RHEOLOGY BULLETIN

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TECHNICAL ARTICLES & ADVERTISING DEBUT IN RHEOLOGY BULLETIN

This issue of Rheology Bulletin contains an article by Professor I. Manas-Zloczower entitled, "Analysis of Mixing in Polymer Processing Equipment." Such articles will now be a regular feature of the Bulletin. Author guidelines may be found on page 8. Commercial advertising is also introduced with this issue. Contact the Editor if you wish to place an advertisement.

69th ANNUAL MEETING COLUMBUS, OH OCTOBER 19 - 23, 1997

The Autumn1997 meeting of the Society of Rheology will be held at the Hyatt on Capital Square Hotel in Columbus, Ohio. Details of the technical program may be found on the Society's web page at http://www.umecheme.maine.edu/sor/ or inside this issue of Rheology Bulletin. The meeting organizers are:

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POSTER SESSION A poster session will be held in Columbus on Wednesday, October 22. The deadline for submission of abstracts is September 5, 1997. See inside for details.

RHEOLOGY SHORT COURSE If you would like to attend the Flow Visualization short course in Galveston, information about the course and a MS Word file that contains the registration form is available on the SOR web site. For the Fall 1997 meeting, the Education Committee is considering computational rheology or industrial rheology as the short course topic. The final decision will be made at the Galveston meeting. If you have other topics to suggest or if you would like to present a course, please contact Peter Clark by phone at (205) 348-1682 or by fax at (205) 348-9455.

INSTRUMENT EXHIBIT Several companies will exhibit rheological instrumentation at the annual meeting.

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The Hyatt on Capital Square is a 22 story 400 room luxury hotel in downtown Columbus directly across from the historic State Capital Building which was completed in 1861 in Greek Revival architecture style. It is the eighth oldest working Statehouse in the nation. Abraham Lincoln's body was laid in state in the rotunda of the Capital in 1865 on the way home to Illinois. The Capital has recently been restored to its original grandeur at a cost of $112 million.

The hotel is adjacent to the Ohio Theater and the Columbus City Center, a three story upscale mall with three major department stores and 121 specialty shops. The Hyatt on Capital Square has an award-winning restaurant, two bar lounges, and the 6,000 square foot Governor's Ballroom. Facilities include a Penthouse Fitness Center with exercise and workout equipment, a sauna, and whirlpool.

Port Columbus International Airport is fifteen minutes away and is served by most major airlines. Within blocks of the hotel are major corporate offices, the Columbus Museum of Art, and the Center of Science and Technology. The hotel provides complimentary downtown shuttle service. Weather in Columbus in October is generally pleasant with temperatures ranging from 45 to 65 F, but bring a raincoat just in case.

Registration and housing forms, and other information on the Columbus meeting will be included in the July Bulletin.

TECHNICAL PROGRAM FOR COLUMBUS

Authors wishing to present a paper in Columbus should submit an abstract by **May 12, 1997.** The preferred medium for submitting the abstract is through the World Wide Web using the SOR home address:

http://www.umecheme.maine.edu/sor/

Otherwise abstracts submitted via e-mail or on the enclosed form should be sent to the Technical Program chair, R.L. Powell, with a copy to the appropriate symposium chair. The planned symposia and their organizers follow:

1. NON-NEWTONIAN FLUID MECHANICS:

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POSTER SESSION: Prospective presenters are encouraged to use the **Web-based submission procedure** exclusively. Papers should be submitted by **September 5, 1997** to:

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(206) 543-2271; Fax: (206) 543-3778
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MINUTES OF THE EXECUTIVE COMMITTEE MEETING
August 18, 1996

The meeting was called to order at 9:00 a.m. in the Quebec Hilton, Quebec City, Quebec, Canada. Executive Committee Members in attendance included: Kurt Wissbrun, Ron Larson, Morton Denn, Bob Armstrong, Gerry Fuller, Jeff Giacomin, and Andy Kraynik. Invited guests included: Monty Shaw, Rakesh Gupta, Jack Zakin, Peter Clark, and Janis Bennett.

The minutes of the March 24, 1996 Executive Committee Meeting, which appeared in the July 1996 Rheology Bulletin, were approved as read.

The committee considered an objection, raised by Joe Goddard, to advertising appearing in the Journal of Rheology and decided to continue the current policy.

Monty Shaw, Associate Editor for Finance, provided a Financial Report for the Journal of Rheology. We currently have 471 institutional subscriptions -- dropping below 500 for the first time in recent years. This decline is consistent with the trend established over the last several years. Morton Denn indicated that editorial activities for the Journal are running smoothly.

Kurt Wissbrun reported on the cost of archiving the Journal of Rheology on CD-ROM: $50,000 to produce the first 500 copies and $2.25 for each additional copy of back issues. The disk would be searchable by articles, authors, and abstracts. Kurt also read a report on the financial position of the Society, which was submitted by the Treasurer, Ed Collins.

Rakesh Gupta, Editor of the Rheology Bulletin, indicated interest in forming an ad hoc committe on publishing short articles in the Bulletin. The relation between our WWW page and the Bulletin was also discussed.

Ron Larson led discussion on future meetings of the Society. Maintaining industrial participation at meetings is a concern. Ron read a report provided by Bill VanArsdale on local arrangements for the meeting in Galveston, Texas, February 16-20, 1997. Jack Zakin reported on local arrangements for the regular annual meeting in Columbus, Ohio, October 19-23, 1997. Gerry Fuller discussed plans for a meeting in Monterey, California, October 4-8, 1998. Jeff Giacomin talked about the annual meeting in Madison, Wisconsin, October 17-21, 1999.

The Committee voted to increase to $1500 our contribution to the Physics Olympiad, which is sponsored by AIP. Peter Clark discussed activities of the Education Committee, which he chairs. Jeff Giacomin provided his regular update on healthy Society membership. Kurt Wissbrun appointed an ad hoc committee to consider revising the Society Constitution; the committee includes: Art Metzner, Faith Morrison, and Jeff Giacomin. Janis Bennett provided an update on AIP activities of concern to the Society.

The meeting was adjourned at 2:00 p.m.

NOMINATIONS INVITED

The Nominating Committee is soliciting nominations for all elected positions within the Society, but particularly for the member-at-large positions. Recommendations should be sent before March 15, 1997 to any committee member. Suggestions may be faxed to Bob Mendelson, the committee chair, at (281) 834-1793.

ANALYSIS OF MIXING IN POLYMER PROCESSING EQUIPMENT

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Mixing is a key step in almost every polymer processing operation, affecting material properties, processability and cost. Polymers are blended with other polymers to combine their properties and sometimes to even synergistically increase their physical characteristics. Various additives and reinforcing agents are mixed with polymers to improve mechanical performance and impart specific properties to the mixture. The need for developing new materials with improved properties seems to rely nowadays more on blending and compounding than on the synthesis of chemically new polymers. Therefore the importance of a more fundamental understanding of the mixing process and its dynamics is clearly undeniable.

Modeling the mixing process in real mixing equipment through flow simulations is not an easy task. Major obstacles include, but are not limited to, the very complex geometry of the mixing equipment, the time dependent flow boundaries and the difficulties involved in selecting the appropriate "indexes" to quantify the mixing process. Yet modeling offers a means for understanding, designing and controlling the mixing process.

Key to a fundamental understanding of the mixing process and its optimization is the clear distinction between "dispersive" and "non dispersive" mixing mechanisms and identification of the important process characteristics enhancing realization of these mechanisms. In a multiphase system, dispersive mixing involves the reduction in size of a cohesive minor component such as clusters of solid particles or droplets of a liquid. Distributive mixing is the process of spreading the minor component throughout the matrix in order to obtain a good spatial distribution. In any mixing device, these two mechanisms may occur simultaneously or stepwise. Figure 1 depicts schematically these two mixing mechanisms.

The conditions under which dispersive mixing occurs are determined by the balance between the cohesive forces holding agglomerates or droplets together and the disruptive hydrodynamic forces. Quantitative studies of droplet breakup in simple shear and pure elongational flows [2-7] have shown that elongational flows are more effective than simple shear flows, especially in the case of high viscosity ratios and low interfacial tensions. Also, the magnitude of the applied stresses plays a decisive role in determining droplet size distribution. These studies have been supported by the experimental results reported by Powell and Mason [8] and the theoretical calculations of Manas-Zloczower and Feke [9] who point out that elongational flows enhance the process of agglomerate dispersion by comparison with simple shear flows. In mixing equipment, the complex flow geometry generates field patterns which represent a superposition of flows ranging from pure rotation to pure elongation. Thus, assessing dispersive mixing efficiency in mixing equipment in terms of elongational flow components as well as stress distributions seems appropriate.

Distributions of stress and elongational flow give only a global perspective on mixing efficiency in various types of equipment. A more accurate prediction of mixing efficiency would involve tracking the elements of the minor phase (droplets or agglomerates) during their entire residence time in the equipment and following the dynamics of their breakup / coalescence. Such an approach, if achievable, would be prohibitively expensive in terms of computing time and memory. However, the global approach of characterizing mixing efficiency provides one a means to discriminate between various designs and processing conditions for mixing equipment.

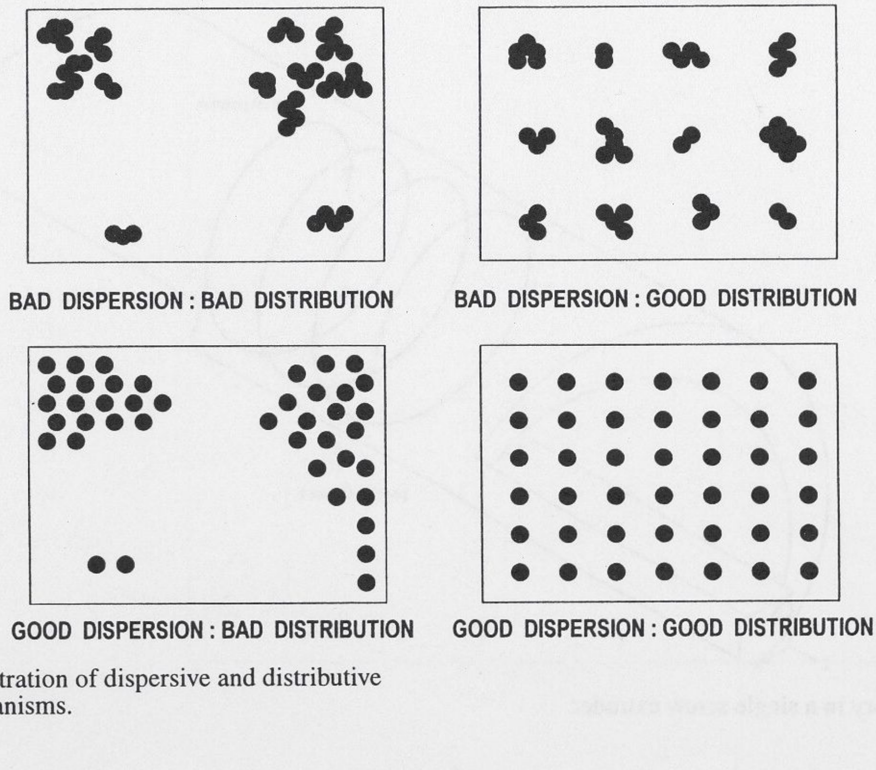

Figure 1 Schematic illustration of dispersive and distributive mixing mechanisms.

Besides its intrinsic limitations, this global approach poses additional problems. As mentioned previously, in most of the existing mixing equipment we face the problem of time-dependent flow boundaries. Take as an example the kneading discs in a corotating twin screw extruder. As the discs rotate, the overall geometry of the flow field changes. A simplified approach to solve for this problem is to select a number of sequential geometries / snapshots for a complete mixing cycle and solve the flow problem in each geometry [10,11]. For polymer processing operations involving laminar flow of highly viscous materials, the overall effect caused by a changing geometry can be analyzed from the results obtained separately in selected sequential geometries. One can then proceed by solving the field equations for each sequential geometry. Shear stress distributions can be obtained for all sequential geometries and subsequently analyzed.

Another important characteristic of the flow field, relevant for dispersive mixing efficiency is the flow "strength". Steady flows can be classified according to the frame invariant concept of flow strength [12,13] in terms of the flow strength parameter, S_f, is defined as:

$$S_f = 2\frac{(tr\underline{D}^2)^2}{tr\overset{\circ}{\underline{D}}{}^2} \qquad (1)$$

where $\underline{D}$ is the rate of deformation tensor and $\overset{\circ}{\underline{D}}$ is the Jaumann time derivative of $\underline{D}$ (i.e. the time derivative of $\underline{D}$ with respect to a frame that rotates with the angular velocity of the fluid element). The flow strength parameter ranges from zero for pure rotational flow to infinity for pure elongational flow; its value is unity for simple shear flow. Determining the numerical value of this parameter requires second derivatives of the velocities. When using the finite element method in flow simulations, high density mesh designs are required in order to minimize the numerical error. This requirement is sometimes impeded by computational limitations, especially when considering processing equipment of very complex geometries.

A different way to quantify the flow strength is by considering the relative magnitude of the rate of deformation and vorticity tensors. A parameter λ can be defined as:

$$\lambda = \frac{|D|}{|D| + |\omega|} \qquad (2)$$

where $|D|$ and $|\omega|$ are the magnitudes of the rate of strain and vorticity tensors respectively. The above parameter assumes values between 0 for pure rotation and 1 for pure elongation, with a value of 0.5 for simple shear. Although not frame invariant, it can be used as a first approximation to discriminate between various equipment designs and processing conditions in terms of their dispersive mixing efficiency [14,15].

Aside from breaking clusters of fine particles or droplets of an immiscible fluid, the aim of any mixing operation is to reduce system nonuniformity. This is accomplished by a repeated rearrangement of the minor component into the major one. In this case, the mechanism of mixing is distributive.

In order to study distributive mixing, one has to track the position of the minor component elements (fluid elements or solid particles) at each instant of the process. This is not an easy task and is usually achieved only by introducing simplifying assumptions. In most cases the minor component elements are assumed to be massless points, such that their presence does not affect the flow field of the otherwise pure matrix. Furthermore, interactions among particles, such as Van der Waals attraction force, friction, and droplet coalescence are ignored. With these smplifications, the location of minor component elements can be found by tracking their motion in the mixing region, provided that their initial position is known. Figure 2 is an illustration of one particle trajectory in a single screw extruder. Due to computational limitations, usually only several thousand particles can be tracked simultaneously during their motion in the equipment.

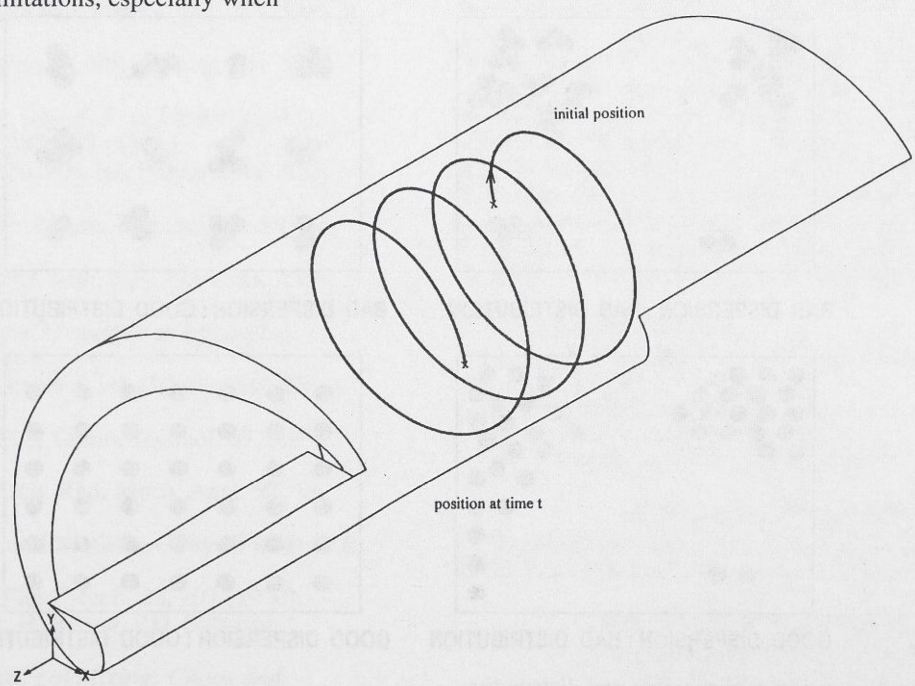

Figure 2 Particle trajectory in a single screw extruder.

SOCIETY OF RHEOLOGY

Type ABSTRACT below. TITLE OF PAPER (to be typed in caps), Authors' Names, Addresses with Zip Code followed by a One-Line Space, then the Abstract. Single-space typing. Use full width of ruled area below, staying within the boundaries. Use elite type if available. The blocked portion will be used to insert paper number and time. Begin typing of paper title to the right of blocked portion.

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In order to facilitate a quantitative analysis of the distributive mixing process, one needs to develop a framework which can provide the means to differentiate among various equipment designs or processing conditions. One index, frequently used for the characterization of distributive mixing efficiency, is the length stretch (distribution and average value) [16]. The length stretch l is defined as the ratio of the distance between two particles at any time t to the initial value of the distance between the same particles [17]:

$$l = \frac{|\underline{X}|}{|\underline{X}_0|} \quad (3)$$

where $|\underline{X}_0|$ is the magnitude of the vector defining the initial locations of two neighboring and distinct particles and $|\underline{X}|$ defines their locations at time t. For a system with N particles, the length stretch distribution $g(l,t)$ can be calculated from:

$$g(l,t) = \frac{2M(l,t)}{\Delta l N(N-1)} \quad (4)$$

where $M(l,t)$ is the total number of pairs of particles with a length stretch ranging from $(l - \Delta l/2)$ to $(l + \Delta l/2)$ at time t.

Using the length stretch distribution, the average length stretch $\bar{l}$ at any time can be obtained through the following relation:

$$\bar{l}(t) = \int_{(l=0)}^{(l=\infty)} l g(l,t)\, dt \quad (5)$$

Time evolution of length stretch distributions and average values can provide a quantitative measure of analysis for distributive mixing efficiency.

Another way of looking at the overall distribution of the minor component in the mixing region (usually in batch type mixing equipment) is by following the dynamics of pairwise correlation functions [18,19]. For a more local analysis of mixing in batch systems, one can search for regions of the mixer void of any minor component elements. Such regions are called islands and they represent an obstacle to efficient mixing [18].

The different indexes of distributive mixing, namely length stretch distributions, pairwise correlation functions or volume fraction of islands provide an objective framework to quantify distributive mixing and to discriminate between various operating conditions and / or various mixer designs. Distributive mixing is related to randomization of a minor component throughout the system and therefore chaotic features of flow will enhance the process. Ottino and coworkers [20-23] have presented the most systematic approach to the modeling of distributive mixing by combining the kinematical foundations of fluid mechanics with chaotic dynamics.

In polymer processing equipment, the origin of chaos is related to complicated, time-dependent flow geometry. In chaotic systems there is a rapid divergence of initial conditions [24]. One way to quantify the divergence of initial conditions is by means of Lyapunov exponents. Positive values for the Lyapunov exponents indicate a more rapid divergence of the initial positions leading to better distributive mixing.

Simulating the mixing process in mixing equipment relies on the predictions of flow simulations. The computational schemes employed in most of the flow analyses in polymer processing are based on finite difference, finite element and boundary element methods. The purpose of these methods is to reduce the partial differential equations for the variables to a set of simultaneous equations for nodal variables at fixed points.

Most of the published literature on complex 3-D flow simulations in polymer processing equipment is based on either the Newtonian fluid or, at the next level of complexity, on the Generalized Newtonian Fluid model. Constitutive equations describing viscoelastic flow phnomena are generally numerically insoluble in multidimensional flows. One source of difficulty may arise from the singularity displayed in many of these constitutive equations when stress is plotted versus the rate of strain.

Larson [13] proposed constitutive equations for materials with a broad distribution of relaxation times using a power-law relaxation modulus. Such equations, although rigorously valid only for special flows (e.g. flows of constant stretch history) may represent a first step to a numerically tractable approximation of viscoelastic flows in complex flow geometries.

With today's rapid advancement in computer technology, there is hope of solving fluid-flow problems involving complex fluids in complex geometries. However, challenges still remain in selecting constitutive equations which describe material flow behavior realistically, yet are tractable in numerical solutions and in the interpretation of flow simulation results in tersms of process efficiency.

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RHEOLOGY BULLETIN AUTHOR GUIDELINES

The Rheology Bulletin publishes papers on the applied aspects of Rheology which are intended for the non-specialist. (Archival research papers should be sent to the Journal of Rheology which is also published by the Society of Rheology.) Appropriate topics include the application of rheological principles to a specific system, instrumentation for rheological measurements, description of interesting rheological phenomena, and the use of well-established rheological techniques to characterize products, processes or phenomena. Papers that describe the historical aspects of the practice of rheology and how these may have influenced current trends are welcome. Also welcome are papers that address the present and changing status of rheological education including papers that describe recent or current innovation in the classroom or laboratory. Consultation with the Editor prior to manuscript submission is encouraged.

Papers should ordinarily not exceed about 4000 words in length. SI units should be used, but any standard style of writing may be employed. The article must have a clear message, and the significance of the work must be explicitly stated. Submit two copies of the manuscript at least three months prior to the issue in which publication is desired. The initil decision about suitability of publication will be made by the Editor. Both solicited and contributed papers may be sent to two or more reviewers. If the paper has been published previously in essentially the same form, permission for reprinting must have been obtained from the copyright holder.

Student-Member Travel Grants for Columbus

The Society of Rheology is again offering grants to support the cost of public transportation to the annual meeting of the Society to any second or third year graduate student who is a member of the Society as of July 1, 1997, and whose faculty advisor is also a member as of that date. Each grant will be a maximum of $350, available on a first-come, first-served basis, until available funds are exhausted. To apply, the student should write a letter requesting the grant. The student's faculty advisor should add a letter of support, certifying that both the advisor and the student are members of the Society of Rheology, and that the student is a second or third year graduate student. Only one application per faculty advisor will be accepted. The letters from the student and the advisor should be mailed in the same envelope **before July 1, 1997** to:

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If you are moving, please inform: Janis Bennett, (516) 576-2403, Fax: 576-2223, or Carolyn Gehlbach, (516) 576-2404 at

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Woodbury, NY 1179

Membership Application Forms and other Information Available on the World Wide Web

Application forms for membership in the Society of Rheology can now be downloaded from the home page of the Society on the World Wide Web. The address is http://www.umecheme.maine.edu/sor/ Also available on the home page are abstracts of forthcoming papers in the Journal of Rheology and a listing of upcoming rheology meetings.

New WWW Site for History of Physics

Check out AIP's new WWW site for the history of Physics, Astronomy and Geophysics at http://www.aip.org/history/ Information is available on AIP's Niels Bohr Library and the Center for History of Physics. A featured Web exhibit is **Einstein: Image and Impact** which uses photographs, quotes, and text to present highlights of Albert Einstein's life.

Meeting Announcements

March 24-26, 1997: Conference on Food Processing, Experimentation and Simulation, Lake Vyrnwy Hotel, mid Wales, UK. Contact: Dr. G.W. Roberts, Univ. of Wales. Fax: 01248 355881 e-mail: G.W.Roberts@bangor.ac.uk

May 7-10, 1997: 2nd Int. Conf. on Dynamics of Polymeric Liquids, Capri, Italy. Contact: Prof. K. Walters, Math. Dept., U of Wales, Penglais, Aberystwyth, Ceredigion,UK

June 1-6, 1997: Surfaces and Interfaces in Polymers and Composites, Lausanne, Switzerland. Contact: Prof. J.A.E. Manson via fax at 41 21 693 5880.

July 22-25, 1997: 2nd European Coating Symposium (Euromech 367), Strasbourg, France. Contact: Prof. P. Bourgin via fax at 33 88 61 43 00 or by e-mail at bourgin@imf.u-strasbg.fr

July 27-31, 1997: 2nd Pacific Rim Conference on Rheology, Melbourne, Australia. Contact: Dr. Y.L. Yeow, Dept. of Chemical Engrg., U. of Melbourne, Parkville, Vic. 3052, Australia. Fax: 61 3 9344 4153.

September 29-October 2, 1997: 8th International Conference on Mechanics and Technology of Composite Materials, Sofia, Bulgaria. Contact: Bulgarian Society of Rheology. Fax: 3592 703 433. E-mail: mezi@bgearn.acad.bg

October 5-8, 1997: 47th Canadian Chemical Engineering Conference (includes several rheology sessions), Edmonton, Canada. Contact: Prof. S.G. Hatzikiriakos Dept. of Chem. Engrg., University of British Columbia, Vancouver, BC V6T 1Z4. Fax: (604) 822-6003.

October 22-24, 1997: '97 Int. Symposium on Fiber Reinforced Plastics/Composite Materials, Beijing, P.R. China. Contact Secretariat of China FRP Society, PO Box 261, Beijing 102101, China. Fax: (0086) 10 69132500.

June 21-26, 1998: 13th US National Congress of Theoretical and Applied Mechanics, Univ. of Florida, Gainesville. Contact: Dr. M.A. Eisenberg, AeMES Dept., University of Florida, PO Box 116250, Gainesville, FL 32611.Tel:(719) 333-4034; Fax: (352) 392-7303 e-mail meise@eng.ufl.edu

JOURNAL OF RHEOLOGY
STATEMENTS OF REVENUE AND EXPENSE
AS OF DECEMBER 1996

	1995 Budget	1995 Actual	1996 Budget	1996 Projected	1997 Budget
REVENUES					
Subscription, Advertising and Sale	$ 199,375	$ 204,620	$ 213,850	$ 216,075	$ 202,150
Page Charges	-	-	-	-	-
Publication Award	1,000	1,000	1,000	1,000	1,000
Miscellaneous	1,315	7,666	5,400	4,860	5,200
TOTAL REVENUE	**201,690**	**213,286**	**220,250**	**221,935**	**208,350**
EXPENSES					
Advertising and Marketing	12,760	8,098	12,870	11,350	12,250
Single Copy and Reprints	3,240	6,142	9,850	8,900	7,000
AIP Editorial	36,770	34,267	33,750	29,800	29,806
SOR Editorial	37,000	29,361	40,000	36,000	44,000
Production Costs	56,830	52,054	56,250	48,600	47,294
Printing and Mailing	42,240	49,073	56,100	59,700	50,700
Subscriptin Fulfillment	11,785	12,322	12,315	12,560	12,500
Publication Award	1,000	1,000	1,000	1,000	1,000
Publication Reserve	-	-	-	-	3,800
TOTAL EXPENSE	**201,625**	**192,317**	**222,135**	**207,910**	**208,350**
NET INCOME	$ **65**	$ **20,969**	$ **(1,885)**	$ **14,025**	$ **0**

THE SOCIETY OF RHEOLOGY
STATEMENTS OF REVENUE AND EXPENSE
AS OF DECEMBER 1996

	1995 Budget	1995 Actual	1996 Budget	1996 Projected	1997 Budget
REVENUES					
Dues	$ 50,000	$ 53,575	$ 56,000	$ 54,000	$ 56,000
Interest	16,000	27,017	16,500	27,000	28,000
Journal of Rheology	201,690	213,286	220,250	221,935	208,350
Mailing List Sales	400	46	400	1,040	400
Annual Meetings	4,000	3,728	-	15,889	6,000
Short Courses	5,250	4,520	-	-	10,000
TOTAL REVENUE	**277,340**	**302,172**	**293,150**	**319,864**	**308,750**
EXPENSES					
AIP Administrative Service	7,000	7,000	7,000	7,000	7,000
AIP Member Society Dues	5,000	5,332	5,600	5,400	5,600
AIP Financial Handling	4,500	4,200	4,000	4,500	5,000
AIP Physics Olympiad	1,000	1,000	1,000	1,000	1,500
Renewal Billing	1,500	971	1,500	1,300	1,500
Journal of Rheology	201,625	192,317	222,135	207,910	208,350
Bulletins & Abstracts	7,000	9,026	3,000	4,050	15,000
Short Courses	5,000	5,109	-	-	10,000
Bingham Award	3,500	2,500	-	-	6,000
Executive Cmt. Meeting	6,500	4,665	6,500	6,200	7,500
Pres. Discretionary Fund	1,500	-	1,500	500	1,500
Trea. Discretionary Fund	1,500	685	1,500	675	1,500
Program Chm. Discre. Fund	2,000	-	-	-	4,000
Secretarial Services	1,000	-	1,000	600	1,000
Mailing	5,000	1,247	2,000	1,150	3,500
Office Expenses	1,500	1,077	1,500	1,050	2,000
Banking Services	100	30	120	150	150
Liability Insurance	200	169	169	169	169
Membership Directory	3,500	1,292	6,500	8,380	5,500
Membership Brochure	1,000	-	1,000	715	1,000
Accountant	1,500	1,214	1,500	1,330	1,500
Student Member Travel Grant	5,000	6,437	5,000	4,550	10,000
Advance Deposit For Future Mtg.	1,500	3,000	2,500	2,500	3,000
Miscellaneous	5,500	4,511	1,500	3,500	1,500
TOTAL EXPENSE	**273,425**	**251,782**	**276,524**	**262,629**	**303,769**
NET INCOME	**$ 3,915**	**$ 50,390**	**$ 16,626**	**57,235**	**$ 4,981**
NET ASSETS AT YEAR END		**$ 406,311**		**$ 463,546**	

'96- SACRAMENTO MEETING 1995

'95- PHILADEPLPHIA MEETING 1994

Application for Membership in
THE SOCIETY OF RHEOLOGY

I wish to apply for membership in THE SOCIETY OF RHEOLOGY dating from January 19 ______

(Family Name) ______________________ (Given Name) ______________________
(Please print)

Mail Address ____

____

Telephone Number ______________________ Fax Number ______________________

E-Mail Address ____

Please indicate in the boxes provided below the code letter from the list at the right, which best describes your areas of interest in order of decreasing importance.

☐ PRIMARY

☐ SECONDARY

☐ TERTIARY

INTEREST AREA	CODE
Biorheology	A
Experimental Methods	B
Foods	C
Inks, Paints, Coatings	D
Materials Science	E
Petroleum Production	F
Plastics Processing	G
Polymer Dilute Solutions	H
Polymer Melts and Conc. Solns.	I
Theoretical and Applied Mechanics	J
Rubbers and Elastomers	K
Solid Polymers	L
Suspensions	M
Theory of Viscoelasticity	N
Electrorheology	P
Composite Materials	Q
Other______________	O

Professional Affiliation

☐ Academic ☐ National Laboratory

☐ Industrial ☐ Other

I understand that my regular member's subscription to the **Journal of Rheology** is for my personal use, and not for library use.

______________________ (Signature) ______________________ (Date)

Enclose remittance in U.S. dollars (only) drawn on a U.S. bank and mail to: **THE SOCIETY OF RHEOLOGY**, c/o American Institute of Physics, 500 Sunnyside Boulevard, Woodbury, NY 11797-2999, (516) 576-2403.

☐ $40 for Regular Annual Dues ☐ $25 for Students

Complete if paying by credit card	CREDIT CARD NUMBER	EXP. DATE	SIGNATURE
☐ AMERICAN EXPRESS ☐ VISA ☐ MASTER CARD			