The characterisation of viscoelastic liquids using a Weissenberg rheogoniometer," P. Langborne, N.E.L.

"Converging flow of polymer melts in extrusion dies," by F. N. Cogswell.

"Dynamic rheological measurements in the frequency range 5-1000 Hz and the characterisation of printing inks," by G. A. Lewis and A. J. B. Spaul.

"Liquid migration in paper coating," by K. M. Beazley and M. Climpson.

- "The use of rheological measurements to assess the effects of pigmentation on the flow properties of surface coatings," by R. Smith.
- "Some aspects of orientation in injection moulded objects," by J. L. S. Wales and J. van Leeuwen.
- "Adhesive debonding between two continua," M. L. Williams, Salt Lake City, Utah.
- Paper to be given by J. M. P. Papenhuijzen, Unilevers, Vlaardingen.
- "Effect of surfactant additives on motor oil viscosity," C. E. Chaffey and P. Leroux, University of Toronto.

SYMPOSIUM ON WAXY CRUDES

Waxy crudes in relation to pipe line problems is the title of a symposium organised by the IP to be held at the Mount Royal Hotel, London, W.1, from November 26th-27th, 1970.

The registration fee, which includes preprints, two lunches, dinner, and light refreshments, will be £15 for members and £18 for non-members.

The meeting will run as follows:

Thursday, November 26th

Opening address—President of IP.

Availability and utilisation of waxy/low sulphur crudes—C. M. Sorrell (University of Stirling).

Pipe line problems resulting from handling of waxy crudes—Dr. A. Uhde.

Viscosity measurement—E. Barry (Mobil, U.S.A.).

Lunch.

Yield value and breakdown of crude oil gels—T. C. Davenport (B.P.).

Pilot-scale studies on the re-start of gelled waxy crude pipe lines—A. P. den Hartog, E. Verschuur, and C. M. Verheul (Koninklijke/Shell laboratorium).

A joint discussion on the above two papers.

Heat transfer problems encountered in the handling of waxy crude oils in large pipe lines—T. C. Davenport (B.P.).

Close and, later on, dinner.

Friday, November 27th

Physical methods for improving flow—Three papers from B.P., Shell, and Texaco.

Flow improvers for waxy low sulphur crudes—R. C. Price (Esso).

Field evaluation for flow improvers—B. Deane, and F. Rossi (Esso).

Lunch.

Full-scale tests in the Rhine-Rotterdam pipe line—Mr. Knegt (Chevron).

Design of pipe lines to carry waxy crude oils—J. W. Ells and V. R. R. Brown (B.P.).

Closing summary.

Registration forms and fuller details from: C. H. Maynard, 61 New Cavendish Street, London, W.1.

HEAT AND MASS TRANSFER IN RHEOLOGICALLY COMPLEX FLUIDS

International Centre for Heat and Mass Transfer

1970 International Seminar

Supported by:

Yugoslav Federal Council for the Co-ordination of Scientific Activities; Yugoslav Society of Heat Engineers, Thermal Physics Department, Boris Kidric Institute, Beograd. September 8th–12th, 1970. Herceg Novi—Yugoslavia.

SEMINAR COMMITTEE

Co-chairmen:

A. V. LUIKOV Akademiya Nauk B.S.S.R., Minsk—U.S.S.R.

W. R. SCHOWALTER, Princeton University, Princeton—U.S.A.

**Co-chairman:
(for organisation)**

N. H. AFGAN, Boris Kidric Institute, Beograd—Yugoslavia.

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M. MIKHAILOV, Bulgarian Academy of Sciences, Sofia—Bulgaria.

T. MIZUSHINA, Kyoto University, Kyoto—Japan.

M. REINER, Israel Institute of Technology, Haifa—Israel.

I. SCHNELLER, National Research Institute for Machine Design, Bechovice—Czechoslovakia.

C. THIRRIOT, Ecole Nationale Supérieure, Toulouse—France.

Secretariat:

E. Kicovic
P. Pavlovic
G. N. Pustincev
L. P. Shulman
D. Spasojevic

PROGRAMME

The list of the lectures is given below. In addition approximately 40 short communications, selected by the Seminar Committee, will be presented.

LECTURES

- | | |
|---|--|
| G. Astarita
University of Naples, Naples,
Italy. | Transport phenomena in turbulent flow of
rheologically complex fluids. |
| H. Brenner
Carnegie - Mellon University,
Pittsburgh, U.S.A. | Suspension Rheology. |
| G. E. Barnenblatt
Moscow State University, Mos-
cow, U.S.S.R. | The effect of additions on hydrodynamics
and mass transfer in turbulent flows |
| A. C. Eringen
Princeton University, Prince-
ton, U.S.A. | Continuum foundation of rheology—New
adventures. |
| C. Gazley
R.A.N.D. Corporation, Santa
Monica, U.S.A. | Rheological properties of biological flow
systems. |
| A. V. Luikov
Heat and Mass Transfer Insti-
tute, Minsk, U.S.S.R. | Rheological aspects of the convective heat
and mass transfer problems. |
| A. B. Matzner
University of Delaware, Dela-
ware, U.S.A. | Recent development in the rheology of
polymer solutions. |
| J. R. A. Pearson
University of Cambridge, Cam-
bridge, United Kingdom. | Heat transfer effects in polymer melt flow. |
| P. A. Reh binder
U.S.S.R. Academy of Science,
Moscow, U.S.S.R. | Rheology of disperse structures. |
| C. Thirriot
Ecole Nationale Supérieure,
Toulouse, France. | Heat transfer of non-Newtonian fluids in
porous media. |
| G. V. Vinogradov
Institute of Oil Chemical Syn-
thesis, Moscow, U.S.S.R. | Relaxation characteristic and polymer flow. |

Process Engineering Group

Joint I. Mech. E./Plastics Institute

CONFERENCE "PLASTICS IN MECHANICAL ENGINEERING"

May 22nd–24th, 1972, London

A Conference on "Plastics in Mechanical Engineering," sponsored by the Process Engineering Group of the Institution of Mechanical Engineers, and the Plastics Institute, will be held in London on May 22nd–24th, 1972.

The theme of the Conference will be education in the broadest sense on the total impact of plastics in mechanical engineering, and the implications of future developments over the next twenty years. Due to the rapid rate of development of the use of plastics in engineering, frequent reviews of materials and technology are necessary to keep abreast of their potentialities. Critical review papers will be sought, which should concentrate on the frontiers of the topic, including the reporting of new and original work, both published and unpublished. It is important that there should be comment on areas where little knowledge in the subject exists as much as on those areas where more is known. Coverage would include basic characteristics of plastic materials, processing techniques, fabrication, related design problems, the scope for future design, and educational implications.

A general call for papers will be made in June 1970. Meanwhile, offers of papers are invited and should be addressed to Mr. J. H. Cole, The Institution of Mechanical Engineers, 1 Birdcage Walk, London, S.W.1. Synopses of about 100 words in length, which will be used as a basis for the first selection of papers, will be required by October 30th, 1970, and should be sufficiently detailed to indicate the proposed content of the paper.

Draft manuscripts of approximately 4,000 words in length must be submitted before October 1st, 1971. After being subjected to refereeing procedures, accepted papers will be published as Conference Proceedings papers of the Institution.

Society of Glass Technology, London

Wednesday, Thursday and Friday, September 30th
and October 1st and 2nd, 1970

SYMPOSIUM ON ELECTROCHEMICAL GLASSES MEETING

The meeting will be held in Imperial College of Science and Technology, in Lecture Theatre 1 of the Department of Physics which is situated at the corner of Prince Consort Road and Queen's Gate.

PROGRAMME

Wednesday, September 30th, 1970

Basic Properties. In the Chair: Dr. J. O. Isard.

Electron spin resonance studies of native and impurity defects in silica and germania: G. F. J. Garlick, J. E. Nicholls, C. Prasad and A. M. Ozer (Department of Physics, University of Hull).

Annealing of the E-band in radio frequency sputtered SiO₂ films: T. W. Hickmott (I.B.M. Corporation, Hopewell Junction, New York).

Deviations from OHM's law in ionic and electronic conduction in glasses: J. L. Barton (Saint Gobain, Paris).

The influence of phase separation on the electrical properties of sodium silicate glass: S. Pizzey (Mullards Research Laboratory, Mitcham).

The antiferromagnetic properties of transition element/phosphorus pentoxide glasses: A. W. Simpson and A. L. Terry (School of Applied Sciences, University of Sussex).

Amorphous Semiconductors. In the Chair: Dr. A. E. Owen.

Transport and optical properties of amorphous semiconductors: N. K. Hindley (Corning Glass Works, Corning, New York).

Physical factors affecting switching in chalcogenide films: J. M. Robertson and A. E. Owen (Electrical Engineering Department, University of Edinburgh).

Switching effects in thin chalcogenide semiconducting films: G. V. Bunton, S. C. M. Day, R. M. Quilliam and P. H. Wisbey (The Marconi Co. Ltd., Great Baddow Laboratories).

Switching effects related to the compositions of three or four component chalcogenide glasses: R. E. Booth, S. V. Phillips and P. W. McMillan (Nelson Research Centre, Stafford).

Investigations of memory effects in chalcogenide glasses: K. Weiser, M. H. Brodsky, R. J. Gambino and R. T. Tsui (I.B.M., Watson Research Center, Yorktown Heights, New York).

A 256-bit, diode isolated semiconductor read mostly memory: R. G. Neale,* D. L. Nelson* and G. E. Moore† (*Energy Conversion Devices Inc., Troy, Michigan; †Intel Corporation, Mountain Heights, California).

Thursday, October 1st, 1970

FILMS

(a) *Thin Insulating Films.* In the Chair: Mr. R. G. Finch.

R.F. sputtered insulations for silicon integrated circuits: R. J. Jeacock and R. Rathbone (Hirst Research Centre, G.E.C. Ltd., Wembley).

Electroluminescence and negative resistance of Ta-Ta₂O₅-Au and Al-Al₂O₃-Au Diodes: T. W. Hickmott (I.B.M. Corporation, Hopewell Junction, New York).

(b) *Thick films and substrates in microelectronics*

The uses of glasses in thick film microelectronics: P. L. Kirby (Welwyn Electric Ltd., Bedlington).

Glass in heterogeneous films in electronics applications: F. E. Kerridge and O. N. Collier (Johnson Matthey & Co. Ltd., London).

Application of glass-ceramic in a microelectronics substrate: K. C. Bingham,* S. E. Davies† and P. W. McMillan* (*Nelson Research Centre, Stafford; †Computer Research and Advance Development Division International Computers Ltd., Stevenage).

Surface Effects and Coatings. In the Chair: Dr. F. S. Hawkins.

Glass-ceramic bonds for electronic and electrical engineering applications: G. Partridge and P. W. McMillan (Nelson Research Centre, Stafford).

Glass coated grids for iron engines: E. P. Denton and B. O. Baker (Hirst Research Centre, G.E.C. Ltd., Wembley).

Tea

The coloration of glass surfaces by sodium vapour: R. M. Muncaster and L. F. Oldfield (Hirst Research Centre, G.E.C. Ltd., Wembley).

The effect of the vitreous envelope on the transport cycle in tungsten halogen lamps: J. M. Rees and D. T. Evans (Thorn Lighting Limited, Leicester).

Friday, October 2nd, 1970

Special Materials and Techniques. In the Chair: Dr. R. E. Bastick.

Some glass problems in the manufacture of channel plates: H. J. L. Trap (Philips Research Laboratories, Eindhoven).

Superconducting metals in porous glass: J. H. P. Watson (Corning Glass Works, Corning, New York).

The electrical properties of some ruby and aventurine type glasses: S. Pizzey (Mullards Research Laboratory, Mitcham).

New uses for carbon in shaping special glass components: J. B. Patrick (Hirst Research Centre, G.E.C. Ltd., Wembley).

Brief research reports and announcements

Optical Glasses. In the Chair: Dr. S. Parke.

Glasses for optical communications systems: G. R. Newns (Post Office Research Department, London).

The preparation of glasses having transmission in the near infra-red: B. Scott and H. Rawson (University of Sheffield).

Glass fibre waveguides for optical telecommunications: R. W. J. Uffen (Standard Telecommunication Laboratories, Harlow).

NOTICE
SOCIETY OF GLASS TECHNOLOGY
Symposium on Electrotechnical Glasses
Preprints

A volume of preprints of the papers to be presented to the above meeting is being prepared for distribution to participants and, in addition, a limited number will be made available for sale. Each author has been asked for a typescript of up to 2,000 words which will be reproduced photographically.

The price of the volume will be 25s. (including packing and postage) for orders received by August 14th, 1970, and 40s. (including packing and postage) for orders received after that date.

IXth INTERNATIONAL CONGRESS ON GLASS

Palais des Congrès, Versailles

September 27th–October 2nd, 1971

Brochures and preliminary application forms for the IXth Congress are now available and Members interested in receiving further details are asked to contact the Society's office immediately.

Preliminary application forms must be returned by September 1st, 1970.

Papers, together with an abstract of 200–250 words must be submitted by *October 20th, 1970*.

Registration fees: for participants, 600 FF
for those accompanying participants 300 FF.

THE INSTITUTE OF PHYSICS AND THE PHYSICAL SOCIETY

Publishing Division

Branch Publishing Office in Bristol

The Institute of Physics and The Physical Society will shortly open a branch publishing office in Bristol to supplement its existing premises in London.

The address will be: Netherton House, 23/29 Marsh Street, Bristol, BS1 4BP.

Moving to Bristol

The editorial production of the following journals will be transferred from Lowther Gardens, London, to Netherton House, Bristol.

As from July 8th, 1970

Journal of Physics A: General Physics
Journal of Physics B: Atomic and Molecular Physics
Journal of Physics C: Solid State Physics
Journal of Physics D: Applied Physics
Reports on Progress in Physics
Review of Physics in Technology

As from July 28th, 1970

Physics Education

Remaining in London

The editorial production of Physics Bulletin and Journal of Physics E: Scientific Instruments; the Advertisement Department for all journals; meetings of the Institute and Society's Publications Committee and of the various Editorial Boards.

New Appointments

Dr. D. G. Fisher, F.Inst.P. has accepted an invitation to succeed Mr. H. G. Jenkins, F.Inst.P. as Executive Editor, and will take up her appointment in Bristol at the beginning of July. Mr. P. E. Lafferty, at present Assistant Editor of Journal of Physics C: Solid State Physics, is being appointed to the new position of Production Manager, Journal of Physics series, with effect from July 1st, 1970.

UNIVERSITY OF BRADFORD SCHOOLS OF CHEMICAL ENGINEERING

Radascan Flow/No Flow Detector

The Radascan flow detector is a useful industrial tool for the detection of flow failure in granular or powder flow. It can be used for a wide range of materials covering most of the current industrially important materials of interest in the chemical and food processing industries.

Operation

A change in the amount of material flowing within the pipe volume covered by the instrument will show up as a variation in the volt-meter reading. The output can be used to stimulate a warning device at a present level and to shut down the plant section.

Flow rates of less than about 0.6 meters/sec. also give no output and this is thus an additional flow failure detection. This low flow rate cut off can be varied to suit requirements.

Principle

The instrument works on the doppler radar principle using a continuous low power source and a specially designed projection

system. The output is of the order of a few milliwatts and is sufficiently low to represent no hazard with inflammable materials or to physically change the flow material.

Specification

Power Supply: 250 volts 50 Hz. at 1 Amp.

(Other power supplies can be accommodated)

Operating Range: Typically operates above 0.3 meters/sec. The voltmeter reading depends upon the type and quantity of material present. As an example: a stream of sand 1 cm. $\times$ 0.3 cm. can be detected.

Environment: For operation in difficult environments the unit can be supplied totally sealed with provision for forced air cooling.

Applications

Most pneumatically conveyed and freely falling divided solids can be detected.

Two-phase flow with non-aqueous continuous phase can be detected at temperatures providing some transparency to radiation. Above about 85°C. at atmospheric pressure aqueous continuous phases can be treated, this represents one of the more difficult applications.

Due to the fast response time this system is well suited to automatic control systems.

Radascan Flow Meter/Mass Flow Meter

The Radascan flow meter is a useful industrial tool for the measurement of flow rate or mass flow rate. It can be used for a wide range of industrial materials covering many of the current industrially important materials of interest in the processing industries.

Operation

The flow rate (velocity) of the system shows up as a meter indication which will rapidly follow any variation flow rate, minor local fluctuations are smoothed out due to the design of the instrument which is aimed at measuring general rather than local changes.

As an additional extra the mass flow rate may be indicated.

Principle

The instrument works on the doppler radar principle using a continuous low power source and a specially designed projection system. The output is of the order of a few milliwatts and is sufficiently low to represent no hazard with inflammable materials or to physically change the flow material.

Specification

Power Supply: 250 volts 50 Hz. at 1 Amp.

(Other powder supplies can be accommodated)

Operating Range: Typically operates above a flow speed of 0.6 meters/sec. The temperature of the material is unimportant.

Environment: For operation in difficult environments the unit can be supplied totally sealed with provision for forced air cooling.

Applications

Most pneumatically conveyed and freely falling divided solids can be treated.

Two-phase flow with non-aqueous continuous phase can be detected at temperatures providing some transparency to radiation. Above about 85°C. at atmospheric pressure aqueous continuous phases can be handled.

Due to the fast response time this system is well suited to automatic control systems.

Patent cover has been obtained.

Both instruments will be available from Automation Techniques and Systems Ltd., Pendeford, Wolverhampton.

Further details of the above instruments can be obtained from:

J. Harris,
Schools of Chemical Engineering,
The University,
Bradford 7, Yorks., U.K.

SITUATIONS VACANT

University of Surrey

Department of Physics

Research Studentships in Rheological Topics

Applications are invited from holders of First or Upper Second Class Degrees who satisfy Science Research Council requirements for research studentships in the following fields:

Viscosity of Suspensions of Particles in Polymer Melts and Solutions

Solid fillers are widely used in polymers of various kinds but there has been little systematic study of the influence of particles on the viscosity of molten polymers. Previous work in this Department on the viscosity of suspensions of spheres in polymer solutions has suggested that the viscoelastic properties of the solutions as well as their non-linear flow curves may need to be considered when predicting the viscosity of the suspensions. It is now intended to extend this work to suspensions in other solutions and in polymer melts and in particular to determine the range of validity of the correlations between suspension viscosity, fluid viscosity and concentration already established.

In tests on some of these suspensions particle migration has proved to be troublesome and a second programme of work is planned to establish the circumstances under which this occurs. The origins of this migration represent a most intriguing problem.

Further information may be obtained from Mr. R. W. Whorlow.

Fracture of Polymers

An examination will be undertaken of the fracture of crystalline and amorphous polymers under various states of stress, with a view to understanding the molecular and microstructural factors which govern the initiation and propagation of cracks. Particular attention will be paid to the role of orientation, and of voids in the material, and the work will be chiefly concerned with high density polyethylene and polystyrene.

A considerable research effort, supported by the S.R.C., is already devoted in the Physics Department to the mechanical properties of polymers. A visiting Reader in the Department, Dr. J. P. Berry (Assistant Director of the Rubber and Plastics Research Association), is well known for his studies of crack initiation in glassy polymers. Facilities exist within the Department for tensile testing, optical and electron microscopy, and low-angle X-ray scattering, and scanning electron microscopy is available as a university facility.

Further information may be obtained from Professor K. E. Puttick.

Applications for these Studentships should be addressed to the Head of the Physics Department, University of Surrey, Guildford, Surrey.

Van Leer (U.K.) Limited
Passfield Research Laboratories

Applications are invited for the following vacancies

Rheologist

to study rheological properties of thermoplastics in relation to their processing behaviour, and to advise on extruder and die design from a theoretical standpoint using computer techniques where appropriate. Successful candidate for this post will be an Honours Graduate probably with a research degree, between 25 and 35 years of age and able to display initiative and inventiveness.

Research Assistants

qualifications being H.N.C. or Pass Degree

The laboratories which form the research centre for an international industrial packaging organisation, are well equipped and are situated in pleasant rural surroundings. There is a contributory pension scheme in operation and housing assistance is provided.

Please send brief details of age, present salary, qualifications and experience in confidence to:

The Administrator,
Van Leer (U.K.) Limited,
Passfield Research Laboratories,
Passfield,
Nr. Liphook, Hampshire.

BRITISH SOCIETY OF RHEOLOGY

Computer Program Catalogue

Publication Abstracts

Abstract No. 5

1. Author

R. I. Tanner and G. Williams

2. Establishment

Division of Engineering, Brown University, Providence, Rhode Island, 02912.

Tel. No. (401) 8632602

3. Program Abstract

(1) Compute $\gamma(\tau)$ from capillary viscometer data

(2) Compute $\gamma(\tau)$ from couette viscometer data

Input Data

(1) N pairs of data $(\tau\omega, F)$, $F = -4Q/\pi r^3$

(2) N trios of data $(s, \Omega, \tau r)$, $S = \gamma/R = < 1$

Output Data

for both 1 and 2 τ , $\gamma(\pi)$, $\eta_s(\gamma)$

4. Program data

January, 1969

5. Language

Fortran IV

6. Computer requirements

None

7. Type of Input/Output

Card input, printer output

8. References

R. I. Tanner and G. Williams, Iterative Numerical Methods for Some Integral Equations arising in Rheology, Trans. Soc. Rheology, 14 : 1, 19-38 (1970)

9. Related programs

None

10. Available for copy/data processing

None

BRITISH SOCIETY OF RHEOLOGY

Computer Program Catalogue Publication Abstract

1. Author
2. Establishment
..... Tel. No.
3. Program Abstract
.....
Input Data
Output Data
4. Program date
.....
5. Language
.....
6. Computer requirements
.....
7. Type of Input/Output
.....
8. References
.....
.....
.....
9. Related programs
.....
10. Available for copy/data processing
.....
.....

Return to: Dr. J. Harris,
Postgraduate School of Chemical
Engineering,
University of Bradford,
Bradford 7, U.K.

Additional blank abstract sheets are available as required from the above address.

LOST MEMBERS

The present whereabouts of the members listed below is unknown. Any information which will assist in tracing them will be gratefully received by the Membership Secretary:

Mr. B. Warburton,
Schools of Pharmacy,
Brunswick Square,
London.

Mr. P. Connor, 9 East Shrubbery, Redland, Bristol.

Dr. D. P. Earp, 35 Westfield Drive, Woodley, Reading, Berks.

Mr. B. Holdaway, c/o Bank of N.S.W., 47 Berkeley Square, London.

Dr. J. L. Maddock, 12 Addison Court, Maidenhead, Berks.

Mr. J. W. Sellars, "Pantiles," 6 Hazell Way, Stoke Poges, Bucks.

Mr. H. R. S. Tage, 16 Cae Rhadyn, Croesyceiog, Cwbran, Mon.

BRITISH SOCIETY OF RHEOLOGY SPRING CONFERENCE 1971

A conference on "THEORETICAL RHEOLOGY" will be held at The University College of Wales, Aberystwyth, from April 13th-16th, 1971. It will include sessions on "Fundamentals" and "Applications." Intending contributors are asked to submit a title and abstract (of up to 300 words) to either

Dr. J. R. A. Pearson, Dept. of Chemical Engineering, Pembroke Street, Cambridge,

or

Dr. K. Walters, Dept. of Applied Mathematics, University College of Wales, Aberystwyth.

by November 30th. A programme of talks to be presented will be prepared and circulated early in 1971 together with application forms giving details of charges for participation at the conference, accommodation and meals. Application forms should be returned by March 1st, 1971.

It is not intended to publish the proceedings of the conference.

(Accommodation will be available in a University Hall of Residence.)

RECENT ELECTIONS

NAME AND ADDRESS	INTERESTS
G. J. Addis Materia Medica Dept. Glasgow University, U.K.	Expt. Biological Maths.
H. G. Allen Civil Engineering Dept. The University Southampton, U.K.	Theory and expt. Composites Natural fibrous Matls., Building and Road Matls., Theoretical Matls.
A. J. Anderson Faculty of Pharmacy University of Alberta Edmonton 7, Canada	Expt. Liquid-liquid and Liquid-solid systems
J. W. Goodwin School of Chemistry The University Bristol, U.K.	Theory and expt., Liquid-solid systems, Biological Matls.
T. H. Hammond Glamorgan Polytechnic Pontypridd Glamorgan, Wales	Theory and expt., Liquid-solid systems, Biological Matls.
S. J. Higgs Nat. Coll. of Food Tech. St. George's Avenue Weybridge Surrey, U.K.	Expt. Liquid-liquid and Liquid-solid systems, Foodstuffs
H. Holstein Dept. Applied Maths. University College Aberystwyth, Wales	Molten or dissolved polymers
P. J. Huck Unilever Research Lab. 455 London Road Isleworth Middlesex, U.K.	Composites, solid polymers, molten or dissolved polymers
M. J. Keedwell Lanchester Polytechnic Priory Street Coventry, U.K.	Theory and expt. Clays
R. A. Kemp Department of Engineering University of Leicester Leicester, U.K.	Theory and expt. molten or dissolved polymers, oils, greases
A. F. Lashine Department Civil Engineering The University Nottingham, U.K.	Theory and expt. Building and road matls.
A. N. Magnall School Chemical Engineering The University Bradford 7, U.K.	Molten or dissolved polymers. Liquid-solid systems
C. Marriott School of Pharmacy Leicester Polytechnic Leicester, U.K.	Theory and expt. Biological matls.

NAME AND ADDRESS	INTERESTS
L. N. Milatovich Faculty of Technology Dept. Food Processing Barotawski Zagreb Yugoslavia	Rheology of Food
N. A. Orr School of Pharmacy Brunswick Square London W.C.1, U.K.	
A. C. Park Unilever Research Lab. Isleworth Middlesex, U.K.	Expt. Natural fibrous matls. Biological matls.
J. D. Peel Paper Science Building Amist Manchester 1, U.K.	Expt. Natural fibrous matls.
P. W. Riley Dept. Chemical Engineering The University Loughborough, U.K.	Theory and expt. Liquid-liquid Liquid-solid and particulate solid systems
P. K. Sage Sangamo Controls Ltd. North Bersted Bognor Regis Sussex, U.K.	Expt. Rheological instruments
G. V. F. Seaman Divn. of Neurology University Oregon Med. School Portland Oregon 97201 U.S.A.	Theory and expt. Liquid-liquid and Liquid-solid systems. Biological matls.
A. Singleton Mobil Oil Co. Research and Tech. Services Ltd. Coryton Essex, U.K.	Dissolved polymers. Oils
I. Wagstaff I.C.I. Paints Division Slough, Bucks., U.K.	Expt. Molten or dissolved polymers. Liquid-solid systems
R. A. Weston Nat. Coll. Rubber Tech. Holloway Road London N.7, U.K.	Theory and expt. Solid polymers. Molten or dissolved polymers. Liquid-solid systems. Theoretical matls.
M. A. M. A. Younes Dept. Mechanical Engineering The University Leeds 2, U.K.	Theory and expt. Oils and greases.

DIARY

1970

1-3 September. Conference—The Hydraulic Transport of Solids at Coventry. B.H.R.A. Cranfield, Beds.

29 September-1 October. Conference—Advances in Polymer Science and Technology No. 3. Chemistry of Liquid and Thermoplastic Co-polymers. Joint I.R.I., P.I., S.C.I., O.C.C.A. and S.D.C.

September. Conference—Furniture. Plast. Inst.

6-10 October. Exhibition and Conference—Inter. Science, Research and Technology Exhibition and Conference. Boardman Ltd., 8 Leicester Street, London, W.C.2.

13 and 14 October. Conference—Reinforced Plastics at Solihull. Plast. Inst.

20-22 October. Conference—7th Int. Reinforced Plastics Conference at Brighton. Brit. Plast. Fed.

November. Exhibition—Internat. Reinforced Plast. Exhib. (REPLEX) at Earls Court, London. Brintex Exhibitions Ltd., 3-4 Clements Inn, Strand, London, W.C.2.

9-13 November. Exhibition—Scottish Plastics, Packaging and Printing Exhibition at Glasgow.

19 and 20 November. Conference—Plastics in Furniture. Plastics Inst.

1971

4-6 January. Conference—Designing for Plastics; The Integrated Approach, at Cranfield. Plast. Inst.

2-4 February. Conference—Carbon Fibres, their Composites and Applications. Plast. Inst.

25-27 March. Conference—Exploitation of Polymer Research at Loughborough. Joint I.R.I., Plast. Inst.

March. Conference—Plastics in Fire: Building. Joint Plast. Inst./Agreement Board.

March. Conference—Plastics in Fire: Building. Joint Plast. Inst./Agreement

22 and 23 April. Conference—Industrial Conference at Leamington Spa. I.R.I.

15-18 May. Conference—International Rubber Conference at Brighton. I.R.I.

16-23 September. Exhibition—6th International Plastics Trade Fair "K-71" at Dusseldorf.

1972

6th Intn. Congress on Rheol. France 1972.