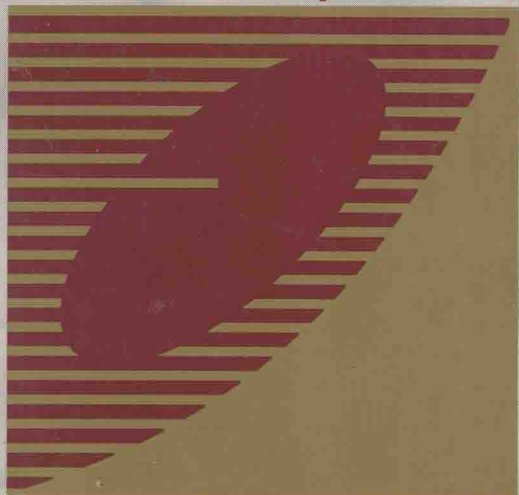


ANTEC 94

San Francisco May 1-5 1994



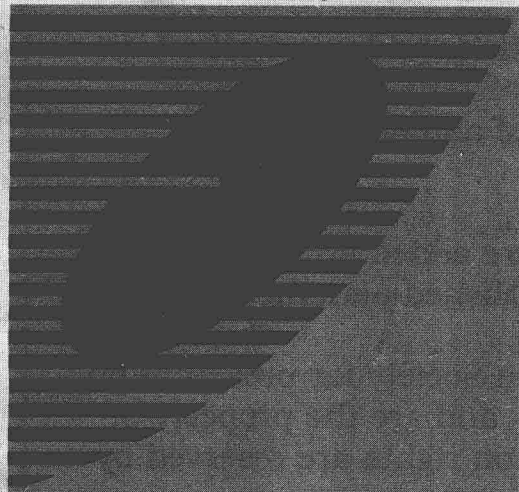
PLASTICS 
Gateway to The Future

VOLUME II—MATERIALS
1994

CONFERENCE PROCEEDINGS
Society of
Plastics Engineers
Plastics
Engineering

ANTEC 94

San Francisco May 1-5 1994



PLASTICS 
Gateway to The Future

江苏工业学院图书馆
藏书章

VOLUME II—MATERIALS
1994

Society of
Plastics Engineers

CONFERENCE PROCEEDINGS

Plastics
Engineering

STATEMENT OF POLICY ON RELEASE FOR PUBLICATION OF SPE CONFERENCE PAPERS

ANTEC is a forum for discussions of contributions addressing the business, engineering and science of plastics. Conference preprints aid communication between speaker and audience and encourages meaningful discussion.

Selected conference papers and discussions are added to SPE literature through publication by the Society in its established periodicals.

1. All papers submitted to and accepted by the Society for presentation at one of its conferences are copyrighted by and are the property of the Society of Plastics Engineers. Publication rights are reserved by the Society.
2. As soon as practicable after a conference, the Society will contact all authors whose papers are being considered for publication in an SPE journal or *Plastics Engineering*.
3. The Society shall not be responsible for statements or opinions expressed in publications, reports, papers or discussions at its meetings unless specifically approved by the Council.
4. An abstract, not to exceed one hundred words, may be published without further permission from the Society provided appropriate source credit is given to the Society of Plastics Engineers and the conference at which the paper was presented.

**COPYRIGHT © 1994 BY THE SOCIETY OF PLASTICS ENGINEERS,
14 FAIRFIELD DRIVE, BROOKFIELD, CONNECTICUT 06804
REPRODUCTION IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION IS PROHIBITED.**

52ND ANNUAL TECHNICAL CONFERENCE

OPERATING COMMITTEE

GENERAL CHAIRPERSON

Michael LoDico
Plasco Inc.

VICE CHAIRPERSON

Brian Scappaticci
Automated Assemblies Corp.

SPONSORSHIP CHAIRPERSON

Jill S. Hughes
Sierra Services Corp.

EXPOSITION CHAIRPERSON

Jim Reedy
Euro-Tec Inc.

STUDENT ACTIVITIES CO-CHAIRPERSON

Lee Hornberger
Santa Clara University

STUDENT ACTIVITIES CO-CHAIRPERSON

Brian Donnelly
San Francisco State University

SPOUSE EVENTS CHAIRPERSON

John LaFountain
Bay Polymer Corp.

SPECIAL EVENTS CHAIRPERSON

Robert Vitale
Consultant

PRESS AND PUBLIC RELATIONS CHAIRPERSON

Paul Appelblom
Jatco Inc.

COMMUNICATIONS & INFO. CHAIRPERSON

Richard Chung
SJSU—Division of Technology

SECTION COORDINATOR/SECRETARY

Ruth Birman
Cap Snap Company

CONFERENCE DIRECTOR

Jeffrey Forger
Society of Plastics Engineers

TECHNICAL PROGRAM COMMITTEE

TECHNICAL PROGRAM CHAIRPERSON

Richard Grossman
Cookson Specialty Additives

TECHNICAL PROGRAM COORDINATOR

Michelle O'Donnell
Society of Plastics Engineers, Inc.

DIVISION/SPECIAL INTEREST GROUP TECHNICAL PROGRAM CHAIRPERSONS

Paul Szilvagy
PMS Consolidated

James Nangeroni
Warner Lambert Co.

Mark Habetz
LA Productivity Ctr.

Gyanendra Gupta
Texas Instruments Inc.

Donald Hylton
Exxon Chemical Co.

Avraam Isayev
Univ. of Akron

Victor Giuffrida
Vygen Corporation

John Beaumont
Penn State/Behrend College

Vipin Kumar
Univ. of Washington

Don Peters
Phillips 66

Jane Maselli
Inland Fisher Guide—GM

George C. Martin
Syracuse University

Ralph Starkey
Windsor Plastics

Frederick Gerson
F. T. Gerson Ltd.

Nancy Hermanson
The Dow Chemical Co.

William Kuhlke
Kuhlke & Associates

Ernest Coleman
Consultant

Marion Hansen
Univ. of Tennessee

James Jones
J. M. Jones Associates

Jordan Rotheiser
Jordan Rotheiser Design

Kalyan Sehanobish
The Dow Chemical Co.

Dilhan Kalyon
Stevens Inst. of Tech.

Bruce Whipple
Miles Inc.

Robert Wegelin
Advanced Elastomer Sys.

Avi Benatar
Ohio State University

Omar Boutni
Himont

Steven Wolfer
Ferris State University

Michael Kozak
Univ. of North Texas

Vijay Stokes
GE Corporate R&D

1993-1994 DIVISION/SPECIAL INTEREST GROUP CHAIRPERSONS

Brian West
Techmer PM

Billy L. Chow
IBM V06/060

Richard F. Grossman
Cookson Specialty Additives

Delbert Yarbrough
Stewart/Walker Company

Randy Calvert
Phillips Plastics Corp.

Isobel Wayrick
GR Technical Services

Suzanne Cole
National Environmental Testing

Robert Hooper

W. Robert Abell
DuPont Co.

Stuart J. Kurtz
Union Carbide Corp.

Martin Mack
Berstorff Corporation

Stephen Murrill
Profile Plastics Corp.

Daniel Buckley
The C. A. Lawson Co.

Terrence Q. Cressy
DuPont Co.

Leon J. Grant
Hobart Tafa Tech. Inc.

Jack MacMillan
Zeneca Inc.

Glenn L. Beall
Glenn Beall Plastics Limited

Michael T. Takemori
GE Plastics

Omar M. Boutni
Himont

Raymond J. Veno
Digital Equipment Corp.

Jehuda Greener
Eastman Kodak Co.

Raymond J. Shute
Huls America Inc.

Gibson Batch
3M Corp., 3M Center

Charlie Smith
Bard Interventional

David W. Garrett
Amoco Performance Products

Ted Abbott
Neste Resins Canada

Lewis P. Yasenchak
P&Y Associates

John W. Gillespie, Jr.
University of Delaware

52ND ANNUAL TECHNICAL CONFERENCE

PAPER REVIEW BOARD

- ALBERT, K.
Rohm & Haas Company
- ANDERSEN, P. G.
Werner & Pfleiderer Corp.
- BAIRD, D. C.
Virginia Polytechnic Institute
- BAUER, C.
Eastman Kodak Co.
- BAUER, P.
AT&T Bell Laboratories
- BAUMAN, D. C.
Plaslok Corp.
- BAUMGARDT, W. G.
Occidental Chemical
- BEATTY, C. L.
University of Florida
- BEAUMONT, J. P.
The Pennsylvania State University at Erie
- BEEBE, G.
AtoHaas North America Inc.
- BELCHER, S.
Sabel Plastics
- BENATAR, A.
The Ohio State University
- BERADINO, B.
Rohm & Haas Company
- BIESENBERGER, J.
Stevens Institute of Technology
- BIGIO, D.
University of Maryland
- BISKOWSKI, B.
Allied Signal Inc.
- BOUTNI, O. M.
Himont
- BOWLAND, C. D.
ICI Fiberite Inc.
- BRADLEY, M.
ARCO Chemical Co.
- BROWN, S. B.
General Electric Co.
- BRUNING, K.
Bekum America Corp.
- BUCKLEY, D. T.
C. A. Lawton Company
- BUEHLER, D.
AmeriHaas
- BUTLER, T.
The Dow Chemical Company
- CAKMAK, M.
University of Akron
- CALDWELL, K.
University of Utah
- CAROPRESO, M.
GE Plastics
- CHAN, T. W.
University of Akron
- CHIANG, M. Y.
Natl. Inst. of Stds. and Tech.
- CHOI, K.-J.
Fleetguard, Inc.
- CHOW, B. L.
IBM
- CLARK, R.
Texaco Chemical Co.
- CLOUGH, R.
Natl. Inst. of Stds. and Tech.
- COBURN, J.
E. I. du Pont de Nemours & Co.
- COCCO, D. A.
The Geon Company
- COLEMAN, E. A.
Premix
- COLLISTER, J.
University of Akron
- CORAN, A.
DuPont Company
- CORCORAN, W. R.
GE Plastics
- COSMA, L.
COWELL, R. D.
- CRUZ, C.
Rohm & Haas
- CZUBA, L.
Exxon Chemical Co.
- DAVIS, D.
Enimont America Inc.
- DE MUESE, M. T.
General Electric Plastics
- DEKKERS, M. E. J.
Syracuse University
- DENG, Y.
Natl. Inst. of Stds. and Tech.
- DI MARZIO, E. A.
Consultant
- DI SALVO, G.
Patco Div. American Ing. Co.
- DIECKMANN, D.
E. I. du Pont de Nemours & Co.
- DORAISWAMY, D.
Rohm & Haas Company
- DUNKELBERGER, D. L.
Aristech Chem. Corp.
- EHRIG, R.
FAJARDO, B.
- ENGLEHARD CORP.
- FALTER, J.
Lonza, Inc.
- FAVIS, B. D.
École Polytechnique de Montréal
- FOUNTAS, N.
James Layton Internat'l Inc.
- GALIATSATOS, V.
University of Akron
- GALLUCCI, B.
GE Plastics
- GARDNER, P.
GE Specialty Chemicals
- GAVIN, G.
Monsanto Chemical Company
- GERSON, T.
F. T. Gerson Limited
- GIBLIN, F.
Seiko Instruments
- GILBERT, R.
- GILHAM, H.
Productive Plastics, Inc.
- GILLESPIE, JR., J. W.
University of Delaware
- GLEESON, J. D.
Advanced Elastomer Systems
- GOLDING, T.
Spectrum Colors
- GRAY, R.
- GREEN, J.
FMC Corp.
- GREENER, J.
Eastman Chemical Company
- GRELLE, P. F.
The Dow Chemical Co.
- GRIMM, R.
Edison Welding Institute
- GROSSMAN, E. M.
Scortec Div. British Technology Group
- GROSSMAN, R. F.
Cookson Specialty Additives
- GUIFFRIDA, V. E.
Vygen Corporation
- GUPTA, G.
Texas Instruments
- HAGBERG, C. G.
Monsanto Chemical Co.
- HAM, S.
Cashiers Plastic
- HAMILTON, R.
Rohm & Haas Company
- HAMPSON, D. G.
Akros Chemicals America

- HANSEN, M.
University of Tennessee
- HAWKINS, T. W.
Lamson & Sessions
- HENKEE, C.
Texaco Chemical Company
- HENNEBERRY, G.
Occidental Chemical Co.
- HEYDWEILLER, J. C.
Syracuse University
- HIRT, D.
Clemson University
- HOLSOPPLE, P. S.
Elf Atochem
- HORN, JR., W. E.
Aluminum Company of America
- HOUGHAM, G.
IBM Corporation
- HUBBAUER, P.
AT&T Bell Laboratories
- HYLTON, D. C.
Exxon Chemical Co.
- IRVINE, J. L.
Vista Chemical Company
- ISAYEV, A. I.
University of Akron
- JARRETT, W.
Kerr-McGee Chemical Corp.
- JONES, J.
J. M. Jones Associates, Inc.
- KALYON, D. M.
Highly Filled Materials Inst.
- KASELER, T.
Baerlocher U.S.A.
- KEATING, M.
E. I. du Pont de Nemours & Co.
- KENNY, G.
Magnetic Separation Systems, Inc.
- KHAIT, K.
BIRL at Northwestern University
- KLIEVER, L. B.
Zeon Chemicals USA, Inc.
- KLIMEK, T.
Quantum
- KNITTEL, R.
Cincinnati Milacron
- KORNEY, A.
Crane Plastics Mfg. Company
- KOTAK, J.
Spartech-Franklin Plastics
- KOZLOWSKI, R.
Aristech Chemical Corporation
- KRAMER, W.
Davis-Standard
- KUHLKE, W.
Kuhlke & Associates
- KULKARNI, V. G.
Americhem, Inc.
- KUMAR, V.
University of Washington
- KURTZ, S.
Union Carbide Chemical & Plastics
- KWEI, T. K.
Polytechnic University
- KYUN, K. S.
The Dow Chemical Company
- LAHE, H.
Husky Injection Molding Systems, Ltd.
- LANDES, B.
The Dow Chemical Co.
- LAWSON, J. R.
Natl. Inst. of Stds. and Tech.
- LEARY, K. A.
Uniroyal Chemical Co.
- LEE, L. J.
The Ohio State University
- LO, S. K.
Ashland Chemical, Inc.
- LONGWELL, G.
Moldflow Pty. Ltd.
- LUSTIGER, A.
Exxon Research & Engineering
- LUTZ, J. T.
J. L. Enterprises
- MACKAY, G.
Husky Injection Molding Systems, Ltd.
- MALLOY, R. A.
UMASS-Lowell
- MANZIONE, L. T.
AT&T Bell Laboratories
- MARX, M. F.
AT&T Bell Laboratories
- MARTIN, G. C.
Syracuse University
- MASELLI, J. M.
Inland Fisher Guide—GM
- MC DONOUGH, W. G.
Natl. Inst. of Stds. and Tech.
- MITCHELL, M.
Sewell Plastics Inc.
- MOET, S.
Case Western Reserve University
- MOTT, P. H.
Natl. Inst. of Stds. and Tech.
- MULHOLLAND, B.
Hoechst-Celanese Corp.
- MURREY, J.
Miles Inc.
- MURTHY, M.
Doss Plastics
- MUZZY, J. D.
Georgia Institute of Technology
- NAGEL, R.
AC Technology
- NEHRA, M.
ICI Polymer Additives
- NEWBERG, J.
Morton International, Inc.
- NEWCOME, J.
Miles Inc.
- NIX, R.
BASF Corporation
- OKAMOTO, K.
Himont Technology Center
- OLSON, J.
John Deere Tech. Center
- ORROTH, S.
UMASS-Lowell
- PANG, S.-S.
Louisiana State University
- PAPE, P. G.
Dow Corning Corporation
- PARR, J.
Exxon Chemical Co.
- PATTERSON, D.
Empire Berol
- PAWLAK, K.
Baxter Healthcare Corp.
- PEARSON, W.
Plastics Institute
- PESCE, J.-J.
Natl. Inst. of Stds. and Tech.
- PISIPATI, R.
Miles Inc.
- PLUHAR, H. J.
Omya, Inc.
- PORTNOY, R.
Exxon Chemical Company
- POWELL, K.
GE Corporate R&D
- PROGELHOF, R.
The Pennsylvania State University at Erie
- PUGLIA, P.
Digital Equipment Corp.
- RANGOS, G.
Ciba-Geigy Corp.
- READ, M.
Dow Brands
- REED, J.
E.R.A. Inc.
- REID, A.
DuPont Company
- REINHEIMER, Q. K.
S&C Electric Co.
- RENSHAW, J.
Monsanto Chemical Company
- RILEY, D. W.
Oregon State University
- ROCHEFORT, W. E.
Rotheiser Design, Inc.
- ROTHERS, J.
S&C Electric Co.
- RUSH, R.
S&C Electric Co.
- SADLER, C.
Std. Products Co.

- SCAROLA, L.
Union Carbide
- SCHMIDT, J.
Repro-X
- SCHOOL, R.
R. T. Vanderbilt Co., Inc.
- SCHOTT, N.
UMASS-Lowell
- SCHULTHEISZ, C. R.
Natl. Inst. of Stds. and Tech.
- SCHUTTE, C. L.
Natl. Inst. of Stds. and Tech.
- SEELER, K. A.
Lafayette College
- SEXTON, E.
Crane Plastics
- SEHANOBISH, K.
The Dow Chemical Co.
- SHAH, S.
Inland Fisher Guide—GM
- SHAW, L. G.
Alpha Chemical & Plastics Corp.
- SHAW, M.
University of Connecticut
- SHERMAN, R.
Robert W. Sherman & Associates
- SHEVCHUK, G. J.
AT&T Bell Laboratories
- SHU, C.-C.
Himont
- SHUTOV, T.
Illinois Inst. of Tech.
- SMALL, J. D.
Eastman Chemical Co.
- SMITH, D.
Battenfeld Gloucester Eng. Co., Inc.
- SMITH, W. W.
Advanced Elastomer Systems
- SMITH, Z. P.
Hoechst Celanese Corporation
- SPINU, I.
Natl. Inst. of Stds. and Tech.
- SPRUIELL, J. E.
University of Tennessee
- STECKEL, M.
Ethicon Endo-Surgery
- STEINER, P.
Rohm & Haas Company
- STEVENSON, J.
E. I. du Pont de Nemours & Co.
- STICKLAND, R.
E. I. du Pont de Nemours & Co.
- STOKES, V. K.
GE Corporate R&D
- SUBRAMANIAN, P. M.
E. I. du Pont de Nemours & Co.
- SUBRAMONEY, S.
E. I. du Pont de Nemours & Co.
- SUMMERS, J.
The Geon Company
- SUTHERS, J.
Eastman Chemical Company
- TALLMADGE, B.
Dow Plastics
- TERZIAN, A.
EM Industries Inc.
- THACKER, G.
Anderson & Company
- THIELE, W.
American Leistritz Extruder
- TROY, E.
Rohm & Haas Company
- TULICKI, R. J.
S&C Electric Co.
- VALLESKEY, K.
Natl. Inst. of Stds. and Tech.
- VERDIER, P. H.
Natl. Inst. of Stds. and Tech.
- VIRANT, A.
Plasticolors Inc.
- WALDRON, W. K.
Natl. Inst. of Stds. and Tech.
- WALLING, R.
Advanced Materials
- WALTER, S.
Akros Chemical
- WANG, V. S. F.
New Hampshire Ball Bearings, Inc.
- WAYRICK, I.
GR Technical Services, Inc.
- WEAVER, J.
Eastman Chemical Co.
- WEGELIN, R. C.
Advanced Elastomer Systems
- WEINBERG, E.
Cross Gates Consultants
- WEIZMAN, D.
Rohm & Haas Company
- WEST, B.
Techmer PM
- WETZEL, D. M.
Rohm & Haas
- WHIPPLE, B.
Miles, Inc.
- WHITE, J. L.
University of Akron
- WHITLEY, M.
Enmart, Inc.
- WILLIAMS, J.
Lonza, Inc.
- WILLIAMS, R.
GE Plastics Japan Ltd.
- WOMER, T. W.
Spirex Corporation
- WOOD, B.
E. I. du Pont de Nemours & Co.
- WOOD, C.
WU, W. P.
- WU, W. P.
Mobil Chemical Co.
- ZAHAVICH, A.
Mohawk College

CONTENTS

VOLUME I—PROCESSING

EXTRUSION DIVISION

Interlayer Adhesion between Acrylic Acid Copolymers and Low Density Polyethylene: Test Method Development and Impact of Extrusion Variables	2
G. L. Young, T. J. Pope, <i>The Dow Chemical Company</i>	
Blown Film Frost Line-Freezing Line Interactions	15
T. I. Butler, S. Lai, R. P. Patel, J. E. Spuria, <i>The Dow Chemical Company</i>	
The Influence of Polymer Processing Additives on the Surface, Mechanical, and Optical Properties of LLDPE Blown Film	28
T. J. Blong, D. F. Klein, <i>3M Specialty Fluoropolymer Department</i>	
A. V. Pocius, <i>3M Adhesive Technologies Center</i>	
M. Strobel, <i>3M Corporate Research Process Technology Lab</i>	
Residence Time Distribution in Spiral Mandrel Die Design	35
J. Perdikoulis, <i>Brampton Engineering</i>	
C. Tzoganakis, A. Penlidis, <i>University of Waterloo</i>	
Predicting Film Strength Properties of PCR/LLDPE Blends	38
A. L. Simons, V. Firdaus, <i>Mobil Chemical Company</i>	
*A New Approach to Reactive Compounding	46
D. J. van der Wal, L. P. B. M. Janssen, <i>University of Groningen</i>	
*Preparation of Starch Derivatives by Reactive Extrusion	50
M. E. Carr, <i>National Center for Utilization Research, ARS, USDA</i>	
*Reactive Extrusion of PP-g-AA with Alkyl Amines	55
X. C. Wang, C. Tzoganakis, G. L. Rempel, <i>University of Waterloo</i>	
*Poly(isoprene-g-styrene) by Reactive Extrusion	62
W. Michaeli, W. Frings, A. Ortmann, <i>Institut für Kunststoffverarbeitung</i>	
H. Höcker, <i>Deutsches Wollforschungsinstitut</i>	
*Modeling of Polymer Flow in Single Spiral Dies	70
A. Sakthivel, <i>Hercules Incorporated</i>	
*Comparison of Experimental Velocity Measurements in the Manifold of an Extrusion Die with Numerical Predictions	75
R. Shanker, R. Ramanathan, W. J. Schrenk, <i>The Dow Chemical Company</i>	
*Thermal Effects on Layer Uniformity of Coextrusion Flows	80
E. Takács, A. Torres, J. Vlachopoulos, A. N. Hrymak, <i>McMaster University</i>	
*Flow Birefringence in the Manifold Region of an Extrusion Die	83
S. Jons, R. Ramanathan, W. J. Schrenk, D. L. Headley, <i>The Dow Chemical Company</i>	
*Coextrusion Layer Thickness Variation—Effects of Geometry on Layer Rearrangement	89
J. Dooley, R. Ramanathan, <i>The Dow Chemical Company</i>	
*Use of Die Modeling to Improve the Manufacturing Process for Extruded Silicone Rubber	94
C. Reese, <i>Dow Corning Corporation</i>	
*Melt Grafting of a Basic Monomer onto Polyethylene in a Twin Screw Extruder	102
K. E. Oliphant, W. E. Baker, <i>Queen's University</i>	
*The Grafting of Polystyrene on Starch in a Twin-Screw Extruder	108
R. A. de Graaf, L. P. B. M. Janssen, <i>University of Groningen</i>	
*Continuous Polymerization in a Back-Mixed Drag Flow Reactor	113
Y. Lu, J. A. Biesenberger, D. B. Todd, <i>Stevens Institute of Technology</i>	
*Continuous Polymerization of Caprolactam in a Twin Screw Extruder On-Line Blending and Melt Spinning to Form Blend Fibers	116
H. Kye, J. L. White, <i>The University of Akron</i>	

*Present in a joint session.

*Non-Homogeneous Mixing Rates and Conversion	123
C. Maier, <i>GE Corporate Research and Development</i>	
M. Lambla, <i>EAHP-ULP</i>	
D. Bigio, <i>University of Maryland</i>	
*Evaluation of Chemically Modified Polypropylene with Various Glass Fiber Types, for Performance Enhancement in Glass Filled Polypropylene	127
R. C. Constable, <i>BP Chemicals Inc.</i>	
*Transesterification of Ethylene Vinyl Acetate Copolymer in a Modular Intermeshing Corotating Twin Screw Extruder with Different Screw Configurations	131
P. J. Kim, J. L. White, <i>University of Akron</i>	
Effect of Head Pressure Variation on Stability: An Experimental Verification	142
J. R. Thompson, <i>Davis Standard—Division of Crompton Knowles Corporation</i>	
A Melt Bank Monitoring and Control System for Sheet Forming	146
M. Yagi, <i>Toshiba Machine Co., Ltd.</i>	
Extruding HIPS on ABS Screws	151
J. R. Powers, M. A. Spalding, K. S. Hyun, <i>The Dow Chemical Company</i>	
Continuous Three-Dimensional Forming of Extruded Shapes	156
T. Jacobson, C. Rauwendaal, <i>Continuous Molding, Inc.</i>	
Debugging and Optimizing Extruder Performance Using Process Data Collected with a Data Acquisition System	162
K. S. Hyun, M. A. Spalding, <i>The Dow Chemical Company</i>	
Residence Time Distribution in Extruders Determined by In-Line Ultrasonic Measurements	167
R. Gendron, L. E. Daigneault, J. Tatibouët, M. M. Dumoulin, <i>Industrial Materials Institute</i>	
Heat Transfer during Polymer Melting in ZSK Extruder	172
J. Curry, A. Kiani, <i>Werner & Pfleiderer Corporation</i>	
Intelligent Advisor to Assist Extruder Operators: A Case Study	182
V. A. Folwarczny, J. Gish, <i>Intelligent Systems Application Center (ISAC)</i>	
J. Witt, <i>Witt Plastics Inc.</i>	
Screw Speed Control Strategy for Multicomponent Extrusion	187
J. F. Stevenson, T. E. Codispoti, B. Chung, <i>GenCorp Research</i>	
Gravimetric Throughput Control for Twin-Screw-Extruder/Gear Pump Systems	193
D. Wolf, J. Wortberg, <i>University of Essen</i>	
M. Mahlke, <i>Bayer AG</i>	
R. Stehr, <i>MAAG Pump Systems AG</i>	
The Use of Bubble Kinematics in the Scale Up and Processing-Property Analysis of the Blown Film Process	202
A. M. Sukhadia, <i>Phillips Petroleum Company</i>	
Scale-Up of LLDPE Blown Film Extrusion	211
P. P. Shirodkar, V. Firdaus, H. Fruitwala, <i>Mobil Chemical Company</i>	
Cast Film Extrusion with Water Bath Cooling	218
P. R. Mitchell, <i>Arlin Mfg. Co., Inc.</i>	
N. R. Schott, <i>The University of Massachusetts at Lowell</i>	
Correlation between the Plastic Strain and the Properties of the Low and Linear Low Density Polyethylene Blown Films	224
A. K. Babel, G. A. Campbell, <i>Clarkson University</i>	
Counter-Rotating Die Design in Micro Blown Film Line	229
W. Chinsirikul, T. C. Hsu, I. R. Harrison, <i>The Pennsylvania State University</i>	
Devolatilization of PDMS Gums: A Performance Comparison of Co- and Counter-Rotating TSEs	234
K. G. Powell, <i>General Electric Corporate Research and Development</i>	
Scale-Up Study of Co-Rotating Fully Intermeshing Twin Screw Extruders Using 47 mm, 69 mm, and 96.5 mm Diameters	239
J. P. Christiano, <i>Davis Standard—Division of Crompton Knowles Corporation</i>	
Effect of Screw Root Profile on PMMA Melting in Counter-Rotating Non-Intermeshing Twin Screw Extruder	248
S. Satija, <i>Rohm and Haas Co.</i>	
C. S. Tucker, <i>Welding Engineers</i>	

*Present in a joint session.

Specific Throughput as an Operating Parameter for Mixing	256
D. Bigio, W. Baim, K. Wang, <i>University of Maryland</i>	
The Geometry of Self Cleaning Twin Screw Extruders	261
C. Rauwendaal, <i>Rauwendaal Extrusion Engineering</i>	
The Effect of Viscosity Ratio and Volume Fraction on the Distributive Mixing of Two Miscible Fluids in the NITSE	266
W. Baim, D. Bigio, <i>University of Maryland</i>	
The Twin-Screw Mixing Element Evaluator: On-Line Performance Evaluation of Modular Twin-Screw Mixing Elements	270
C. G. Gogos, M. Esseghir, D. W. Yu, D. B. Todd, <i>Polymer Processing Institute</i>	
J. E. Curry, <i>Werner & Pfleiderer Corporation</i>	
Developing Melt Temperature in Flight Clearances	278
S. J. Derezinski, <i>Eastman Kodak Company</i>	
Barrel Cooling Effects in PET Extrusion	282
E. L. Steward, <i>Davis Standard—Division of Crompton Knowles Corporation</i>	
A Device to Study Solids Compaction and Conveying in Single Screw Extrusion	288
C. G. Gogos, M. Zafar, D. Sebastian, D. B. Todd, <i>Design and Manufacturing Institute and Polymer Processing Institute</i>	
K. S. Hyun, M. A. Spalding, <i>The Dow Chemical Company</i>	
Material Selection, Screw Design, and Process Optimization Using Expert Systems	293
R. Rakos, S. K. Basu, <i>Polymer Processing Institute</i>	
FEA of Flow in Single Screw Extruders	298
C. Rauwendaal, J. Anderson, <i>Rauwendaal Extrusion Engineering, Inc.</i>	
The Effect of Elongational Viscosity on Polymer Melt Distribution in Extrusion Dies	306
J. Vlcek, <i>Compuplast International</i>	
J. Perdikoulis, <i>Brampton Engineering</i>	
J. Vlachopoulos, <i>McMaster University</i>	
C. Tzoganakis, <i>University of Waterloo</i>	
Area Deformation as a Basis for Mixing Prediction	310
S. Zerafati, D. Bigio, <i>University of Maryland</i>	
Fully Transient Analysis of Heat Transfer in Single and Twin Screw Mixing Elements	318
A. Kiani, J. E. Curry, <i>Werner & Pfleiderer Corporation</i>	
E. Grald, <i>Fluent Inc.</i>	
3D Finite-Element Analysis of the Flow in the Intermeshing Region of Co-Rotating Twin Screw Extruders	327
M. A. Huneault, M. M. Dumoulin, <i>Industrial Materials Institute</i>	
Three Dimensional Numerical Analysis of an Energy Transfer (ET) Screw Section of a Single-Screw Extruder	332
T. A. Plumley, M. A. Spalding, J. Dooley, K. S. Hyun, <i>The Dow Chemical Company</i>	
Simulating Mixing in the Extrusion Process	336
A. Biswas, B. A. Davis, P. J. Gramann, L. Stradins, T. A. Osswald, <i>University of Wisconsin-Madison</i>	

INJECTION MOLDING DIVISION

Process Quality Assurance for Injection Molding of Thermoplastic Polymers	342
J. C. Rowland, K. Ho-Le, <i>Moldflow Pty. Ltd.</i>	
An Investigation of Time Based Holding Pressure Profiles	348
M. Bandreddi, R. Nunn, R. Malloy, <i>University of Massachusetts at Lowell</i>	
A Total System Approach to Improving an Injection Molded Plastic Part Quality	353
Q. Zou, <i>Black and Decker Inc. (US)</i>	
G. Ari, <i>Bowles Fluidics Corporation</i>	
On the Study of Surface Defects in the Injection Molding of Rubber-Modified Thermoplastics	360
M. C. O. Chang, <i>Monsanto Company</i>	
Visual Analyses of Flow Marks Generation Process Using Glass-Inserted Mold—Part I. Micro-Grooved Flow Marks	368
H. Yokoi, Y. Murata, <i>University of Tokyo</i>	
S. Nagami, <i>Mitsui Petrochemical Industries, Ltd.</i>	
A. Kawasaki, <i>Sekisui Chemical Co., Ltd.</i>	

Fiber Orientation and the Mechanical Properties of SFRP Parts	374
E. Henry, P. Kennedy, <i>Moldflow Pty. Ltd.</i>	
S. Kjeldsen, <i>Grundfos</i>	
Fiber Length Degradation in the Feed Zone during Injection Molding	378
A. Parkar, <i>SCIMED Life Systems, Inc.</i>	
R. E. Nunn, S. A. Orroth, <i>University of Massachusetts at Lowell</i>	
Injection Molding Process Development for Long Fiber Reinforced Thermoplastics	384
C. G. Gogos, C. K. Yoon, J. Brizzolara, <i>Stevens Institute of Technology</i>	
Visual Analysis of Fiber Orientation Process by Glass-Inserted Mold. Part 1:	
Analysis Using a Back-Lighting Method	392
H. Yokoi, Y. Murata, <i>University of Tokyo</i>	
Y. Nishi, <i>Polyplastics Co., Ltd.</i>	
T. Seki, <i>Toppan Printing Co., Ltd.</i>	
Applications of Fiber Orientation Analysis in Injection Molding of	
Fiber-Filled Composites	397
C. S. Randall, <i>AC Technology North America, Inc.</i>	
H. H. Chiang, <i>AC Technology, Inc.</i>	
Experimental Study of Gas-Assisted Injection Molding	404
S. Y. Yang, S. J. Liou, <i>National Taiwan University</i>	
Influence of Processing Parameter on Quality of Gas-Assisted-Injection-	
Molded Parts	408
S. Y. Yang, S. J. Liou, <i>National Taiwan University</i>	
Filling and Packing CAE Software for Gas Injection Molding	411
G. Sherbelis, <i>Moldflow Pty. Ltd.</i>	
Numerical Simulations and Experimental Studies of Gas-Assisted Injection Molding	417
S. C. Chen, K. S. Hsu, <i>Chung Yuan University</i>	
M. C. Jeng, <i>Central University</i>	
General Design Guidelines for Gas-Assisted Injection Molding Using a CAE Tool	421
K. S. Barton, <i>AC Technology North America, Inc.</i>	
L. S. Turng, <i>AC Technology, Inc.</i>	
Characterization and Studies of Clamp Force Generation Using Toggle Molding Machines	428
R. W. Peterson, D. F. Reuter, <i>3M Corporate Molding Technology Center</i>	
Capability Evaluation of a Toggle Clamping System for Injection Compression Molding	435
M. Rahman, N. R. Schott, V. N. Reddy, <i>University of Massachusetts at Lowell</i>	
Remanufacture of Toggle and Hydraulic Clamp Injection Molding Machines	439
S. R. Schroeder, <i>John Brown Plastics Machinery</i>	
An Empirical Study of Various Non-Return Valves Available to the Injection	
Molding Industry Today	444
T. W. Womer, M. F. Durina, <i>Spirex Corporation</i>	
The Measurement and Control of Nozzle Melt Temperature in Injection Molding	448
G. Ruscitti, W. I. Patterson, M. R. Kamal, <i>McGill University</i>	
Equipment Temperature Influence on Infrared Temperature Measurements	454
L. E. Barron, <i>Dynisco Instruments Inc.</i>	
*Preventing Plastic Part Failure after Radiation Sterilization	464
J. A. Stubstad, K. J. Hemmerich, <i>Ageless Processing Technologies</i>	
*Effect of Injection Molding Process on Radiation Stability of Polypropylenes	470
N. M. Tollefson, T. A. Shepard, <i>Becton Dickinson Research Center</i>	
*Injection Molding of LDPE/BaSO₄ Blends for Medical Applications	474
K. Amellal, C. Tzoganakis, G. L. Rempel, A. Penlidis, <i>University of Waterloo</i>	
*Injection-Spin Process	479
B. Cao, T. Shepard, N. Tollefson, H. Sugg, <i>Becton Dickinson Research Center</i>	
*The Effect of Chemical Visbreaking and Molding Conditions on Physical Properties	
of Three Polypropylenes: Homopolymer, Random Copolymer, and Heterophasic Copolymer	483
M. R. Drickman, <i>Himont U.S.A., Inc.</i>	
Real-Time Optical Monitoring of Polymer Injection Molding	490
A. J. Bur, <i>National Institute of Standards and Technology</i>	
C. L. Thomas, <i>University of Utah</i>	

*Present in a joint session.

Experimental Investigation of Thermal Contact Resistance in Injection Molding	496
B. O. Rhee, <i>AJOU University</i>	
Investigation of Thermal Conduction between Mold and Melt during Injection Molding Process	501
M. K. Liao, C. S. Li, <i>National Taiwan University</i>	
The Effects of Differential Mold-Surface Temperatures on the Warpage of Packed Injection-Molded Parts	506
W. C. Bushko, V. K. Stokes, <i>GE Corporate Research and Development</i>	
Shrinkage Analysis of Injection Molded Polypropylene Parts	513
A. Mamat, F. Trochu, B. Sanschagrin, <i>Applied Polymer Research Centre</i>	
Misuse and Abuse of Plastic Process Simulation	520
G. Engelstein, <i>GR Technical Services</i>	
Interpreting Process Set-Up Sheets for Flow Analysis	522
C. S. Randall, <i>AC Technology North America, Inc.</i>	
Computer Analysis—The Optimization Tool for the '90s	527
C. Austin, <i>Moldflow Pty. Ltd.</i>	
Warpage Analysis and Resulting Improved Design for a Laser-Printer Part	531
S. Ni, <i>Tianjin Institute of Light Industry</i>	
R. A. Guinn, <i>Lexmark International Inc.</i>	
Simulation of the Complete Injection Cycle	542
P. Ehret, A. Davidoff, F. Jacque, <i>Cisigraph</i>	
H. Bung, <i>French Atomic Energy Commission</i>	
3D Effects in Injection Molding Simulation	547
G. Batch, <i>3M Corporate Molding Technology Center</i>	
Numerical Simulation of the Sequential Filling in Injection Molding Process	554
D. M. Gao, K. T. Nguyen, P. Girard, G. Salloum, <i>Industrial Materials Institute</i>	
Shrinkage of Packed Injection-Molded Parts: Simulation of Gate Freeze-Off Effects	559
W. C. Bushko, V. K. Stokes, <i>GE Corporate Research and Development</i>	
New Developments in the Simulation of Injection Moulding and Special Processes	565
W. Michaeli, S. Galuschka, <i>Institut für Kunststoffverarbeitung</i>	
An Experimental Comparison of State of the Art High Shear Rate Polymer Rheological Characterization Techniques	572
C. T. Burke, <i>GE Plastics</i>	
D. O. Kazmer, <i>Stanford University</i>	
High Modulus Impact Copolymer Polypropylene. Effects of Polymer and Processing Variables on the Physical Properties of Injection Molded Articles	579
G. Hebert, <i>Himont USA, Inc.</i>	
Injection Molding of Semi-Crystalline Polymers: Characterization and Modeling	587
A. I. Isayev, T. W. Chan, M. Gmerek, K. Shimojo, <i>University of Akron</i>	
Processing Effects for High Speed Thin Wall Injection Molding of Polyethylene Improved Processing (IP) Resins	593
A. Whetten, D. Belcher, <i>The Dow Chemical Company</i>	
Injection Molding for Part Stress Reduction in Plating Grade ABS	601
M. Serrano, <i>The Dow Chemical Company</i>	
Advanced Styrenic Resins: A New Alternative for Value Engineering	608
J. R. Montanye, J. McGettrick, <i>The Dow Chemical Company</i>	
Introduction to Dynamic Feed Control for Injection Molding	616
D. O. Kazmer, <i>Stanford University</i>	
Monitoring the Multiple Live Feed Injection Molding Process with Cavity Instrumentation	621
S. Parekh, S. Desai, J. Brizzolara, <i>Stevens Institute of Technology</i>	
A Moving Boundary Technique to Strengthen Weld Lines in Injection Molding	626
G. Gardner, R. Malloy, <i>University of Massachusetts at Lowell</i>	
Increasing Weld-Line Strength through Dynamic Control of Volumetric Shrinkage	631
D. O. Kazmer, <i>Stanford University</i>	
D. S. Roe, <i>GE Plastics</i>	
Weldline Strength Evaluation in Injection Molded HDPE/PA6 Blends	637
S. Fellahi, B. Fisa, B. D. Favis, <i>École Polytechnique de Montréal</i>	

Advanced Methods for Monitoring Injection Molding Processes	644
B. Souder, <i>United Technologies Research Center</i>	
S. Woll, D. Cooper, <i>University of Connecticut</i>	
Force Reflex Energy Differential Sensing—A New Method to Quantify the Molding Process	651
F. J. Buja, <i>Hi-Volume Molding/Machine Co., Inc.</i>	
Gaining Statistical Process Control of Injection Molding Machines:	
To Buy or Not to Buy	655
M. F. Martin, <i>The Dow Chemical Company</i>	
Effects of Small Changes in the Melt Viscosity on the Filling and Packing	
Stages of Injection Molding	659
A. J. Poslinski, C. A. Deborski, S. Aslam, <i>GE Corporate Research and Development</i>	
Temperature Profiles and Shear Heating Effects in Polymer Processing: Tapered Die	666
M. Yue, A. K. Wood, <i>University of Manchester and UMIST</i>	
Study of Polymer Melt Flow during Injection Molding Using Co-Injection	
Molding Technique	671
S. C. Chen, K. F. Hsu, W. R. Jung, <i>Chung Yuan University</i>	
An Intelligent Function-Based Design System for Injection Molded Plastic Parts	680
S. Manoochehri, <i>Stevens Institute of Technology</i>	
Design for Cost of Plastic Injection Molded Parts	684
D. W. Merino, Jr., D. N. Merino, Sr., <i>Stevens Institute of Technology</i>	
Concurrent Design Methodology for Injection Molded Parts	687
D. H. Sebastian, <i>Stevens Institute of Technology</i>	
Expert System for Injection Molding	692
R. E. Farrell, L. Dzeskiewicz, <i>The Pennsylvania State University-Erie, The Behrend College</i>	
The Use of Process Measurements for Real Time Injection Moulding Process Control	696
R. G. Speight, P. D. Coates, J. B. Hull, <i>University of Bradford</i>	
Control of Cavity Pressure during Packing	701
W. I. Patterson, M. R. Kamal, <i>McGill University</i>	
F. Gao, <i>Moldflow Pty. Ltd.</i>	
Cavity Pressure Control during Cooling	706
M. R. Kamal, W. I. Patterson, <i>McGill University</i>	
F. Gao, <i>Moldflow Pty. Ltd.</i>	
Effect of Variable Injection Speed in Injection Mould Filling	712
D. M. Gao, K. T. Nguyen, P. Girard, G. Salloum, <i>Industrial Materials Institute</i>	
Part Dimensional Consistency with Different Switchpoint Controls Techniques	716
M. Wagner, <i>Xerox Corporation</i>	
MAD Approach to the Determination of Optimum Machine Setups in Injection	
Molding of Thermoplastics	721
D. B. Hunkar, <i>Hunkar Laboratories, Inc.</i>	
Applying Design of Experiment Analysis Techniques to the Injection Molding Process	729
P. J. Blyskal, P. J. Meheran, <i>PreSource Technologies, Inc.</i>	
An Experimental Study of Ejection Temperature and Cooling Time for Injection Molding	733
F. S. Lai, Y. S. Wang, H. H. Tseng, <i>University of Massachusetts at Lowell</i>	
*The Secrets of Proper Gate, Runner, and Vent Design	740
D. M. Bryce, <i>Texas Plastic Technologies</i>	
*Effects of Molding Conditions upon the Molding Shrinkage of Polypropylene	745
W.-S. Jou, <i>National Kaohsiung Institute of Technology</i>	
*An Integrated Design System for 3-D Runner Balancing of Injection-Molding Process	749
W. R. Jong, S. C. Chen, <i>Chung Yuan Christian University</i>	
K. K. Wang, <i>Cornell University</i>	
*Use of Computerized Mold Filling Analysis to Optimize Tool Design	754
S. E. Blackson, <i>ARCO Chemical Company</i>	
*Artificial Intelligence in Runnerless Molding	759
T. P. Linehan, <i>D-M-E Company</i>	
F. Humbert III, <i>American MSI</i>	

*Present in a joint session.

*Use of a Differential Scanning Calorimeter as a Trouble Shooting Tool for Injection Molding	766
S. L. Thompson, <i>The Pennsylvania State University-Erie, The Behrend College</i>	
*Dimensional Stability for Powder Injection Molding Using Isothermal Techniques	770
R. T. Shaffer, <i>The Pennsylvania State University-Erie, The Behrend College</i>	
*Modeling the Shear Dissipation along the Injection Screw during Injection for Various Materials	773
O. P. Bartholomew, <i>The Pennsylvania State University-Erie, The Behrend College</i>	
*A Math Model to Predict the Actual Melt Viscosity to be Used in Flow Analysis Software	778
M. L. Selker, <i>The Pennsylvania State University-Erie, The Behrend College</i>	
*Comparison of Mechanical Properties between Isothermal Molding and Injection Molding	783
C. T. Stipkovic, <i>The Pennsylvania State University-Erie, The Behrend College</i>	
*A Study of Corner Cooling as Related to Warpage Analysis	786
J. E. Shrock, <i>The Pennsylvania State University-Erie, The Behrend College</i>	
*Warpage Scale to Evaluate Injection Molded Plastics	791
D. E. Heberlein, Jr., <i>The Pennsylvania State University-Erie, The Behrend College</i>	
*The Effects of Shear on Fiber Filled Materials during Injection Molding	796
G. Turcovsky, <i>The Pennsylvania State University-Erie, The Behrend College</i>	
Experimental Validation of Mold Cooling Analysis	802
M. Rezayat, D. Hampton, <i>Structural Dynamics Research Corporation</i>	
M. Yamabe, T. Ishii, <i>Nissan Motor Co., Ltd.</i>	
Temperature Prediction of Part and Mold Using Finite Element Simulations	809
Y. Lauzé, J.-F. Héту, <i>Industrial Materials Institute</i>	
Development of Cooling Process Window for Injection Molding	813
D. Bigio, B. Xie, <i>University of Maryland</i>	
Prediction of Anisotropic Shrinkage of an Injection Molded Part	817
H. Kumazawa, <i>Japan Synthetic Rubber Co., Ltd.</i>	
Visual Analysis of Fiber Orientation Process by Glass-Inserted Mold. Part II: Analysis Using a Fiber Tracing Method	824
H. Yokoi, Y. Murata, <i>University of Tokyo</i>	
N. Nagaya, <i>Fanuc Ltd.</i>	
H. Harada, <i>Sekisui Chemical Co., Ltd.</i>	
Visual Analyses of Flow Marks Generation Process Using Glass-Inserted Mold—Part II. Synchronous Flow Marks with Same Phases on Both Top and Bottom Surfaces of Molded Samples	829
H. Yokoi, Y. Murata, <i>University of Tokyo</i>	
Y. Deguchi, <i>Sekisui Chemical Co., Ltd.</i>	
I. Sakamoto, <i>Sumitomo Heavy Industries, Ltd.</i>	
Measurement of Shear Stress Distributions on a Mold Cavity Wall during the Filling Process	833
H. Yokoi, N. Masuda, R. Kosaki, <i>University of Tokyo</i>	
Inverse Method for Obtaining the Temperature Profile within a Mold Cavity via IR Pyrometry	836
J. X. Rietveld, G.-Y. Lai, <i>University of Wisconsin-Madison</i>	

THERMOFORMING DIVISION

Thermoforms and the Solid Waste Issue	842
N. H. Malone, Jr., <i>Eastman Chemical Company</i>	
Experimental Study of Thermoforming Dynamics	844
M. J. Stephenson, M. E. Ryan, <i>State University of New York at Buffalo</i>	
Some New Results in Modeling of Thermoforming	850
K. Kouba, M. O. Ghafur, J. Vlachopoulos, <i>McMaster University</i>	
W. P. Haessly, <i>Eastman Kodak Co.</i>	
The Sag Process in Modified Polypropylene	854
C. A. Cruz, Jr., <i>Rohm and Haas Company</i>	
Development of Sparsely Reinforced Elastomer Sheet	860
D. F. Watt, R. Pan, <i>University of Windsor</i>	

*Present in a joint session.

A New Polypropylene Resin with Enhanced Thermoformability	865
P. Jacoby, J. C. Yang, W. J. Kissel, <i>Amoco Chemical Company</i>	
Thermoformed Packaging to Extend the Shelf-Life of Fresh Meats	872
J. Caldwell, <i>Eastman Chemical Company</i>	
The Sleeping Giant: Thermoforming	877
R. Kostur	

THERMOSET DIVISION

*The Effect of Recycled Phenolics on Processing	880
D. A. Hoffman, <i>The Pennsylvania State University-Erie, The Behrend College</i>	
*The New Plastic "Masonry" Block	884
T. P. Morrissey, T. W. Sinnott, <i>Shawnee State University</i>	
*The Use of Polyurethane Elastomers for Orthodontal Applications	886
L. M. Rembiszewski, <i>University of Massachusetts at Lowell</i>	
*Rubber Toughening of Thermosetting Poly(methyl methacrylate)	889
P. Brandenburger, <i>Lehigh University</i>	
*Determining Mold Filling Analysis Accuracy for Thermoset Material	894
E. A. Mutkus, <i>The Pennsylvania State University-Erie, The Behrend College</i>	
Calculation of Volume-Flow Disturbance on RIM Plant	898
W. Michaeli, K. Hohenauer, <i>Institut für Kunststoffverarbeitung</i>	
Processing of Glass Fiber Reinforced Composites with RIB in Structural Resin Transfer Molding with Twin Injection System	904
H. Hamada, N. Ikegawa, Z. Maekawa, <i>Kyoto Institute of Technology</i>	
Quality Improvement in Thermoset Processing through the Use of New Processing Methods	909
T. Schröder, <i>Battenfeld GmbH</i>	
Experimental Verification on Simulating Shrinkage and Warpage of Thin Compression Molded SMC Parts	914
T. A. Osswald, E. M. Sun, S.-C. Tseng, <i>University of Wisconsin-Madison</i>	
P. J. Gramann, <i>The Madison Group: Polymer Processing Research Corp.</i>	
Simultaneous Dielectrometry and Rheology of Model Epoxy Resins	918
A. Ajji, P. Sammut, M. M. Dumoulin, <i>Industrial Materials Institute</i>	
E. Bellefleur, L. Boutin, <i>IBM Canada</i>	
Recycling of Mineral Filled Thermoset Epoxy	924
J. P. Whalen, D. D. Poston, <i>Loranger Manufacturing Corporation</i>	
Phenolic Composites with Recycled Paper Fibers	929
R. D. Deanin, G. F. Bixby, <i>University of Massachusetts at Lowell</i>	
Evaluation of Regrind in Thermoset Applications	931
L. A. Dzeskiewicz, J. D. Ralston, <i>The Pennsylvania State University-Erie, The Behrend College</i>	
Viscosity Characterization of Fast-Curing Epoxy Molding Compound Using a Modified Slit Rheometer	935
S. Han, K. K. Wang, <i>Cornell University</i>	
Dielectric Analyses of Microelectronic Epoxy Compounds	941
H. W. Rauhut, <i>Dexter Electronic Materials</i>	
Dilatometry of Thermoset Resins in Reactive Processing	951
M. Kinkelaar, S. Muzumdar, B. Wang, Y.-Y. Chiu, L. J. Lee, <i>The Ohio State University</i>	
Modification of Polyester Composites by the Use of Cellulosic Fibers and Butyl Acrylate Monomer	956
C. F. Jasso, R. Sanjuan, E. Mendizabal, <i>Universidad de Guadalajara</i>	
Syntheses and Properties of Allyl Novolac Resin/Polyurethane Interpenetrating Network Polymers	959
W. Y. Chiang, D. M. Chang, <i>Tatung Institute of Technology</i>	

BLOW MOLDING DIVISION

Systems Integration for Downstream Operations	964
S. H. Aidlin, <i>Aidlin Automation Corporation</i>	
Shuttle IML & Value Added Packaging for the '90s	969
T. L. Blucher, <i>Techno Graham—A Division of Graham Engineering Corporation</i>	

*Present in a joint session.

A Novel Method of Developing a Blow Molding Head	971
Y. Kanoh, <i>Ube Industries, Ltd.</i>	
H. Furuya, L. Ferguson, <i>GE Plastics</i>	
The New Extrusion Blow Molding Machine—Standard PET Resin	980
S. L. Belcher, <i>Sabel Plastics, Inc.</i>	
Manufacture of Axle Boots Made of Thermoplastic Elastomers	985
K. Haub, <i>Ossberger-Turbinenfabrik GmbH & Co.</i>	
*Recycled Content in PET Bottles—A Review of the Options	996
M. Bakker, <i>Technology Forecast</i>	
*Recycling Postconsumer PVC Bottles: Technology and Market Development	1001
W. F. Carroll, Jr., <i>Occidental Chemical Corporation</i>	
*Recycling of Polyolefins in Blow Moulding	1004
R. W. DiRaddo, L. Pecora, A. Garcia-Rejon, <i>Industrial Materials Institute</i>	
J. I. Inch, <i>Ciba-Geigy Canada Ltd.</i>	
*Blow Molding of Low Modulus TPO Resins	1010
O. J. McGarel, <i>Quantum Chemical Company</i>	
*Blow Molding of Long Fiber Reinforced Thermoplastics	1016
M. Thielen, <i>Krupp Forschungsinstitut GmbH</i>	
Determining the Center Layer Volume of Multilayer Bottles	1022
K. Kurtz, <i>KONA Corporation</i>	
Simulation and Experimental Study of Annular Extrusion from Round, Non-Round and Coextrusion Dies	1026
R. W. DiRaddo, A. Garcia-Rejon, L. Pecora, D. Poirier, <i>Industrial Materials Institute</i>	
Zero Defects via Integrated Quality Systems and Procedures	1031
C. Maczko, <i>TopWave Instruments USA</i>	
3-D Numerical Simulation of the Blow Moulding Process	1037
B. Debbaut, B. Hocq, Y. Jiang, J. M. Marchal, <i>Polyflow S.A.</i>	
Heat Transfer Dynamics of the Cooling and Solidification Phase of Blow Moulding	1042
R. W. DiRaddo, A. Garcia-Rejon, <i>Industrial Materials Institute</i>	
Low Energy Drying and Heating of Raw Plastic Resins for the Production of Blow Molded Container	1048
R. Farrag, <i>FASTI GmbH</i>	
Process Drying—Innovations in Technology and Energy Efficiency Advancements	1052
D. Rainville, R. Crawford, <i>Universal Dynamics, Inc.</i>	
Cost-Effective Mold Dehumidification of Blow and Injection Molds and Tools	1058
Using a Refrigerant Based System	
B. Stipsits, <i>FASTI GmbH</i>	
PET Preforms for Custom Containers: Achieving Competitive Prices and Availability—Without the Pain	1061
J. C. Maddox, <i>Broadway Companies, Inc. and Encon, Inc.</i>	

MOLD MAKING & MOLD DESIGN DIVISION

*Utilizing Stereolithography to Produce a Rapid Prototype Thermoforming Mold	1064
D. S. Cummings, <i>The Pennsylvania State University-Erie, The Behrend College</i>	
*Computer Integrated Manufacture of an Injection Mold	1069
D. Picarsic, <i>North Carolina Agricultural and Technical State University</i>	
*Creating Mold Technology for the Isothermal Molding Process	1073
J. D. Davis, <i>The Pennsylvania State University-Erie, The Behrend College</i>	
*Selecting the Proper Gate Selection Using Moldflow	1077
H. E. Payne, Jr., D. K. Knauff, <i>Shawnee State University</i>	
*Using Stereolithography to Produce Production Injection Molds	1082
K. Maley, <i>The Pennsylvania State University-Erie, The Behrend College</i>	
*Comparing Thermoforming Computer Analysis to Actual Molded Parts	1085
D. D. Lumpkin, <i>The Pennsylvania State University-Erie, The Behrend College</i>	
*Development of Mold Design Software	1090
M. A. Lodenstein, D. M. Romps, P. Tran, <i>Western Michigan University</i>	

*Present in a joint session.