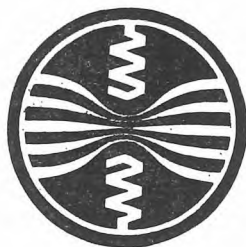


BULLETIN



BRITISH SOCIETY OF RHEOLOGY

1974, Vol. 17, No. 1

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Hon. Editor:

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National Engineering Laboratory,
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FOREWORD

Conferences and meetings often follow developments in technology or the needs of the times we live in. With the wisdom of hindsight we occasionally find a gathering on a topic which appeared to anticipate some important event or situation. For example, when the recent conference on conservation of materials was first proposed could its organisers have known the importance it would assume when the actual date arrived? World trends can change so suddenly that they must have had some psychic power or premonition of impending crisis in this case.

What if others had similar powers? We could learn much about future world conditions from a study of published lists of forthcoming meetings—a kind of rheo-astrology! Consider possible interpretations of a few meetings to be held during the next few months.

“Rheology of clays and cement pastes”. Rising costs of houses and shortage of building materials leads to a new interest in stabilised mud huts.

“Cushioning and shockproof packaging”. How to protect goods from careless handling by militant transport workers.

“Polymers and plastics in fire situations”. Not another Summerland, just the worsening fuel situation.

“Theoretical rheology”. Further cuts in research spending means that rheologists cannot afford sophisticated apparatus.

It is to be hoped that we can still smile at this when it appears in print.

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MR. R. VINEN, Applied Chemistry Department, Footscray Institute of Technology, Ballarat Road, Footscray, Victoria.

SOME COMMENTS ON THE NEDONCHELLE-SCHUTZ EFFECT

G. W. Scott-Blair

(Based on a Paper read at the Annual Conference, Brit. Soc. Rheol.,
Norwich, September 1973.)

Abstract

A brief historical survey is given to the history of double-logarithmic equations relating stress to shear-rate for two-phase systems. Early attempts to find a dimensionless form of this equation failed, but recently, for certain systems that thicken or thin in the course of time, a logarithmic relation has been found between the two parameters of the double logarithmic equation. This leads to a dimensionless expression. Further experiments should show whether all changing suspensions which give good linear double logarithmic flow curves follow this equation. It is concluded, in the mean time, that this relation is neither a mathematical necessity nor a case of pure chance; but rather that it expresses the simplest possible relation between the parameters.

Introduction

Although a few papers were published before the nineteen-twenties in which the stresses (τ) of two-phase systems were shown to be linearly related to shear rates ($\dot{\gamma}$) when double logarithms were used, the first major studies of this method are generally ascribed to de Waele^{1*} and Ostwald.²

de Waele's work needs only brief mention here. He was criticized for not making it clear that his use of the symbol (η) did not refer to properties having the dimensions of viscosity ($\text{ML}^{-1}\text{T}^{-1}$). No doubt he should have used some other symbol, such as η^1 , but this is not a very serious matter. More serious, and not apparently noticed in his lifetime, was his use of the term $e^{-\text{stress}}$. It is hard to see what this could possibly signify.

In later years, de Waele abrogated use of double logarithmic equations, though he appears to have returned to them again before his death.

Ostwald and his pupils, on the other hand, developed a much more complex model for $\tau:\dot{\gamma}$ relations in two-phase systems. This is illustrated in Fig. 1.

If the shear rate is progressively increased, in the early stages, while structure is being broken down, a double logarithmic relation holds.

* Both these authors published much on this subject. Only the principal representative papers need be cited here.

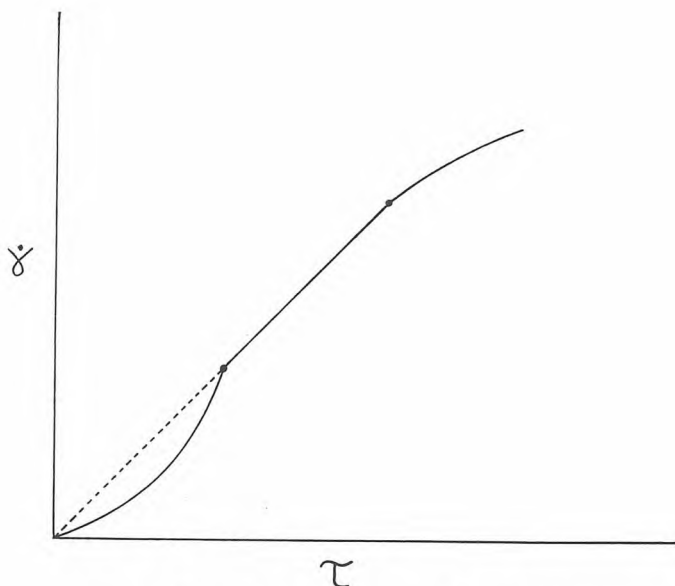


Fig 1. Schematic Representation of Ostwald Curve

The equation for this is most simply written as

$$\tau = K \dot{\gamma}^A \quad (1 > A > 0) \quad (1)$$

This region he called "Strukturviskosität."

At a well-defined point, all the structure has been destroyed, the system becomes Newtonian, resulting in a linear relation between τ and $\dot{\gamma}$. This region he rather misleadingly called the "Laminarast". At still higher shear rates, local turbulence around the dispersed particles was alleged to produce an increase in apparent viscosity: "Struktur-turbulenz".

Later Reiner and Schoenfeld-Reiner³ found experimentally a small Newtonian region at the lowest shear rates before the start of the Strukturviskosität.

Although Ostwald published data from very many experiments, the present writer claimed that many of the individual experiments did not have data adequate to justify the use of the double logarithmic equation (Scott Blair⁴) though Ostwald⁵ could not agree with this criticism. Certainly there was little real evidence for a "Laminarast" until this was found quite definitely by Reiner and Schoenfeld-Reiner, and later by Russian workers, followed by many others.

The use of double logarithms has been criticized on two counts: (1) it has been stated that equation (1) is "dimensionally inhomogeneous"

(e.g. by Andrade⁶); and (2) that the linearity of double-logarithmic curves means no more than that, if a linear plot does not show very much curvature, plotting on double logarithmic paper will always produce more or less a straight line.

The first criticism is incorrect, because the dimensions of K are adjusted to allow for the magnitude of A . Nevertheless though not "inhomogeneous", equation (1) is certainly dimensionally awkward, since K represents a different "property" for different systems. The second criticism is easily refuted by drawing a definitely (but slightly) curved line on double logarithmic paper, reading off the τ and $\dot{\gamma}$ coordinates and re-plotting on linear paper. This will produce a not very strongly curved line which has already been shown not to give a straight line when transferred to double logarithmic paper.

In the last forty or fifty years so many (perhaps thousands) of linear double logarithmic $\tau:\dot{\gamma}$ curves have been published, that some model to account for this seemed desirable; and in 1965, Scott Blair⁷ derived a double logarithmic equation from the very simple assumptions that, even when there is a monotonic relation* between τ and $\dot{\gamma}$ increasing stress breaks down the bonds in the two-phase system, whereas increasing shear (as measured by shear rate) inhibits their re-forming; both processes being exponential. These two differential equations combine to give the differentiated form of equation (1). Similar equations can be derived for systems that thicken on shearing.

It seems that as early as 1933, a certain Dr. Lark-Horowitz wrote a private letter to Professor Reiner (quoted in the latter's book⁸) in which he suggested that equation (1) could be written in a dimensionless form if only a stress and a shear rate could be found characteristic of the system. Three years later, Nadai⁹ made the same point. What is truly remarkable is that it does not seem to have occurred to any of those concerned (including the present writer) that the coordinates of the point where the "Laminarast" started would adequately serve this purpose. (Since this is probably not quite a sharp point in practice, the double logarithmic curve and the "Laminarast" could be extrapolated to a small extent to mark a sharp meeting-point).

The Nédonchelle-Schutz Effect

It would seem that the idea of a dimensionless form for equation (1) was not again discussed until Nédonchelle and Schutz¹⁰ and Schutz, Nédonchelle and Wick¹¹ published their work on starch pastes.

One part of this work only will be discussed here: that concerned with "retrogradation" under conditions when there is no thixotropy. "This retrogradation corresponds to an association of solvated particles which modifies the size distribution of the hydrodynamic units without appreciably modifying the free volume." (G.W.S.B.'s translation).

* Thixotropic systems are not considered.

Stress-shear rate curves were obtained at a number of times during about $1\frac{1}{2}$ h. as the paste thickens. All these curves were found to give excellent straight lines when plotted double-logarithmically. What is striking is that the curves converge and, on extrapolation would meet at a single point whose coordinates serve as a singularity, (τ^1 and $\dot{\gamma}^1$) so that all stresses may be expressed as a fraction of this unique stress value and likewise for rates of shear.

This is shown more clearly by plotting $\ln K$ against A , when a straight line is obtained and it is easy to show on dimensional grounds that the slope-constant of this line must have the dimensions of a shear rate and its position constant those of a stress ($\dot{\gamma}^1$ and τ^1).

Substituting the values of K from this equation, and re-writing equation (1) we get:

$$\text{for a single curve: } \ln \underline{K} = \ln \underline{\tau} - A \ln \dot{\gamma} \quad (2)$$

$$\text{and for a series of curves: } \ln \underline{K} = \ln \underline{\tau}^1 - A \ln \dot{\gamma}^1 \quad (3)$$

where the constants are underlined.

From these equations, Nédonchelle and his colleagues derive the dimensionless equation

$$\frac{\tau}{\tau^1} = \left(\frac{\dot{\gamma}}{\dot{\gamma}^1} \right)^A \quad (4)$$

which, for a series of curves measured in the course of time, is identical with that proposed by Nadai for a single curve; only now the constants τ^1 and $\dot{\gamma}^1$ have a clear physical significance.

Following this result, Tuszyński and Scott Blair¹² treated a number of milk samples with rennet, holding them overnight at a very low temperature (about 2°C). Under these conditions, the enzyme acts on a part of the casein in the milk without causing coagulation. When, on the following day, the temperature is raised to about 20°C. the milk thickens very slowly and a series of $\tau:\dot{\gamma}$ curves was obtained during about the same period of time as that covered by Nédonchelle for starch. Exactly similar results were obtained.

Later, Camina and Roffey¹³ carried out similar experiments on highly pigmented paints (undercoats), but at very much lower shear rates than those used for starch and milk, and over much shorter periods of time; but the results were similar. Thus we have three very different systems (vegetable, animal and mineral) all obeying equation (2) for individual curves and equation (3) for a series of curves in the process of thickening in the course of time. Finally, Moyses,¹⁴ working with the French team, successfully repeated a similar experiment on starch pastes caused to *thin* in the course of time, through the action of ozone.

The Significance of the Nédonchelle-Schutz Effect

When the French data on starch only were available, it seemed likely that a very simple explanation could be found for the convergence

of the curves to a single point. This point should surely represent a limit of stress (and shear rate) at which all structure is destroyed and it should mark the beginning of a "Laminarast". Unfortunately the data on milk and paint makes this explanation at the least very unlikely, unless several types of structure are postulated as present in the same system.

For technical reasons, the French workers were unable to do experiments at a high enough shear rate to reach the convergence point experimentally. It could be found only by extrapolation, or from the $\ln K:A$ straight line.

With milk, especially in the later stages of the experiments, the structure broke down *before* the convergence point was reached, the double-logarithmic curves only aiming at a unique point. However, Camina and Roffey, with paint, could not only reach the unique point experimentally but could experiment beyond it. Here, a single double logarithmic straight line was obtained, independent of time, but it was not a "Laminarast", since its slope was considerably less than unity ($A \approx .84$) and this means that a structure which breaks down as shear rate is increased must exist above the unique point.

It would seem that three possibilities exist: the fact that equation (3) holds for a series of curves each obeying equation (2) must be due either to (a) pure chance (b) logical necessity or (c) a high probability that, if the thickening or thinning processes occurring in the course of time are similar to those resulting from shearing, the corresponding equations will hold.

The first explanation seems highly unlikely since such diverse systems show the phenomenon, nor would there seem to be any mathematical justification for the second. Two arguments can be advanced in favour of the third explanation. First, it seems certain that, as the consistency of a system increases with time, the degree of its non-Newtonian behaviour must also increase, i.e. if K increases A must decrease. Moreover, since A is an exponent (a power but not a logarithm, since $\dot{\gamma}$ is not a numeric), it would seem to be extremely likely that

$$\ln K = -f(A) \quad (5)$$

The third stage is no more than a probability, since the simplest assumptions concerning the effects of stress and shearing appear to hold for a single curve, leading to the ubiquitous double logarithmic equation, one might expect that the simplest function might at least generally hold in equation (5), and this is undoubtedly linear, giving equation (3).

Prentice¹⁵ appeared to find a simple and direct relation between the two exponential parameters in Scott Blair's equations for a single double logarithmic curve⁷ and Nédonchelle and Schutz' τ^1 and $\dot{\gamma}^1$ but, in a later note, he pointed out that "it is not possible to isolate three independent parameters from the monotonic flow curve obtained with many systems." This would seem to imply that we cannot assume that,

if Scott Blair's treatment for a single curve is correct, equation (3) will follow automatically for a series of curves obtained during the course of time.

The second reason for expecting equation (3) to hold is slightly more complex. If, to obtain equation (2) a series of shear rates is imposed and the resulting stresses are measured, the effects on stress are defined by two linked properties of the system, K and A . (Linked, because the dimensions of K depend on the magnitude of A). A similar argument applies if stresses are imposed and shear rates measured.

When a series of curves is obtained during a period of time, a chemical or physico-chemical reaction is imposed or selected and the times at which experiments are done are also chosen. This implies that a series of increasing (or decreasing) consistencies is selected, so that the variable K 's become the "subject" of the experiment and the measured A 's are the "object". This suggests that there must be some property or pair of linked properties (the verb) which define how the subject affects the object, since these equations are simply mathematical forms of simple sentences consisting of subject, object and verb (with adverb added if necessary).

There should therefore be a property common to all the curves and, short of introducing some quite extraneous entity, it would therefore seem likely (though not essential) that a common stress and shear rate should exist. These properties, τ^1 and $\dot{\gamma}^1$ are "linked" in the sense that viscosity is defined as $\tau/\dot{\gamma}$ and the unique point represents an apparent viscosity common to all the curves.

Other work bearing on the Nédonchelle-Schutz Effect

A number of other workers, concerned with the effects of temperature and concentration changes in the stress-shear rate relations in high polymers, show or imply a convergence of the double-logarithmic flow curves to a unique point. (Kataoka and Ueda¹⁶); Ito and Shishido¹⁷; Bellet and Sengelin¹⁸; but, for various reasons, these data are not altogether comparable to those discussed in the present paper.

Temple and Godfrey¹⁹ described experiments on thixotropic fuel oils which give double logarithmic curves converging to a point, but the changes in consistency do not occur in time. Cheng²⁰ finds rather similar results for a negatively thixotropic alkaline perbunan latex. These phenomena show a similarity to the Nédonchelle-Schutz Effect.

Acknowledgements

The author is indebted to many fellow-rheologists for helpful discussions, written and verbal. These include all the authors of papers on the Effect and also Drs. J. Godfrey, D. C-H Cheng and M. M. Cross for drawing his attention to appropriate references.

Grist Cottage,
Iffley, Oxford

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AUSTRALIAN BRANCH MEETING

Address by Professor R. I. Tanner.

Professor R. I. Tanner, of Brown University, R.I., U.S.A., addressed a meeting of the Australian Branch of the B.S.R. in Melbourne on 20th November, 1973.

In a most informative and stimulating talk, entitled "Some connexions between continuum mechanics, molecular theory and experiment in rheology", Professor Tanner first reviewed the types of measurement that can be made to determine the rheological properties of liquids, including measurement of viscosity and normal stress differences in viscometric flows, small oscillations, Trouton extension, relaxation, transient phenomena and Maxwell rheometry on pairs of eccentric discs, cylinders or hemispheres. He then listed a variety of theoretical approaches, based on continuum mechanics as well as on models of molecular structure, and discussed the reliability of predictions from each theory for the experimental measurements listed. While behaviour can be fairly well established for the limits of small deformations, of very slow and of very fast changes, there is a vast grey range of behaviour for finite frequencies of oscillations and large deformations, about which hardly anything is known. Professor Tanner feels that theories based on molecular models show great potential promise, not only for predicting rheological behaviour from structure but also for establishing molecular structure from rheology.

NEWS FROM DR. MARVIN, CHAIRMAN INTERNATIONAL COMMITTEE ON RHEOLOGY

Site of the Seventh Congress

Dr. Marvin received a letter from Professor Friml, Director of the Institute of Macromolecular Chemistry in Prague, informing him that it will not be possible to hold the 1976 Congress in Prague. After careful consideration of all the factors and consultation with his colleagues and with representatives of other Institutes of their Academy of Sciences, Professor Friml has reluctantly concluded that they cannot at this time undertake the sponsorship of a meeting as large as ours. They intend to continue the smaller-scale microsymposia and conferences which many of us have attended in the past.

At Lyon, Dr. Kubát suggested Sweden as an alternate location if any complications prevented its being held in Prague, and that it was agreed that this would be a desirable site. Dr. Kubát is now evaluating their situation to see if a formal invitation can be extended for us to meet in Sweden in 1976.

It has now been agreed that the 1976 Congress will be held in Sweden—Editor.

Proceedings of the Sixth Congress

Dr. Smadja has experienced problems in concluding a formal agreement with Rheologica Acta for distribution of copies of the Proceedings of the Sixth Congress and in obtaining information about the publication schedule for the balance of the Proceedings (Part 1 appeared as Vol. 12, No. 2, June 1973). Dr. Marvin has written to both Dr. Meskat and to Steinkopff Verlag urging them to attempt to resolve any problems and provide the information sought by Dr. Smadja.

Affiliation with I.U.P.A.C.

The International Union on Pure and Applied Chemistry accepted the International Committee on Rheology as an Associated Organization in August. We anticipate fruitful relations with the various Divisions and Commissions of I.U.P.A.C. and have already received a communication from Commission I.6, Colloid and Surface Chemistry, regarding some suggestions on rheological nomenclature.

PUBLICATION—DEGRADABILITY OF POLYMERS AND PLASTICS

Conference papers printed and available in book form from the Plastics Institute (A Prime Reference for Scientists, Technologists and Environmentalists).

This conference—sponsored and organized by the Plastics Institute, and held in London in November 1973—dealt comprehensively for the first time on an international scale with the question of Degradability of Plastics and Polymers in a total of 17 papers.

This was a meeting of world experts with major contributions from Professor J. E. Guillet (University of Toronto) on "Polymers with controlled lifetimes", Professor G. Scott (University of Aston) on "Controlled autoxidation of plastics", and Professor R. Ranby (Royal Institute of Technology, Sweden) on "Photochemically-induced reactions".

Other speakers came from Canada, West Germany, Holland, Japan, U.K. and U.S.A.

The conference anticipated the growing interest in the whole question of degradability, and in particular in controlling the rate of degradation of polymers and plastics, and in understanding the associated problems, social, economic and environmental.

The papers are well referenced and illustrated with photographs and graphs. Price to members £3.00, non-members £5.00 from the publishers, the Plastics Institute.

FUTURE MEETINGS AND COURSES

PLASTICS IN FURNITURE: A COMPREHENSIVE "TALK-IN" ON MANUFACTURING PROCESSES, PAST AND PRESENT USES AND FUTURE OPPORTUNITIES

30th April and 1st May, 1974

The Plastics Institute is to hold a two-day plastics in furniture "talk-in" which is intended to create an informal atmosphere whereby furniture designers and manufacturers can obtain an insight into the various plastics manufacturing methods available and discuss them with expert technologists from the plastics industry. Some 30 specialists will be involved in presenting information covering all relevant techniques, materials, finishes and furniture applications, and the meeting is being promoted in association with the Furniture Industry Research Association.

Eight discussion groups will run throughout the meeting during which delegates will be able to talk informally about the various techniques and the applications where plastics can and cannot be used. Plenary sessions will bring delegates together to consider more generalized topics like economics and European practices. Mr. Terence Conran of Habitat will open the proceedings.

A display of plastics furniture will be on view throughout the meeting, which should be of interest to delegates from both the furniture and the plastics industries.

The "talk-in" will be held at the London Esso Hotel, Wembley (easily accessible from London by Underground). Registration fees will be £29.70 including V.A.T. (P.I. and F.I.R.A. members) and £39.60 including V.A.T. (non-members) which will include preprints of all the papers and refreshments and lunches on each day. Further information and registration forms can be obtained from Mr. D. H. Cohen, Assistant Secretary (Activities), The Plastics Institute, 11 Hobart Place, London SW1W 0HL (tel. 01-245 9555).

SEMINAR CUSHIONING AND SHOCKPROOF PACKAGING

30th May, 1974, in Solihull

The Packaging Group of the Plastics Institute has organised a one-day seminar to consider cushioning and shockproof packaging, which is a vital factor in packaging economics. It is a highly technical subject involving many material groups of which plastics are very probably the most important at the present time.

The programme will discuss the various materials and their technology, and is divided into three sessions:

Foams and fibres

Structures

Technical (testing and approval).

In the papers the emphasis is on problems of application and the relationship of economics to packaging cost and the efficiency of distribution.

For further information please contact: Miss S. M. Keeble, Executive Officer (Meetings), The Plastics Institute, 11 Hobart Place, London SW1W 0HL (tel. 01-245 9555).

Continuing Education Course sponsored by the Institution of
Chemical Engineers

NON-NEWTONIAN FLOW AND HEAT TRANSFER

Postgraduate School of Chemical Engineering, University of Bradford, Bradford, Yorkshire BD7 1DP.

The course has been designed for engineers and scientists who are involved in the problems associated with the processing of non-Newtonian fluids in such industries.

It will be largely self-contained and the theoretical background will be developed before proceeding to a study of the behaviour of non-Newtonian fluids in a range of the more important engineering applications.

The characterization of materials will be covered followed by the design of pipelines, heat transfer and mixing equipment. Some of the recent developments on instrumentation for non-Newtonian fluids will also be dealt with.

Opportunity will be provided for discussion on industrial problems of particular interest to course members and on the current research in the department.

Course Organiser: Mr. J. M. Kenchington (tel. 0274 33466, ext. 364).

Chairman: Professor W. L. Wilkinson.

Lecturers on the Course: Dr. G. W. Scott-Blair, Oxford; Mr. D. T. Shore, A.P.V. Co. Ltd.; Professor J. Parnaby, Manufacturing Systems Design Centre and Schools of Mechanical Engineering, University of Bradford; Professor W. L. Wilkinson, Mr. R. Dodd, Dr. M. F. Edwards, Mr. J. C. Godfrey, Mr. J. M. Kenchington, Dr. W. C. MacSporran, Schools of Chemical Engineering, University of Bradford.

PROGRAMME

Monday, 1st July

- 12.00 Registration at Halls of Residence.
- 14.30 Review of Non-Newtonian Behaviour.
- 16.00 Experimental Characterization of Purely Viscous Liquids.

Tuesday, 2nd July

- 09.30 Experimental Characterization of Viscoelastic Fluids.
- 11.00 Experimental Characterization of Thixotropic and Rheopectic Fluids.
- 14.30 Laminar Flow of Non-Newtonian Fluids in Pipes and Channels.
- 16.00 Turbulent Flow of Non-Newtonian Slurries.

Wednesday, 3rd July

- 09.30 Design of Mixing Equipment.
- 11.00 Design of Pipeline Systems for Non-Newtonian Fluids and Slurries.
- 14.30 Visit to place of interest.

Thursday, 4th July

- 09.30 Heat Transfer to Non-Newtonian Fluids in Tubes.
- 11.00 Augmented Heat Transfer to Non-Newtonian Fluids.
- 14.30 Design of Heat Transfer Equipment.
- 16.00 Design of Processing Equipment for the Food Industry.
- 19.30 Course Dinner.

Friday, 5th July

- 09.30 Viscoelastic Flow Phenomena.
- 11.00 Design of Polymer Processing Equipment.
- Depart after lunch.

Fee for the course: members of I.Chem.E. £80 (including V.A.T.), non-members of I.Chem.E. £90 (including V.A.T.). Fees include accommodation in halls of residence, all meals, and a course manual. Special fees are available for those who cannot attend the whole course.

I.U.T.A.M. Symposium

THE MECHANICS OF VISCO-ELASTIC MEDIA AND BODIES

Gothenburg, Sweden, 2nd-6th September, 1974

The aim of the symposium is to present and discuss new results in the mechanics of visco-elastic media and bodies. The programme will be based on studies in the following four fields:

1. Limits of linearized theories and effective versions of the non-linear theory of viscoelasticity.
2. Theory and experimental studies in linear and non-linear viscoelasticity aiming at the determination of constitutive equations and conditions of strength and failure under an arbitrary deformation process.
3. Experimental and theoretical studies of thermal effects in viscoelasticity taking into account thermo-mechanical coupling.
4. Novel analytical and numerical techniques for the solution of problems in viscoelasticity and thermo-viscoelasticity.

According to established I.U.T.A.M. practice attendance will be limited and will be restricted to personally invited scientists, active in the fields mentioned above. I take this opportunity to ask your assistance in disseminating this information to researchers in your country. Any scientist who wishes to take active part in the symposium should write to the Scientific Committee, address being given below, for further information.

Scientific Committee: J. Hult, Chairman. Local Organizing Committee, J. Hult, Chairman, H. Broberg, Secretary, I.U.T.A.M. Symposium 1974, Chalmers Univ. of Techn., Fack, S-403 20 Gothenburg, Sweden (tel. 031-81 01 00, telex 2369 Chalbib S.).

Continuing Education Course "SOLID-LIQUID SEPARATION"

The Institution of Chemical Engineers is sponsoring a three-day course on Solid-Liquid Separation to be held at the University of Bradford from 16th to 18th September, 1974.

The course will cover the physical and engineering aspects of separation of particulate matter from liquids. Whilst not exclusively concerned with filtration and sedimentation, these operations will be dealt with in depth. The treatment will be such that prior knowledge of the subject is not essential. Emphasis will be laid on those aspects of this fast expanding technology which are of immediate practical importance. The course will be particularly useful to industrialists seeking a concise coverage of the essential principles and recent developments of importance in the subject. Further particulars may be obtained from Dr. L. Svarovsky, Schools of Chemical Engineering, University of Bradford, Bradford BD7 1DP, Yorkshire, England.

CONFERENCE "CREEP AND CREEP RUPTURE IN THERMOPLASTICS"

Background

In March 1973 the Institute held a successful meeting at Cranfield which combined for the first time the interests and experience of those involved in creep and creep rupture.

Purpose

A one-day conference on Creep and Creep Rupture in Thermoplastics has now been planned, and will be held in London on 17th September, 1974. It will aim to bring together scientists from university, industry and government departments to present and discuss

current research activities. The subject matter will cover both unreinforced and reinforced thermoplastics and will include:

Theoretical developments

Testing techniques

The relation of properties to service.

Consideration will also be given to papers on creep and creep rupture only.

Anyone interested should please contact: Miss S. M. Keeble, Executive Officer (Meetings), The Plastics Institute, 11 Hobart Place, London SW1W 0HL (tel. 01-245 9555).

THE INSTITUTE OF PHYSICS AND THE CHEMICAL SOCIETY POLYMER PHYSICS GROUP

Group Meetings 1974

1. "Spectroscopy of Polymers"

Third European Symposium on Polymer Spectroscopy, on behalf of the European Physical Society. Brunel University, 22nd-24th April, 1974. Secretaries: Dr. D. Bower (Physics Dept., Leeds University) and Dr. P. Hendra (Chemistry Dept., Southampton University). (Details from Meetings Dept., Institute of Physics, Circular 42/BG/0318.)

2. "Inter-relation of Structure, Properties and Applications of Polymers"

Conjoint with Materials Group of I.O.P. Nottingham University, 9th-12th July, 1974. Secretary: Dr. M. Folkes (Physics Dept., Bristol University). (Details from Meetings Dept., I.O.P., Circular 22/42/BG/0369.)

3. "Electrical Properties of Polymers"

U.W.I.S.T., Cardiff, 18th-19th September, 1974. Secretary: Dr. M. Baird (U.W.I.S.T., Cardiff).

Although not organised under the specific auspices of the group, a meeting on "Electro-Optical Properties of Macromolecular Solutions", Liege, Belgium, 22nd-25th September, 1974, is being organised partly by the Group Secretary, Dr. B. Jennings (Physics Dept., Brunel University), from whom details are available.

WHAT'S ON AT THE PLASTICS INSTITUTE

Full day and in London unless otherwise stated.

1974

30th April–1st May

Conference: Plastics in Furniture II. Wembley H.Q. Meetings Committee.

7th–10th May

Visit to V.T.K.B. Symposium: Plastics in Building—a Challenge! Rotterdam H.Q. Building and Construction Group.

6th–9th June

P.I./I.R.I. Visit to Europlastique/Eurocaouchouc 1974 Exhibition. Paris H.Q. Meetings Committee.

19th–20th June

Conference: Finishing and Decoration of Plastics Mouldings. Coventry H.Q. Meetings Committee.

July

Symposium: Polymers and Plastics in Fire Situations. H.Q. Meetings Committee.

9th–12th July

Conference: Inter-relation of Structure, Properties and Applications of Polymers. Enquiries to the Institute of Physics.

24th–25th September

Conference: Reinforced Plastics in Construction. Wembley H.Q. Reinforced Plastics Group.

20th–21st November

Conference: Plastics in Tele-communications. H.Q. Meetings Committee.

Date to be announced

Symposium: Heat Transfer in Plastics Processing. H.Q. Processing and Engineering Group.

The Plastics Institute, 11 Hobart Place, London SW1W 0HL (tel. 01-245 9555).

PERSONAL NOTES

May we offer belated congratulations to Professors Ulbrecht and Walters on their respective promotions. Professor Ulbrecht has been given a personal chair in the Department of Chemical Engineering, University of Salford. Professor Walters has become a Research Professor in the Department of Applied Mathematics, University College of Wales, Aberystwyth.

NEW MEMBERS

- Serge O. Boucher, Laboratoire de Mécanique Rationnelle, Faculté Polytechnique de Mons, 31 Boulevard Dolez, 7000 Mons, Belgium.
- Martin Camina, B.Sc., Paint Research Association, Waldegrave Road, Teddington.
- H. A. M. van Eekelen, Ph.D., Koninklijke/Shell Exploratie en Productie Laboratorium, Rijswijk, Holland.
- R. Jongepier, Koninklijke/Shell Laboratorium, Badhuisweg 3, Amsterdam, N. Holland.
- James Lowndes, B.Sc., Dept. of App. Maths. & Theoretical Physics, University of Liverpool, Liverpool.
- Brian Richard Parker, B.Tech., M.Sc., Dept. of Chemical Engineering, University of Bradford, Richmond Road, Bradford BD7 1OP.
- David Howard Pollitt, B.Tech., M.Sc., Research Dept., Coalite & Chemical Products Ltd., Bolsover, Derbyshire.
- Brian Kenneth Revill, B.Tech., Chemical Engineering Dept., University of Bradford, Richmond Road, Bradford BD7 1OP.
- William B. Russel, Ph.D., D.A.M.T.P., Silver Street, University of Cambridge, Cambridge CB3 9EW.
- Antony Temple, B.Tech., School of Chemical Engineering, University of Bradford, Bradford BD7 1OP.
- Miss H. Süheyla Yálabik, Chelsea College, University of London, King Street, 271-273 Hammersmith, London W6.

OBITUARY

We have recently been notified of the death of Dr. D. Tollenaar, of Amsterdam, and extend our sympathy to his family and friends.

BULLETIN—BACK NUMBERS

The Editor's shelves are beginning to sag elastically under the ever increasing weight of back numbers of the *Bulletin*. In an effort to save space and not wishing to throw them away he thought it possible that new members might find a use for them. Copies back to 1970, Vol. 13, No. 1, are available free to anyone who has recently joined our ranks. It is hoped that sufficient numbers will take up this offer to prevent the onset of plastic deformation.

DIARY

1974

9th-11th April. General discussion—Gells and gelling processes. University of Essex, Colchester.

17th-18th April. Engineering design of plastics processing machinery. University of Bradford.

24th-25th April. B.S.R. conference on rheology of clays and cement pastes. University of Sheffield.

1st-5th July. Course on "Non-Newtonian flow and heat transfer". University of Bradford.

11th-13th September. Conference on chemical engineering rheology. Salford.

16th-18th September. Course on "Solid-liquid separation". University of Bradford.

16th-19th September. B.S.R. meeting "Theoretical rheology". Cambridge.

UNIVERSITY OF STRATHCLYDE

Department of Fibre Science

C.I.B.A.-Geigy Post-Doctoral Fellowship

Applications are invited for a Fellowship for research on the rheology of pigment suspensions. Experience in rheology is desirable but not essential. The post is for three years at a starting salary of £2,058 p.a. plus F.S.S.U.

Applications stating qualifications and experience together with the names of two referees should be sent to Dr. J. Ferguson, Department of Fibre Science, University of Strathclyde, George Street, Glasgow G1 1XW.

WE WOULD LIKE TO HEAR FROM YOU

B.S.R. members are reminded that the Editor of the *Bulletin* is always interested in receiving informative articles, comments, news and other material which would help to make the *Bulletin* one of the more welcome sights in the flood of reading matter to which most of us are accustomed and resigned.

Suggestions of possible improvements in the *Bulletin* would also be welcome. So if you have a thought and a minute to put pen to paper why not let us hear about it?