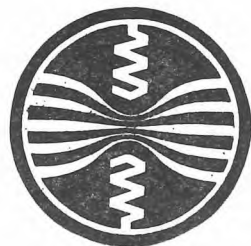


BULLETIN



BRITISH SOCIETY OF RHEOLOGY

1974, Vol. 17, No. 4

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Hon. Editor:

Dr. J. M. HOBBS,
Properties of Fluids Division,
National Engineering Laboratory,
East Kilbride,
GLASGOW, G75 0QU.



FOREWORD

In contrast to the situation a year ago there were some refreshing changes in the Council at the A.G.M. last September. Just as a period of stability is good for an organisation, so also is an injection of new talent and enthusiasm from time to time.

We have said farewell to our retiring President, Professor Feltham, who has worked quietly and effectively to keep the administrative side of the Society's affairs on a steady course. His ability to fit a full agenda into the standard time allotted to meetings of Council will be long remembered by those who served with him. Our new President, Professor Walters, is a popular choice and he needs little introduction to most members.

Dr. Beazley, whose outstanding efforts as Secretary have been appreciated by all has now taken a back seat and become an Ordinary Member of the Council. The Secretarial pen is now in the capable hands of Neil Cogswell, an active Member of Council for the last two years.

The retiring Members of Council, Dr. Neumann, Mr. Hutton and Mr. Whorlow, have all served the Society well in various capacities over the past few years and we are most grateful to them for all the hard work they have put in. Their places have been filled by Mr. Camina, Dr. Cheng and Dr. Jones. We welcome them to the Council and wish them as interesting and rewarding a term as that experienced by their predecessors.

OFFICERS AND MEMBERS OF COUNCIL 1974-75

President: PROFESSOR K. WALTERS, Department of Applied Mathematics, University College of Wales, Aberystwyth.

Secretary: MR. F. N. COGSWELL, I.C.I. Ltd., Plastics Division, Welwyn Garden City.

Treasurer: DR. D. R. OLIVER, Department of Chemical Engineering, University of Birmingham, Birmingham B15 2TT.

Membership Secretary: DR. J. FERGUSON, Department of Fibre Science, University of Strathclyde, Glasgow G1 1XW.

Abstracts Editor: DR. D. MARSHALL, Institute of Polymer Science, Loughborough University of Technology, Loughborough.

Bulletin Editor: DR. J. M. HOBBS, National Engineering Laboratory, East Kilbride, Glasgow.

Ordinary Members:

DR. K. M. BEAZLEY, 44 Brockstone Road, Boscoppa, St. Austell PL25 3DP.

MR. M. CAMINA, Paint Research Association, Teddington, Middlesex.

DR. D. C-H. CHENG, Warren Spring, Laboratory, Stevenage.

MR. A. EVANS, Department of Surgery, Royal Victoria Infirmary, Newcastle-upon-Tyne NE1 4LP.

DR. T. E. R. JONES, Plymouth Polytechnic, Plymouth.

DR. P. SHERMAN, Department of Food Science, Queen Elizabeth College, London W8.

SECRETARY'S REPORT 1973-74

Once again, the mail has brought its usual assortment, varying from the serious to the not so serious. Among the latter could be cited the ad for letter addressing services with seven mistakes of fact or spelling on the envelope containing it, the advertisement for health foods and the American journal which reaches me at 44 Brockstone Road, Cornwall. On the serious side are the frequent requests for copies of the non-existent Proceedings of the Aberystwyth Conference on Theoretical Rheology. The present meeting at Cambridge is the first for several years from which we shall be producing printed proceedings; I rather think that there will be a good demand for them.

1. Conferences

Norwich came and went fairly successfully last year. Financially we made a modest profit, and the criticisms that were levelled at it from other angles were fair and constructive, and therefore welcome. Spring brought us a meeting at Sheffield on clays and cement pastes; my spies tell me that this went down very well and—again—several requests for non-existent proceedings have come in. At Salford, a meeting supported but not sponsored by the BSR preceded this one. It dealt with transport phenomena in molecularly complex fluids. This brings us to the present meeting at Corpus Christi, whose success or otherwise I can best leave you to judge.

The future programme is also quite varied. April 75 will bring us to Shrivenham with rheological measurements and their interpretation. This meeting will be a joint one with the Italian Society of Rheology, whose participation we welcome most warmly. Shrivenham can only provide us with accommodation for 100, but ample hotel facilities exist within striking distance of Shrivenham, so a number in excess of this could be accommodated if necessary. The 1975 Autumn meeting will be at Loughborough and will deal with polymer rheology and process formation; it will be a joint meeting with the Plastics Institute. In Spring 1976 we hope to hold a meeting on colloids, jointly with the Faraday Division of the Chemical Society.

Finally, it was proposed that the 1976 International Congress should be held in Prague, but certain local difficulties have prevented this. The Congress will be held in Gothenburg, in Sweden.

2. Liaison

We noted in our last report that the joint meeting with the Dutch Society was tangible evidence of the excellent liaison that exists between the various Societies. That our Italian friends wish to join

with us for the 1975 Spring meeting strongly suggests that this sort of meeting could well become an established practice. It is certainly to be hoped so.

Finally, on a personal note, I ought to add that it has been a genuine pleasure to serve as your Secretary, and the experience has been more than useful. I apologise for those occasions when I have left undone those things which I ought to have done, and have not replied promptly to a letter. Daily work now involves me in the properties of paper, rather than in the rheology of suspensions—but since paper itself has important rheological characteristics, the change is perhaps only one of direction and I may still find that I have a valued link with rheology.

K. M. BEAZLEY, 17.9.74.

REPORT OF HON. TREASURER FOR THE YEAR 1973-74

The year has again been successful financially, with an excess of income over expenditure of £871.79.

The Conference Account is particularly healthy, because the previous year's provisions allowed for the worst contingencies. The Dutch meeting cost us £97.19 (estimated maximum £180), whilst the Norwich meeting made a gain of £139.61 (it was previously suggested that £86 in advanced payments would be lost on payments to the University of East Anglia). The Sheffield meeting made a gain of £4.30. The Conference organisers are to be complimented on their efforts.

Under "Expenditure", Council meeting costs are down because a meeting was held in July rather than June; B.S.I. Committee costs have ceased, membership Secretary and Circulation costs are much reduced (for the second successive year). Additionally, there was no "Gold Medal" this year.

Under "Income", Subscriptions and Entry Fees are somewhat increased, though our share of the profits from the distribution of Rheology Abstracts is reduced. Investment income has also increased (see also "Trustee Savings Bank Interest" on the Balance Sheet).

The overall Income of the Society is almost constant but the Expenditure has been well contained this year. The next financial year may see considerable expenditure on a new printed membership List; a large excess of income over expenditure is not anticipated.

D. R. OLIVER, Honorary Treasurer.

BRITISH SOCIETY OF RHEOLOGY

BALANCE SHEET as at 30th June, 1974

ASSETS

Brentwood U.D.C. 7% Bond	1500.00
Trustee Savings Account	1355.16
Debtors	15.75
Cash at Lloyd's Bank	
Deposit Account	1120.06
Current Account	431.18
	1551.24
	£4422.15

Less

CURRENT LIABILITIES

Sundry Creditors	27.50

NET ASSETS	£4394.65

Represented by:—

GENERAL FUND

As at 1st July 1973	3467.70
Add Excess of Income over expenditure for year	871.79
Add Trustee Savings Bank Interest	55.16
	£4394.65

CONFERENCE ACCOUNT

Estimated cost of Spring 1973 meeting (1973 Accounts)	180.00
Actual Cost of Spring 1973 meeting	97.19
Net Gain of Spring 1973 meeting	82.81
Gain Autumn 1973 meeting	139.61
Less Early payments shown in 1973 Accounts	86.00
Net Gain of Autumn 1973 meeting	53.61
Gain Spring 1974 meeting	4.30
	140.72
Less Cash Float for Autumn 1974 meeting	12.00
Net Income shown in Revenue Account	£128.72

D. R. OLIVER, Hon. Treasurer.

We have examined the above Balance Sheet and annexed Revenue Account together with the books and vouchers of the Society, and certify them to be in accordance therewith. We have not inspected the membership records.

ALFRED SIMMONS & Co.,

Auditors.

The Market Hall,
Redhill, Surrey.

BRITISH SOCIETY OF RHEOLOGY

REVENUE ACCOUNT for year ended 30th June 1974

EXPENDITURE		
1973		1974
	Committee Expenses (mainly travel)	
271	Council	226.18
156	B.S.I. Committee	0.00
5	B.N.C.M.	12.53
432		238.71
346	<i>Bulletin</i> Production Costs (562 in 1972) ...	614.51
95	<i>Abstracts</i> Production Costs	84.55
	Expenditure by Officers:—	
29	Secretary	18.58
9	Treasurer	11.42
333	Membership Secretary and Circulation ...	117.45
371		147.45
27	Professional Fees	27.50
103	Miscellaneous Expenses (e.g. Insurance) ...	15.63
		1128.35
495	Excess of Income over Expenditure for year	871.79
		£2000.14

INCOME		
948	Annual Subscription and Entrance Fees ...	1009.33
789	Publisher— <i>Rheology Abstracts</i>	666.28
6	<i>Bulletin</i> Subscriptions	5.00
0	Advertising in <i>Bulletin</i>	15.00
	Investment Income	
62	Bank Deposit Account Interest	70.69
105	Brentwood 7% Bond	103.43
-128	Conference—net profit	128.72
1	Miscellaneous Income	1.69
		£2000.14

MEMBERSHIP SECRETARY'S REPORT

The membership of the Society is, remarkably, identical in numbers to last year. The Society has 570 members of whom 24 are £2 in arrears. A further 4 members continue to pay £1 per annum.

During the year 33 new members joined the Society and 9 resigned. Once again the resignations were due to changes of work or retirement. A further 24 members resigned by default. It is perhaps worth pointing out that this turnover in membership of just under 6% seems to be a normal figure for scientific societies.

Since the last Membership List was published there has been, based on the 6% per annum figure, a considerable change in membership. This, together with the very large number of changes of address has meant that a new Membership List is necessary. This has been prepared and should be available to members in the near future. I should mention that the daunting task of compiling the List, with members' rheological interests included, has been carried out by Mr. Cogswell.

J. FERGUSON,
Hon. Membership Secretary
11th September, 1974

REPORT OF THE EDITOR OF THE BULLETIN

During the year the *Bulletin* has continued to provide a blend of reports on past meetings, comments about present problems and announcements for future events. In addition, a few technical papers have been published. I would therefore like to take this opportunity to thank all those who have provided material under these different categories.

Like most other things, the *Bulletin* has been affected recently by rising prices and has suffered a 35 per cent increase in printing costs this year.

However, there does not appear to be any need for drastic economies as yet, so do not be put off from making a contribution—no matter how large or small. All will be welcome.

J. M. HOBBS, September, 1974.

RHEOLOGY ABSTRACTS—EDITOR'S REPORT

During this, my first year as editor I have continued in the same manner as Mr. Evans, and produced an almost identical number of abstracts. I had hoped that volume 17 might well contain 1,000 abstracts, but it now seems that 950 will be a more realistic total.

At this time I would particularly like to thank Dr. Mardles for the many years of service he gave as compiler of the subject index before stepping down on completion of the index for volume 16. In his place I welcome Professor Stacey-Ward, University of Birmingham, who has kindly offered to take on this onerous task.

During the year, a number of abstractors have resigned and others joined, and at present, there are 29 active abstractors, see appendix. To all these, I offer the thanks of the Society. To anyone who would wish to begin abstracting there are still many journals not yet covered, and if they would contact me I'm sure a relevant journal or two can be found.

D. E. MARSHALL, September, 1974.

Institute of Polymer Technology,
Loughborough University,
Loughborough.

Appendix

List of Abstractors

Mr. B. C. Akram
Mr. D. M. Bancroft
Mr. M. Bayliss
Dr. K. M. Beazley
Prof. C. E. Chaffey
Mr. F. N. Cogswell
Mr. M. M. Cross
Dr. M. F. Culpin
Dr. P. K. Currie
Mr. C. R. Dimond
Mr. A. Evans
Dr. J. Ferguson
Mr. P. Freakley
Mr. F. A. Glover
Dr. D. W. Hadley
Mr. R. W. Higman
Mr. J. F. Hutton
Mr. H. A. Johns
Dr. R. S. Jones
Mr. P. Langborne
Dr. F. M. Leslie
Dr. D. R. Oliver
Dr. A. J. Palfrey
Dr. C. J. S. Petrie
Mr. R. N. F. Pinfold
Dr. A. Plochocki
Dr. R. Roscoe
Dr. J. Scott
Dr. M. Sherriff
Prof. J. Ulbrecht

REPORT ON THE CONFERENCE ON "THEORETICAL RHEOLOGY" HELD AT CORPUS CHRISTI COLLEGE, CAMBRIDGE, 16th-19th SEPTEMBER, 1974

By P. L. LANGBORNE

Conferences on Theoretical Rheology are apt to be heavy going for all except mathematicians and your reporter approached this one with some trepidation. He need not have worried—most of the speakers, who include some distinguished theoreticians, went out of their way to make their subjects intelligible to their audience and a great deal of good humour was in evidence at the discussions.

Attendance was good, 89 delegates representing 12 countries, apart from the U.K. were present and 8 countries were represented among the speakers. Opening the conference on 17th September Professor J. R. A. Pearson, reminded us that since the last "Theoretical" Conference at Aberystwyth in 1972 the theoreticians in the Society had emerged as a homogeneous group, he welcomed the international participation and looked forward to further meetings at two yearly intervals. With regard to rheology equations of state, little progress had been made over the past 20 years but ideas had been widely spread and finer points of detail could now be discussed. The important question of the present day was whether general equations could be used to describe complex flow situations? Professor Pearson felt that the Conference would show that the problem was being tackled—not avoided. Approximations were being used to resolve problems but these were backed up by a large body of serious mathematical work. An interdisciplinary approach was in evidence and he welcomed this.

Professor K. Walters chaired the first session, the first paper of which described a numerical perturbation solution to the creeping flow of a viscoelastic liquid through a constriction. The authors, J. R. Black, M. M. Denn and G. C. Hsiao of the University of Delaware, had studied creeping planar flow by combining a numerical solution with a perturbation in Weissenberg number. The numerical method used converted the solution of the bi-harmonic equation to the solution of a set of Fredholm integral equations for a density function along the system boundary: weighted integration of the density function enabled the stream function and its derivatives to be obtained. The conclusions were said to be applicable to practical polymer processing situations. Professor Denn and his colleagues came under attack in the ensuing discussion. One critic maintained that they were not reporting on a non-Newtonian material at all and Professor Rivlin put an end to the first session with a classic remark "well of course, everything applies to something!"

Professor J. G. Oldroyd chaired the second session of three excellent papers. The first of these, read by Dr. A. L. Halmos of Imperial College, was a joint effort with Dr. D. V. Boger of Monash University, Australia and was unusual in that it dealt with the "Deceleration of viscoelastic liquids", in 2:1 abrupt expansions. The Weissenberg number was found to be a good parameter for predicting the onset of instability. The authors presented results for a number of geometries.

Professor Stefan Zahorski of the Institute of Fundamental Technological Research, Warsaw, proved to be a very able lecturer with a modest approach. He contributed a paper on "Plane entry flows of viscoelastic fluids". This discussed plane flows in the inlet region of a channel. A very simple formula for the determination of entrance length was found and the Author went on to draw attention to the danger of avoiding the constitutive equations and merely explaining flows in different parts of the fluid. Dr. Karl Strauss, University of Dortmund, gave a paper on a similar subject illustrated by excellent slides showing assymetrical flow between converging plane walls. Despite the excellence of the visual presentation and the clarity of explanation, it was evident that Dr. Strauss' theories did not find universal acceptance. Professor Rivlin disagreed forcefully: Professor Dean claimed that the findings were vitiated by Giesekus's photographs.

The first day of the Conference ended with a short evening session, chaired by Professor R. I. Tanner of Brown University, U.S.A. This session was notable, firstly for a good practical paper by J. L. White and B-L. Lee, University of Tennessee, on the "Applications of lubrication theory to polymer processing" and secondly for an all-out attack on the "new thermodynamics" by Professor R. S. Rivlin, Lehigh University in his paper "thermomechanics". Truesdell and Coleman came under particularly heavy fire from the Professor who showed that many of the results claimed as deductions from the latter's theory were actually well-known results of classical theory. Discussion following this paper seemed remarkably subdued—several persons, whom one remembered as regular quoters of Coleman, evidently preferred not to face Professor Rivlin's wrath and remained discreetly silent.

Retiring President of the Society, Professor P. Feltham, chaired the first session on 18th September; a session which brought us to be core of the theoretical content of the Conference.

Professor J. G. Oldroyd's appearances at B.S.R. Annual Conferences have been infrequent in recent years but his past contributions to Rheology have been outstanding and an eager audience listened intently to his paper "Rheological equations of state and thermodynamic principles". They were not disappointed. Professor Oldroyd began by pointing out that it was possible to formulate

equations of state without knowing whether they were consistent with the general laws of physics. As opposed to this practice, he outlined a method for constructing general equations of state for some solids and liquids possessing high elasticity and viscosity which took account of the restriction imposed by thermodynamic principles. It was necessary to assume that classical thermodynamic laws apply to apparent equilibrium on different time scales as well as to absolute equilibrium. The materials initially considered had different internal deformation mechanisms with characteristic times of different orders of magnitude, but the final form of the equations proposed suggested that the method might be suitable for other classes as well.

Professor Oldroyd was followed by Professor M. J. Crochet of the Catholic University, Louvain, also a convincing and competent lecturer. The latter outlined his "Non-isothermal theory of viscoelastic materials" which was characterized by three main features.

- a determination of the free energy from isothermal behaviour;
- b a modified time-scale for past history; and
- c a thermal dilatation tensor which was a functional of past temperature history.

Both Professors Oldroyd and Crochet were pressed, in discussion, to give examples of the materials to which their theories were likely to apply. The former considered that it was too early to give examples as yet and the latter was unable to give examples apart from glasses.

The remaining time on 18th September was taken up with papers by Professor Sarti (Naples), Dr. T. G. Rogers (Nottingham), Dr. S. L. Passman (Atlanta) and Professor I. Nicolais (Naples).

Professor Sarti considered a class of non-linear viscoelastic materials which could only accumulate elastic energy by means of changes in conformational energy. This was all clever stuff, of course, but so far without verification. Not surprisingly, Professor Sarti was vigorously challenged from the floor by Professor Rivlin. Although Professor Sarti's English was limited he defended his ideas well.

Dr. T. G. Roger's paper on finite deformations of strongly anisotropic materials was interesting in that it could be applied to composites reinforced by one or two families of "fibres". The theory predicted the existence of thin layers of very high stress both at a boundary and inside a body.

Dr. S. L. Passman's "Mixtures of structured continua" was concerned with soil mechanics. A dry, granular medium was considered as a structural continuum. Several situations were considered including mixtures of granular media, mixtures of a granular medium with a fluid, and chemical reaction.

Professor Nicolais closed the proceedings of 18th September with a paper by J. K. Kardos, J. C. Halpin and himself dealing with the

"Mechanical properties of semi-crystalline polymers as composite materials". This was a difficult subject. Perfect adhesion was assumed. Preliminary results only were available in support of the authors' theories.

The evening of 18th September found the delegates gathered for the Conference Dinner in the delightful surroundings of Corpus Christi College. The meal was excellent and the company convivial but, as at Norwich in 1973, speeches were banned by the President "in accordance with established custom" (???). It is to be hoped that our incoming President, Professor K. Walters will establish a new "custom" so that delegates at future dinners will be able to hear from some of the interesting overseas guests who visit us from time to time.

The final day of the Conference, 19th September, was a crowded one, in which the emphasis shifted slightly from theoretical to experimental rheology. Under the Chairmanship of Professor Rivlin delegates welcomed the return to these shores of Professor R. I. Tanner (Brown University). Professor Tanner's paper was essentially a review of recent "Progress in Experimental Rheology". Professor Tanner dealt with a plethora of rheological apparatus; he was under no illusions as to the capabilities (or lack of capabilities!) of any of them and said what he thought. This paper was followed by that of Dr. M. C. Phillips who spoke on the "start-up of steady elongational flow of viscoelastic materials". Despite interruptions by Professor Rivlin (which had by now become a regular feature of the Conference!) Dr. Phillips succeeded in putting over a good explanation of the fundamentals of elongational flow and initiated a lively discussion.

Dr. E. A. Kearsley of The National Bureau of Standards, Washington is known to many as the co-ordinator of the N.B.S. Non-Linear Test Sample Program. Besides taking an active part in the discussions he delivered a very informative paper on "Hole pressure and normal stress measurement".

H. A. M. van Eekelen and H. E. van Es were co-authors with Dr. Phillips of a paper on new validity tests on the Bird-Carreau Type Constitutive Equations. Van Eekelen described interrelations they had obtained between shear and normal stress responses for four types of transient shear flows, namely, start-up, cessation, reversal and shear-rate doubling. Agreement between theory and experiment was good for the last two named, but doubtful overall. However, the authors were confident that the model could be improved. Appropriately this speaker was followed by Professor P. Carreau (Ecole Polytechnic, Montreal) who had been examining the "Correlation between linear and non-linear viscoelastic data for polymer solutions". He assumed fluids characterized by a single relaxation time, and a short memory function and that long and short range inter-

acting segments gave elastic and viscous responses respectively. No simple correlation was found between linear and non-linear data and existing theories were found to be unsatisfactory. Brian Warburton can usually be relied upon to come up with something original at B.S.R. Conferences. With co-author M. Sherriff he delved deeply into control theory and told us of a "Simple, universal oscillatory instrument" now being developed for the measurement of linear, viscoelasticity. However "simple" and "universal" an instrument is said to be, one usually finds the associated theory to be complex and specialized. This was not entirely true of the Warburton/Sherriff oscillating surface rheometer. The outstanding feature of the instrument was that external feedback networks could be used to shift, restore, and sharpen resonance.

Dr. M. R. Mackley (University of Bristol) let delegates into the secrets of crystal growing when he described an analysis of the hydrodynamic factors affecting the solution growth of extended chain polymer fibrous crystals.

This was a recently discovered phenomemon and the clear-thinking approach used was appreciated by the delegates. "Local colour" was provided by Dr. E. J. Hinch and Mr. J. G. Evans, both of the University of Cambridge. My remarks on Dr. Hinch's contribution to the '73 Conference could fittingly be applied to both speakers on this occasion. Their theories "had everything". Dr. Hinch spoke on suspension mechanics at the micro and macroscopic levels. His wide-ranging review of the former included external dipolar fields, rotary Brownian motion, elastic particles, droplets with interfacial tension, model particles of macromolecules, hydrodynamic and electrostatic interactions and small interia. What more does one want?

Mr. J. G. Evans examined the effect of the non-Newtonian properties of a suspension of rod-like particles on flow fields. This was studied in several geometries. The pipe flow situation was particularly interesting, where the anisotropic viscosity produced a compression of length scales. The concluding paper of the Conference, that of Astarita and Denn, University of Delaware, read by the latter, could best be described as a bumper review of the kinematics of non-Newtonian fluid flow. No less than seven interesting anomalies were examined.

Approximately thirty delegates stayed to the end of the Conference. Organization was in the capable hands of Mr. J. Astin, U.C.W. Aberystwyth to whom delegates owe a debt of gratitude for the smooth running of what must surely be noted one of the most successful conferences ever staged by the Society.

It is understood that the proceedings of the Conference are to be published and made available to delegates at a special reduced rate. These should be well worth reading.

P. L. LANGBORNE, 21st November, 1974.

CONFERENCE ON "CHEMICAL ENGINEERING RHEOLOGY"

This conference was held in the University of Salford on 11th-13th September 1974 with the aim to bring together those concerned with the transport processes in rheologically complex systems.

Two sessions ran simultaneously during the first day. The programme in Session A was started by Professor W. R. Schowalter from Princeton University who reviewed the present knowledge on the links between the microscopic and the macroscopic models of rheological behaviour. In this review also the electromagnetic theories, flow birefringence and flow dichroism were included. The arguments were supported by some new data on the flow dichroism in D.N.A. solutions. Professor L. Nicolais from the University of Naples reported then on the rheological behaviour of suspensions of glass beads in fibres in polymer solutions. Shear-thinning as well as viscoelastic behaviour was observed in these systems stronger than in the solutions without fillers. The morning session was then concluded by a lecture by Dr. G. Titomanlio from the University of Palermo who proposed a new integral stress-strain rheological model backed by experimental data for biaxially oriented polyethylene terephthalate.

In the afternoon Dr. B. Mena from U.M.I.S.T. described a new experimental technique for the measurement of the drag on spheres and cylinders immersed in a flowing non-Newtonian liquid. The data obtained were used to discuss the nature of the higher terms in the correlating equation. Dr. R. A. Mashelkar from the University of Salford presented then a theoretical as well as experimental analysis of the flow in a helically coiled tube where the secondary flow brought about by the centrifugal forces interferes with the secondary pattern due to viscoelastic anomaly. The pressure-drop data were satisfactorily correlated by the proposed mathematical model. Dr. W. C. MacSporran from the University of Bradford talked then about the velocity profiles of the viscoelastic flow in the entry section of a tube. His experimental data confirm the theoretical predictions regarding the flow distortions due to the influence of walls. The same topic was also tackled by Professor D. V. Boger from Monash University in the subsequent paper. Extensive experimental data on the velocity profiles and flow pattern in the entry region were used to discuss the stability of the flow in this particular flow situation. He as well as Professor M. M. Denn from the University of Delaware in the following lecture pointed out the controlling character of the Weissenberg number in the converging flows of viscoelastic liquids. An interesting result of Denn's solution is the conclusion that the elastic anomaly of the polymer solutions and melts leads to a decrease in entry pressure drop so that the observed increase must be due to the shear-thinning behaviour. The programme of the first day in the Session A was then concluded by a paper by Professor Z. Kemblowski from

the Technical University in Lodz who found no instabilities in the converging flow of shear-thinning inelastic fluids.

The first day of Session B was started by three papers on different aspects of the non-Newtonian rheometry. Dr. G. Langer from the University of Dortmund analysed the discrepancies which might arise due to the non-isothermal flow in a viscometer and Dr. H. Chmiel from the Technical University of Aachen demonstrated a new capillary rheometer capable of measuring the shear rates up to 10^6 s^{-1} which makes use of two capillaries of unequal length operating under identical volumetric flow rates. Professor C. W. Macosco from the University of Minnesota presented new experimental results on the elastic and viscous shear moduli measured in the Mechanical Spectrometer.

Most of the afternoon of the first day in Session B was taken by papers on extrusion. Whilst Professor R. I. Tanner from Brown University and Dr. J. Nebrensky from the "Catalytic Inc" in London tackled the flow of polymer melts in extruders considering the complexities of the non-isothermal and rheologically complex flow, Dr. D. Schlegel from the Technical University in Aachen dealt with an interesting case of the extrusion of clay pastes.

The whole of the second day of the Conference was tuned on mixing of rheologically complex systems. The session was opened by Professor E. Oshima from the University of Tokyo who proposed a new approach to the assessment of the efficiency of laminar mixing in vessels based upon the circulation time distribution. His lecture was followed by a paper by Professor J. Ulbrecht from the University of Salford who reported new experimental results regarding the influence of rheological parameters on mixing and circulation times in vessels agitated by helical screw impellers. Also the following contribution by Professor P. J. Carreau from the Ecole Polytechnique in Montreal dealt with a similar problem, only he used a helical ribbon impeller. Both Ulbrecht's as well as Carreau's work confirm that the viscoelasticity brings about a complex flow pattern in vessels which leads to segregated vortices. This conclusion was further stressed by the next paper and a very instructive film presented by Professor J. L. White from the University of Tennessee. He also showed the existence of a secondary flow pattern in a vessel agitated by turbines and propellers and pointed out the consequences of these segregated regions for the operation of polymerisation reactors. The following two papers dealt with polymer mixing in static mixers. Dr. S. J. Chen from the "Kenics Corporation" in Danvers (Mass.) described several new applications of these mixers in extrusion and injection moulding and Professor C. D. Han from the Polytechnic Institute of New York used the Kenics mixers in conjunction with extrusion and injection moulding to blend two incompatible polymer blends.

Also the following paper by Professor J. L. White from the

University of Tennessee dealt with injection moulding of a two-phase polymer melt. He analysed the complex flow pattern in the cavity as well as the shape of the interface and showed how this is influenced by the temperature and the rheological properties of the two melts. His conclusions were then illustrated by a colour film.

The problems of laminar mixing dominates a number of operations in the polymer processing industry and its understanding is therefore crucial. Professor S. Middleman from the University of Massachusetts proposed a physical model for the laminar mixing of two fluids with different viscosities. The numerical procedure based upon this model allows to calculate the rate of increase of the contact area. The second day of the Conference was then concluded by a contribution from Dr. D. C-H. Cheng from the "Warren Spring Laboratory" in Stevenage who suggested a new model for the assessment of the process of mixing. He drew a parallel between the rate of structural changes in thixotropic materials and the rate of mixing and suggested a mathematical model.

In the last day the Conference was split again into two sessions. All the papers in Session A were concerned in one way or another with the phenomenon of drag reduction. Dr. H. A. Barnes from Unilever Research (Port Sunlight) presented data on drag reducing properties of dilute polymer solutions, surfactants and their combinations. In this way the final effect can be amplified. Professor R. J. Gordon from the University of Florida discussed some aspects of drag reduction in turbulent flow and the degradation of very diluted polymer solution. He has also shown that the concept of "vortex inhibition" can be used to characterize the degradation at low concentration levels. Professor Schummer from the Technical University in Aachen discussed the correlation between the momentum transfer in turbulent flow of viscoelastic liquids and the rheological parameters. Dr. R. Y. Ting from the Naval Research Laboratory in Washington presented some considerations on the phenomenon of drag reduction in turbulent flow in the light of the polymer viscoelasticity using the dumb-bell rheological model. Dr. W. M. Jones from the University College of Wales in Aberystwyth presented interesting results on the interaction of traces of polymer with the turbulence in flow through pipes. The session meeting was then concluded by a paper by Professor S. Middleman from the University of Massachusetts dealing with the turbulent dispersion in drag reducing fluids. The results presented indicate that the phenomenon of drag reduction is not confined to the tube walls only but that it extends into the turbulent core as well.

The morning of the last day in Session B was concerned with papers dealing with heat and mass transfer in rheologically complex fluids. Dr. R. A. Mashelkar from the University of Salford reported new experimental results on gas-liquid mass transfer in dilute poly-

meric solutions and he proposed a model with which the data were satisfactorily interpreted. Professor J. L. Gainer from the University of Virginia suggested a new theory for the diffusion in non-Newtonian solutions with special reference to biological systems such as blood plasma. Special emphasis was laid upon the changes of diffusivity with the concentration of the solute. The following two papers were both concerned with the dispersion of matter in a continuous channel flow of a rheologically complex material. Firstly Dr. R. A. Mashelkar from the University of Salford presented results of an extensive numerical analysis which takes into account not only the rheological complexities but also entry effects, inertial effects, chemical reactions in bulk or on the boundary as well as the nature of the source. His paper was then followed by an analysis by Professor W. N. Gill from the State University of New York which looked more closely upon the unsteady convective flows with the aim of determining the shear rate dependence of molecular diffusivities of solutes in power-law flows. The last paper of the morning session was given by Dr. V. Turitto from the Hoffman-La Roche Research Laboratory in Basle. The topic of his paper was the deposition of platelets from flowing blood on the walls of blood vessels. The platelet diffusion coefficient was measured and was found to depend upon the shear rate.

The programme of the afternoon meeting was commenced by a discussion of the mutual effects of temperature and pressure on the viscous non-linear flows in tubes given by Professor N. Galili from the Israel Institute of Technology followed by a theoretical analysis of the heat and mass transport in elongational flows put forward by Professor D. Acierno from the University of Palermo.

The last two papers were concerned with flow problems of eminent engineering importance. The influence of rheological properties upon the coating of flat and cylindrical surfaces was the topic of the paper by Professor W. L. Wilkinson from the University of Bradford and new correlations for the design of heat transfer in agitated vessels were proposed by Dr. H. G. S. Edney from the Glaxo Company in Ulverston.

The individual sessions were skilfully chaired by Professors J. L. White, H. Giesekus (University of Dortmund), Dr. D. C-H. Cheng, Professors P. Schummer, F. A. Holland (University of Salford), R. Rautenbach (Technical University Aachen), M. M. Denn and W. R. Schowalter. It is mainly to the chairmen's credit that the lectures were followed by a lively discussion and that the Conference was on the whole well received.

FUTURE MEETINGS

"STRUCTURE AND PROPERTIES OF HETEROPHASE AND BLENDED POLYMERS"

8th April 1975

The Polymer Properties Group Committee of the Plastics Institute has organized this, its fourth annual Research Meeting on the "Structure and Properties of Heterophase and Blended Polymers". The meeting will aim to discuss current research in two sessions:

- (A) Heterophase polymers, eg ABS and toughened polystyrene
- (B) Polymeric blends (materials produced by physical blending of two or more polymers or grades of the same polymer).

The programme will include contributions from universities, industry and research institutes on:

1. The morphology of heterophase and blended polymers
2. The effect of morphology on physical properties
3. The techniques of studying and influencing morphology, with special references to new techniques.

The meeting will be held at the University of Bristol on 8th April 1975. For further information please contact: Miss S. M. Keeble, Executive Officer, (Meetings), The Plastics Institute, 11 Hobart Place, London SW1W 0HL (Telephone: 01-245 9555).

RHEOMETRY: METHODS OF MEASUREMENTS AND ANALYSIS OF RESULTS

This joint meeting with the Italian Society will be held at the Royal Military College of Science, Shrivenham, from 8th to 11th April, 1975. It will provide a forum for discussion and debate about measuring techniques and the interpretation of rheological data.

List of papers offered at 4th December, 1974

- G. Brindley, J. H. Davies & K. Walter: "An Investigation of viscoelastic effects in squeeze films using a rheogoniometer"
- P. Oittinen: "Viscoelastic measurements on printing inks in steady and oscillatory shear"
- P. L. Langbourne & S. S. Mackay: "Mathematical techniques for evaluating Oldroyd constants"
- P. L. Langbourne & S. C. Mackay: "Handling normal stress data"
- J. Ferguson: "Elongational viscosity and interpretation of drawing experiments"

- C. J. S. Petrie: 'A review of elongational rheometry'
- A. Plochocki, L. Czarnecki & G. Miller: "Utility of the power law and logarithmic parabolae parameter in the assessment of the composition dependence of polyolefins blends melt viscosity"
- G. R. Dobson: "Interconversion of the flow curves of greases between different rheometers"
- D. R. Oliver: "Combined shear and extension in polymer solutions"
- C. E. Chaffey, D. W. J. Osmond & F. A. Waite: "Shear thinning and thickening in dispersions"
- R. Stenson: "Experiences of the mechanical spectrometer"
- J. Mewis: "Non-linear oscillatory measurements using a Weissenberg rheogoniometer"
- J. J. Benbow, F. N. Cogswell & M. M. Cross: "On the interpretation of oscillatory flow measurements"
- R. W. Whorlow & P. T. Galvin: "Temperature distribution in cone-plate and biconical rheometers"
- J. Godfrey: 'Thixotropic systems'
- D. C-H. Cheng:

The following have also indicated that they expect to contribute

- J. F. Hutton—behaviour of greases
- B. Roberts—dispersions
- K. M. Beazley—paper
- R. R. Zangger—Contraves Ltd.
- R. P. Martin—Instron Ltd.
- J. J. Benbow—pastes

Ten additional papers are expected from the Italian Society.

"PLASTICS PACKAGING FOR ECONOMY"

17th April 1975

The Packaging Group of the Plastics Institute has organized this meeting to discuss how plastics may be used to best effect to package goods satisfactorily and even more economically and to make associated energy savings.

The meeting should be of particular interest to all packaging technologists concerned with the long-term growth of plastics packaging—and who wish to encourage users to introduce new applications of plastics packaging materials.

Two speakers will lead the discussion: Mr. G. Radlett of J. H. Sainsbury Ltd. will consider form design and materials selection in packaging food items, and a speaker from W. H. Smith Ltd. will examine similar problems in plastics packaging of their range of products.

The Chairman will be Mrs. Rowena Mills, a consultant economist in the packaging field, who has formerly worked for the Metal Box Co. Ltd.

The meeting will be held at the Hotel New Ambassadors, Upper Woburn Place, London, W.C.1. Attendance will be limited to 50 delegates—so early registration is advised. For further information please contact: Miss S. M. Keeble, Executive Officer (Meetings), The Plastics Institute, 11 Hobart Place, London SW1W 0HL (Telephone: 01-245 9555).

IONIC POLYMERS

Brunel University, 14th and 15th May 1975

The emphasis of the Conference will be to explore fundamental aspects of ionic bonding in polymers and the applications of polymeric materials to which ionic bonds contribute significantly.

The programme will comprise review lectures and original papers, amongst the review lectures arranged are:

“The Effect of Ionic Bonding on Transition Temperatures and Viscoelastic Behaviour in Polymers”, by Professor A. Eisenberg, MacGill University.

“Inorganic Glasses in Relation to Polymer Chemistry”, by Dr. N. H. Ray, I.C.I. Runcorn.

“A Domain Model for the Structure of Ionomers”, by Professor W. J. MacKnight, University of Massachusetts.

Fee: £25—includes attendance at Conference and coffee, lunch and tea; £5—Conference Dinner.

Accommodation: £3 per night including breakfast. Arrangements will be made to accommodate participants in Hall and, if required, should be booked in advance.

Conference Organiser: Dr. K. A. Hodd, Department of Polymer Science & Technology, Brunel University.

Conference Secretariat (to whom all enquires should be addressed): Industrial Liaison Bureau, Brunel University, Uxbridge, Middlesex UB8 3PH. Telephone: Uxbridge 39234.

POLYMER RHEOLOGY AND PLASTICS PROCESSING

This joint meeting with the Plastics Institute will be held at Loughborough University from 16th to 19th September, 1975. The objectives of the Conference are:

1. To review the state of knowledge and technology relevant to polymer processing.
2. To discuss new developments in this field.
3. To describe those areas where new knowledge is desirable to enhance technology and where new technology could exploit existing knowledge.
4. To provide a forum where delegates from the processing, raw material and machinery industries and from universities and research institutes can discuss their work.

The Conference will include sessions on: plastics processing practice, analysis and engineering design of processing, rheological properties of polymers and the fundamentals of polymer rheology. Review papers in these fields would be particularly welcome. The proceedings of the Conference will be published.

Please send a title and synopsis as soon as possible. Formal abstracts will be required by 1st March and the complete paper by the date of the Conference.

F. N. Cogswell,
67 Daniells,
Welwyn Garden City,
Hertfordshire AL7 1QT.

Conference on

“HYDRAULIC CEMENT PASTES: THEIR STRUCTURE AND PROPERTIES”

Tapton Hall, Sheffield University, on 8th-9th April 1976

The meeting is being organized jointly by the British National Committee on Materials, the Materials Technology Divisional Committee of the Concrete Society and the Materials and Testing Group of the Institute of Physics.

The cement paste fraction in concrete plays a dominant role in determining the properties of fresh and hardened concrete. A vast quantity of literature has been published dealing with the properties of concrete and its aggregate, however, the literature dealing with the properties of the cement paste fraction in concrete is very sparse.

The work of the materials technologist is hampered by this lack of information not only on the well-known properties such as strength but also on the behaviour relevant to the development of new applications for cement and concrete.

During the past few years work has been carried out on an increasing scale on the chemical and physical structure of cement paste and the relationships between structure and properties. The British National Committee on Materials, the Concrete Society and the Institute of Physics have decided that it is opportune to bring together research scientists and materials technologists to discuss advances in the measurement, interpretation and understanding of the structure and properties of hydraulic cement systems. At the conference particular emphasis will be placed on the interrelationship between structure and properties. Offers of original and unpublished papers will be welcomed in the following fields:

- (i) Structure of cement pastes including the influence of admixtures and diluents (i.e. slags, fly ash and bentonite).
- (ii) Relationship between the structure of cement pastes and their properties. This is planned to include rheological properties, strength, deformation, moisture migration, the effects of extremes of temperature, electrical properties and acoustic and damping characteristics.
- (iii) Behaviour of cement pastes in concrete.

Offers of papers with title and short abstract of 150 words should be sent to Dr. D. W. Hobbs, Materials Research Department, Cement and Concrete Association, Wexham Springs, Slough, SL3 6PL. It is intended to publish the proceedings. Directions regarding layout and final date for submission of papers will be sent to contributors at a later date.

Further details and application forms for the conference will be available on request from The Meetings Officer of The Institute of Physics, 47 Belgrave Square, London SW1X 8QX, in the late Autumn 1975.

RECENT ELECTIONS

At the meeting of Council held on 17th September, 1974 the following applications for membership were received and approved.

Professor M. M. Denn, Department of Chemical Engineering, University of Delaware, U.S.A.

Dr. G. C. Maitland, M.A., D.Phil., Department of Chemical Engineering, Imperial College, London.

Mr. G. Smalley, F.R.I.C., Ash Spinning Co. Ltd., Oldham.

Dr. R. Stenson, Ph.D., ERDE, Powdermill Lane, Waltham Abbey, Essex.

OBITUARY

Mr. Alfred Please, a former Council member of the Society and Principal Scientific Officer in the Materials Division of the Transport and Road Research Laboratory at Crowthorne, has died at the age of 52.

Previously employed in the Research and Development of the British Oxygen Company, he joined the Road Research Laboratory in December 1952. There he began work on the properties of bituminous surfacing mixtures, a subject to which he devoted most of his career at the laboratory. He became an internationally recognized expert on the design of asphalt wearing courses and published many important papers on this subject.

He represented the laboratory on many British Standard Committees and similar bodies, being particularly active in the recent revision and preparation of British Standards for rolled asphalt and coated macadam.

The nature of his work involved close co-operation with research, development and technical staff of the road making industry. He was popular and highly respected with many personal friends throughout the industry, both in this country and abroad.

DIARY

1975

10th March. "Oiliness and extreme pressure agents in lubricants—the role of adsorption and chemical reaction." Professor A. Cameron, 14 Belgrave Square, London. 6.00 p.m.

8th April. P. I. Research Meeting No. 4. "Structure and properties of heterophase and blended polymers." University of Bristol.

8th–11th April. B. S. R. Spring Meeting. "Rheometry: Methods of measurement and analysis of results." R. M. C. S. Shrivenham.

17th April. P. I. Discussion Meeting. "Plastics packaging for economy." Hotel New Ambassadors, Upper Woburn Place, London, W.1.

14th–15th May. Conference on "Ionic Polymers" Depts. of Polymer Science and Technology, Brunel University.

3rd–6th June. Joint Meeting of U.S.-Japan Societies of Rheology, Honolulu.

16th–19th September. Joint B.S.T.-P.I. Meeting. "Polymer rheology and plastics processing." Loughborough University.

ADDENDUM TO MEMBERSHIP LIST

The following corrections to the membership list published last summer have been brought to our attention. We regret that these errors and omissions have occurred and hope that members will amend their lists accordingly. The letters o and c in the margin indicate whether the entry was omitted from the list or is simply a correction.

- c BEAZLEY, K. M. (Ph.D., F.Inst.P.), English China Clays, Lovering Pochin & Co. Ltd., 44 Brookstone Road, Boscoppa, St. Austell, Cornwall PC25 3DP. (fesa DEG) 1959
- c BLANSHARD, J. M. V. (M.A., A.I.F.S.T.), Nottingham University School of Agriculture, Department of Applied Biochemistry and Nutrition, Sutton Bonington, Loughborough, Leics. LE12 5RD (et DFGM) 1969
- c BRAGG, R. (B.Sc., Ph.D.), Dept. of Mechanical Engineering, University of Southampton, Southampton SO9 5NH (fetsa DE) ...
- o DAVENPORT, T. C. (B.Sc., F.Inst.P.), BP Research Centre, Chertsey Road, Sunbury-on-Thames, Middx. TW16 7LN (peta FGJ) 1960
- o DUKES, W. A. (B.Sc.), Ministry of Defence, ERDE, Powdermill Lane, Waltham Abbey, Essex (fea CGO) 1957
- o FERGUSON, W. J. (B.Sc., Ph.D.), Research & Textile Dev. Dept., ICI (Fibres) Ltd., Hookstone Road, Harrogate (peta CDO) ... 1973
- c GALVIN, P. T. (B.Sc., Ph.D.), ICI Plastics Division, 71 Ripon Road, Stevenage, Herts. (petsa DG) 1971
- c GILL, P. F. (B.Sc., M.Inst.P.), "Ridge," Tot Hill, Headley, Nr. Epsom, Surrey (peta AJKM) 1970
- c GROVES, M. J. (Ph.D., M.Pharm., M.P.S., M.I.Biol.), Pharmacy Dept., Chelsea College (University of London), 17 Pine Grove, Twyford, Berks. (pesa FGH) 1962
- c HAYWARD, A. T. J. (M.Sc.(Eng.), Ph.D., F.Inst.P., F.Inst.Pet., C.Eng., M.Inst.Mech.E.), Flow Measurement Division, NEL, East Kilbride, Glasgow G75 0QU (pea J) 1965
- o HOWARD, P. (Ph.D., A.R.I.C.), Chemistry Dept., University of Surrey, Guildford, Surrey (petsa DE) 1949
- o LAMMIMAN, K. A. (B.Sc., F.R.I.C.), Esso Research Ltd., Abingdon, Berks. (pa K) 1949
- o LANGBORNE, P. L. (C.Eng., M.I.Mech.E.), Fluids Group, NEL, East Kilbride, Glasgow G75 0QU (fea DGJ) 1958
- c LENK, R. S. (B.Sc.(Chem.), B.Sc.(Zool.), F.R.I.C., Ph.D., F.P.I.), Polytechnic of the South Bank, Borough Road, London SE1 0AA (feta CDGL) 1963
- o MAY, D (B.Sc., A.Inst.P.), 48 Ballbrook Court, Wilmslow Road, Manchester M20 9GU (pea GHK) 1967
- o MILL, C. C. (M.Sc., M.Inst.P., F.I.O.P.), PIRA, 19 Cray Avenue, Ashted, Surrey KT21 1QX (peta EG) 1940
- o MILNE, A. A., 11 Graham Avenue, East Kilbride, Glasgow (petsa DJN)
- c OLDROYD, J. G. (M.A., Ph.D., Sc.D., Professor), Dept. of Applied Mathematics and Theoretical Physics, Liverpool University, Liverpool L69 3BX (fts DFGN) 1946
- c PUGH, H. L. D. (B.Sc., D.Sc., F.Inst.P., F.I.Mech.E., C.Eng.), NEL, East Kilbride, Glasgow G75 0QU (AJ) 1948

- c RICHARDSON, J. F. (B.Sc., Ph.D., D.Sc., D.I.C., F.I.Chem.E., Professor), University College of Swansea, Dept. of Chemical Engineering, Singleton Park, Swansea ... 1964
- o SAMUEL, D. N. (B.Sc.), W. R. Grace Ltd., Technical Centre, Cromwell Road, St. Neots, Huntingdon (pea DG) ... 1964
- c SCOTT, J. C. (Ph.D., M.Sc., D.I.C., M.Inst.P.), Essex University, Fluid Mechanics Research Institute, Wivenhoe Park, Colchester, Essex CO4 3SQ (petsa CDJM) ... 1968
- o TRELOAR, L. R. G. (O.B.E., F.Inst.P., D.Sc., Ph.D., Professor), UMIST, P.O. Box 88, Sackville Street, Manchester 1 ... 1940
AUSTRALIAN MEMBER
- c ADKINS, G. K. (M.Sc., Ph.D.), Fielders Ltd., 167 Kent Street, Sydney NSW 2000 (fetsa DEGHL) ... 1960
EUROPEAN MEMBERS
- c BONTINCK, W. G. (Doc.es Sci.), UCB, Division Sidac, Research Dept., Ottergamse Stwg., Ghent, Belgium (CDFG) ... 1968
- o GUGELMETTO, P. (Ph.D.), Montedison, P. Marghera (Venice) 30173, Italy (pea CDG) ... 1973
- c JANSSEN, L. P. B. M. (Ir.), Laboratorium voor Fysische Technologie, Prins Bernhardlaan 6, Delft 8, Netherlands (pesa CD) ... 1972
- c KOOIJMAN, J. M. (Dr., Ir.), N. V. Nutricia, Postbus 1, Zoetermeer, Netherlands (e FGM) ... 1972
- c MEISSNER, J. (Dr. Rer. Nat., Dipl. Phys., Professor), Eidgen Technische Hochschule, Technische-chemisches Laboratorium, Universitätsstrasse-6, CH-Zurich, Switzerland (fetsa CD) ... 1961
- c MEWIS, J. (Dr. Ir., Professor), Katholieke Universiteit Leuven, Instituut voor Chemie-ingenieurs techniek, de Croylaan 2, B-3030 Heverlee, Belgium (fesa CD) ... 1966
- c OITTINEN, P. T. (M.Sc.), Helsinki University of Technology, Forest Products Dept., 02150 Otaniemi, Finland (feta DFGJ) ... 1971
- c PLOCHOCKI, A. (M.Sci., D.Sci.), 01-769 Warsaw, Krasinkiego 34m9, Poland (fea) ... 1968
- c SMITH, J. M. (M.Sc., F.I.Chem.E., Professor), Laboratory voor Fysiche Technologie, Prins Bernhardlaan 6, Delft 8, Netherlands (pea DFGM) ... 1960

BRITISH MEMBERS' ADDRESSES

The Post Office has given Societies up till 1st July, 1975, to alter their mailing lists using the new Counties/Post Area basis. After that date British mail which does not use the new system will be regarded as wrongly addressed and may be delayed. The Society must, therefore, update its mailing lists in the next six months. Please fill in your name and correct address in the blank spaces below, putting in the new *COUNTY* name, and the POST CODE, and return the slip to me as soon as possible.

To Dr. J. Ferguson, Fibre Science Department,
University of Strathclyde, George Street,
Glasgow G1 1XW.

My correct mailing address is as follows:

Name

Address

.....

.....

.....

Postal Code