

NOTICE TO INTENDING CONTRIBUTORS

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

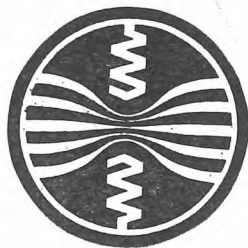
1. Technical papers (two copies required).
2. Descriptive papers of general interest.
3. Letters which may be either
 - (i) technical or
 - (ii) non-technical.

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.

BULLETIN



BRITISH SOCIETY OF RHEOLOGY

1971, No. 3, Vol. 14

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Hon. Editor:

JOHN HARRIS,
Schools of Chemical Engineering,
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Bradford,
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FOREWORD

The economics of research and development is a notoriously difficult subject and causes as much strenuous thought as the physical and chemical problems involved in these activities. An unfortunate aspect of economics is that the answers can, and often do, change annually for a given set of investigations. This means that for research and development scientists, especially those employed in private sector industries, objectives can change not only in emphasis but also in substance. Events of the recent past have underlined this point in a very striking way.

The economic aspect of research and development very frequently remains the hidden but vitally important consideration in discussion on rheology although provision was made for the study of management—which involves economics—in the Bradford Conference of 1968 and also in the Australian Conference “Chemica ’70” which included both rheology and management. However for the most part the economic aspects of research and development in rheology are kept well suppressed; how long will this continue? The situation in Britain relating to the economics of research and development is not materially different in this respect from that in any other country. Perhaps the present type of conference does not provide the right sort of climate for discussions in this field.

It is difficult to believe that factors such as those mentioned above are deemed unworthy of consideration. Yet there is a reluctance to talk freely about these things, perhaps stemming from a lack of expertise which one feels should be rectified for as one person has remarked: “The road to bankruptcy is paved with good inventions.”

COUNCIL 1970-71

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Committee: MR. W. H. COPLEY, MR. J. D. GIBSON, MR. K. MARTIN.

SIXTH INTERNATIONAL CONGRESS ON RHEOLOGY

Lyon, France

September 4th-8th, 1972

Subjects

Papers on the following aspects of rheology will be presented during the congress:

- i. Theory.
- ii. Measuring techniques.
- iii. Test methods.
- iv. Fractures.
- v. Rheologic properties of materials:
 - (a) vapours and gases
 - (b) liquids
 - (c) polymers in the solid state: fibres, films, elastomers and plastics
 - (d) polymers in solution and melts
 - (e) emulsions, suspensions and powders
 - (f) metals and other crystalline materials
 - (g) foods
 - (h) oils and fats
 - (i) cosmetics and drugs
 - (j) paints and printing inks
 - (m) adhesives and lubricants
 - (n) wood and other natural products
 - (o) glass and ceramics
 - (p) concrete and mortars
 - (r) soils and rocks
 - (s) miscellaneous
- vi. Rheo-optic.
- vii. Bio-rheology.
- viii. Miscellaneous.

Inscriptions and Papers

All who wish to have more complete details of the programme, the papers and participation, are invited to write to the congress secretary before November 1st, 1971.

Persons who wish to present a paper should indicate the category into which it falls principally, according to the subject list on page 6. The presentation of the paper together with discussion time should be about 20 minutes. The title and an abstract of no more than 300 words should be addressed to the organising secretary before March 1st, 1972.

Dr. C. SMADJA,
Boîte Postale n° 1
69 Lyon-Mouche,
France.

Joint Spring Conference 1972
RHEOLOGY OF LUBRICANTS

Preliminary arrangements have been made for a joint Institute of Petroleum/Institution of Mechanical Engineers/British Society of Rheology meeting in early July, 1972. The suggested venue for a two-day meeting was either Oxford or Nottingham University. An open reception would be held during the evening prior to the meeting and there would be a Conference Dinner on the first evening.

The main session headings suggested are:

1. The Rheology of Petroleum-based Lubricants.
2. The Rheology of Synthetic Lubricants.
3. The Rheology of Greases.
4. Non-Conventional Lubricants.
5. New Concepts in Theoretical and Experimental Rheology.
6. Research Reports.

Papers are invited for the above meeting and abstracts of about 200 words may be sent to:

Professor D. DOWSON,
Dept. of Mechanical Engineering,
The University,
Leeds, U.K.

or

Dr. J. HARRIS,
School of Chemical Engineering,
The University,
Bradford, U.K.

SYMPOSIUM—NETHERLANDS SOCIETY OF RHEOLOGY

Preliminary Notice

On 28th and 29th of October 1971 the "Nederlandse Reologische Vereniging" organises a symposium on "New developments in experimental technics".

The symposium will be held in Hotel Erica, Berg en Dal near the town of Nijmegen.

Those who are interested in participating are invited to contact:

Bond voor Materialenkennis,
P.O. Box 9321,
The Hague, Holland.

J.S.M.E. INTERNATIONAL SYMPOSIUM

4-9 September 1972—Tokyo

FLUID MACHINERY AND FLUIDICS

Principal Subjects

(A) FLUID MACHINERY

- (a) Internal Flow.
- (b) Cavitation and Supercavitation.
- (c) Transient Phenomena and Unsteady Flow.
- (d) Noise and Vibration.
- (e) Fluid—Dynamic Design and Performance.
- (f) Measurement, Testing and Operation.

(B) FLUIDICS

- (a) Fluid Mechanics of Fluidics.
- (b) Fluidics Components.
- (c) Fluid System Design.
- (d) Applications.

Further details are available from:

The Organising Committee
of the 2nd International J.S.M.E. Symposium,
The Japan Society of Mechanical Engineers,
Nihon Kikaku Kyokai Bldg.,
1-24 Akasaka 4-Chome, Minato-ku,
Tokyo,
107—Japan.

CHEMICAL SOCIETY SUMMER SCHOOL IN RHEOLOGY

9-13 April, 1973—School of Pharmacy, London

Organiser: Professor E. Shotton, School of Pharmacy, London

A Summer School is being planned which will be of interest to chemists in a wide variety of industries who would like to learn something of the rheology of materials and of experimental methods. The Course will be of value to chemists in the pharmaceutical, cosmetics, food, metals, ceramics, paints and printing ink industries, and will be suitable for those of graduate status.

At the beginning of the week basic principles and underlying theory will be dealt with, in a format of morning lectures and afternoon

problem-solving tutorials and demonstrations. Later in the week the School will deal with applications of rheological principles to specific systems, probably under the following headings:

Dispersed Systems—emulsions, suspensions and pastes.

Plastics and Rubber—higher elastics and solids.

Solids—both crystalline and amorphous.

Further details will be available in due course, and these may be obtained by writing to Dr. M. D. Robinson, Education Officer, The Chemical Society, Burlington House, Piccadilly, London, W1V 0BN. Professor Shotton will be pleased to answer technical enquiries concerning the School.

A NOMOGRAPH FOR USE WITH THE WEISSENBERG RHEOGONIOMETER AND THE FERRANTI-SHIRLEY VISCOMETER

by R. W. Higman

Reference: Bulletin, 1971, No. 1, Vol. 14

The attention of members is drawn to the fact that the Nomograph for sale which is referred to above actually measures 15 ins. $\times$ 13 ins. and is in plastic laminated board, suitable for use with a Chinagraph Pencil.

Abstracts of A.I.Ch.E. Symposium on Rheology of Biological Systems, San Francisco, November 1971

RHEOLOGY OF BIOLOGICAL SYSTEMS—PART I

H. L. Gabelnick, Chairman

National Institute of Health, Bethesda, Maryland

Mr. Litt, Co-chairman

University of Pennsylvania, Philadelphia, Pennsylvania

The interest of chemical engineers in biorheology has grown tremendously in recent years. This symposium will concentrate on two areas of research. Part I emphasises the effects of red cell deformability on blood rheology and Part II is mainly concerned with biological lubricants. Panel discussions will follow the formal presentations in each session.

8.30 a.m.: Introduction

H. L. Gabelnick

8.35 a.m.: Rheology of the Human Red Cell and Capillary Blood Flow

R. Wells (Speaker), Peter Bent Brigham Hospital, Boston, Massachusetts, and J. Goldstone, University of California Medical Center, San Francisco, California.

Red cells must deform to pass through human capillaries. Cell deformability analysed by viscometry of packed cells and by filtration time through calibrated micropores revealed ratio of membrane surface to contained volume and viscosity of hemoglobin determined deformability. Cine photomicrography of capillary flow with abnormal cells showed retarded or occluded flow.

9.20 a.m.: Viscometric Studies on Red Blood Cell Damage

R. N. MacCallum (Speaker), W. O'Bannon, J. D. Hellums, Rice University, Houston, Texas, C. P. Alfrey, Jr., and E. C. Lynch, Baylor College of Medicine, Houston, Texas.

A new rotational viscometer has been developed specifically for studies on red blood cell damage by shearing stress. The instrument differs from those used in ordinary viscometry in two ways. First, the volume subjected to shearing is a large fraction of the total specimen volume. In one configuration the entire specimen in the instrument is subjected to a uniform shear rate. Second, the instrument is capable of extremely high shearing rates ($200,000 \text{ sec}^{-1}$) in laminar flow. These two properties are of primary importance in studies on shear degradation. Applications are discussed in both normal and pathologic blood.

9.35 a.m.: A Numerical Analysis of the Flow of Deformable Erythrocyte Models in Capillaries

A. R. Perlin and T. K. Hung (Speaker), Carnegie-Mellon University, Pittsburgh, Pennsylvania, and G. Bugliarello, University of Illinois at Chicago Circle, Chicago, Illinois.

The flow of evenly-spaced erythrocytes proceeding in trains through capillaries has been simulated by means of axisymmetric numerical models, in which the interior of the cell is considered to be a fluid (Newtonian) of greater viscosity than the surrounding plasma (also Newtonian).

9.50 a.m.: The Recoverable Membrane Energy as the Criterion of Red Cell Hemolysis

J. S. Ultman, The Pennsylvania State University, University Park, Pennsylvania, Pennsylvania.

Red cell hemolysis caused by membrane fracture is characterised by a critical value of recoverable mechanical energy. This value is computed from existing experimental data by assuming the membrane behaviour can be predicted by a 3-parameter linear viscoelastic equation.

10.10 a.m.: Penal Discussion

All authors.

RHEOLOGY OF BIOLOGICAL SYSTEMS—PART II

2.00 p.m.: Physical Chemical Factors in Mucus Rheology

M. Litt (Speaker), and R. Lutz, University of Pennsylvania, Philadelphia, Pennsylvania.

The viscoelastic properties of normal mucus are principally a function of pH, weight fraction of glycoproteins, and ionic strength. The storage and loss shear moduli of canine tracheal mucus have been determined for a wide range of these variables using both natural mucus and "mucus" reconstituted from the lyophilised natural polymer to given values of pH, etc.

2.15 p.m.: Rheological Examination of Sputum and Saliva and the Effects of Drugs

S. S. Davis, University of Aston in Birmingham, United Kingdom.

Mucoid fluids, such as sputum and saliva have been characterised in a fundamental rheological manner, using creep and oscillatory testing and the theory of linear viscoelasticity. The *in vivo* and *in vitro* effects of mucolytic agents have been assessed with a view to designing more effective drugs and delivery systems.

2.30 p.m.: Measurement of the Rheological Properties of Biological Fluids

C. D. Han (Speaker), Polytechnic Institute of Brooklyn, Brooklyn, New York, and B. Barnett and E. Meilman, Long Island Jewish Hospital, Long Island, New York.

The viscoelastic properties of serum were measured by means of a capillary viscometer developed earlier by the authors. Changes in viscosity and recoverable shear strain were determined as a function of time on samples from patients who underwent open heart surgery. The measured values showed marked changes in the viscoelastic properties immediately following and for some time after surgery. The effect of using different materials for the capillary (teflon and glass) on the measurements was also evaluated.

2.45 p.m.: Study of the Viscoelastic Properties of Sputum With a Concentric Cylinder Rheometer

A. M. Benis (Speaker), Department of Chemical Engineering, Columbia University, New York, and E. Puchelle and P. Sadoul, Faculte de Medecine de NANCY, Physio-pathologie Respiratoire, Nancy, France.

The rheological properties of mucoid sputum were studied with the use of a concentric cylinder rheometer under conditions of steady

shear flow and constrained recovery after steady shear flow. Measurements are reported of yield shear stress, viscosity and elastic modules for samples obtained from patients with chronic bronchitis.

3.00 p.m.: The Rheology of Hydron for Orthopaedic Implants

P. S. Walker, Hospital for Special Surgery, New York, New York, and R. Roth, Hydron Laboratories, New Brunswick, New Jersey.

Hydron is a viscoelastic acrylic hydrogel polymer which has already had application in implants. The viscoelastic properties of Hydron were determined for static and cyclic loads, and the strength properties determined. It was concluded that Hydron could withstand conditions in the upper limb, and possibly in the hip or spine.

3.15 p.m.: Pseudo-Synovial Fluids Based on NaCMC—In Vitro and In Vivo Applications

C. A. Homsy (Speaker), R. F. Stanley and J. W. King, Baylor College of Medicine, Houston, Texas.

A pseudo-synovial fluid based on sodium carboxymethylcellulose (NaCMC) will be described. The fluid virtually reproduces the pseudo plastic characteristics of normal synovial fluid. Rheological data will be presented for this fluid and the use of the fluid in *in vitro* evaluation of prosthetic articular cartilage will be described in detail. These results were found to inform the quantitative energy absorption function of synovial fluid in the normal joint. Rheological data obtained with near normal and pathologic human synovial fluid will also be presented.

3.35 p.m.: Panel Discussion

All authors.

DIARY

1971

28 & 29 October. Symposium—New Developments in Experimental Techniques, The Hague, Holland, Netherlands, Soc. Rheol.

2 & 3 November. Conference—Plastics in Fire at Inst. Elec. Engrs., London, by Plastics Institute.

23 & 24 November. Conference—Developments in Films for Packaging, London Plastics Institute.

1972

11–13 April. Conference—Polymers in the Transportation Industry, Joint I.Prod.E./P.I./I.E.D./S.E.E. Meeting.

15–18 May. Conference—International Rubber Conference, Brighton I.R.I.

22–24 May. Conference—Plastics in Mechanical Engineering, I.Mech.E./P.I.

July. Conference—Rheology of Lubricants Joint Inst. Pet./I.Mech.E./B.S.R. at Oxford/Nottingham University (venue to be decided).

4–8 September. Congress—6th International Congress on Rheology, Lyon, France.