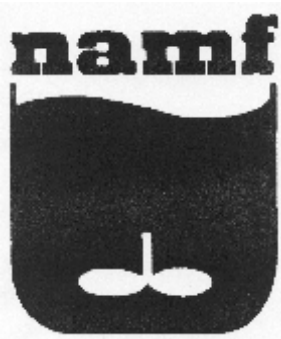


Technical Program

Mixing XVIII

18TH BIENNIAL CONFERENCE ON MIXING

JUNE 24-29, 2001
POCONO MANOR INN AND GOLF RESORT
POCONO MANOR, PENNSYLVANIA, USA



Sponsored by
North American Mixing Forum
American Institute of Chemical Engineers

Chair: David S. Dickey, MixTech, Inc.

Sunday, June 24, 2001

1:00 p.m. to 9:00 p.m.	Registration and Check-in
8:00 p.m. to 9:00 p.m.	Speakers and Session Chairs Meeting Terrace Ballroom
9:00 p.m. to 11:00 p.m.	Reception Stone Room

Monday, June 25, 2001

7:00 a.m. to 8:30 a.m. Breakfast
 Dining Room

8:30 a.m. to Noon Technical Session
 Terrace Ballroom

1 Polymer and Laminar Mixing

Chairs: Shaffiq Jaffer, Procter & Gamble, and Bill Kelly, Villanova University

1.1 Greeting and Introduction

David Dickey, MixTech, Inc.

1.2 The Effect of Fluid Mixing on Polymerization

Dr. James Y. Oldshue, Oldshue Technologies International

1.3 Model Studies of a Vickers-Zimmer Spoked-wheel Polyester Finisher

W. Roy Penney and A. Anvrag, University of Arkansas

1.4 A Strategy for the Simulation of Fluid Flow in Twin-screw Extruders

F. Bertrand and P. A. Tanguy, Ecole Polytechnique de Montreal, F. Thibault, Industrial Materials Institute, Canada, L. Delamare, Elf Atochem, France

1.5 The Role of Mixing in Melting of Plastics

Bainian Qian, David Todd, and Costas Gogos, Polymer Processing Institute

1.6 Kinetics of Blending for Miscible-immiscible Polymer Additives

Jordi Hemsing, Steve Stanley and Suzanne Kresta, University of Alberta

1.7 Laminar Mixing of Non-Newtonian Fluids in Batch Stirred Tanks

Fernando Muzzio and Paulo Arratia, Rutgers University

12:00 Noon to 1:30 p.m. Lunch
 Dining Room

4:30 p.m. to 6:00 p.m. Poster Session
 Terrace Ballroom

2 Multiphase Mixing Opportunities

Poster Session

2.1 Application of a New Interfacial Area Transport Equation to Multidimensional Flow Problems

Mohammed Aliyede, New Mexico State University, Steve Yarbrow, Los Alamos National Laboratory, and Richard Long, New Mexico State University

- 2.2 Effect of Dispersed Phase Viscosity and Interfacial Tension on Drop Size Distribution in a Batch Rotor-stator Mixer**
Supathorn Phongikaroon and Richard V. Calabrese, University of Maryland, USA
- 2.3 A CFD-based Model for Predicting Shear-induced DNA Breakage in Mixing Tanks**
William J. Kelly, Villanova University, and Anand Ekambaram, Merck
- 2.4 Design of Agitation Systems for Large-scale Bioreactors Using Computational Fluid Dynamics**
Sonja P. Svihla and Thomas R. Hanley, University of Louisville
- 2.5 Liquid Macro- and Micromixing in Sparged and Boiling Reactors**
D. Zhao, J. M. Smith, N. F. Kirkby, University of Surrey
- 2.6 Mixing of Cohesive Powders in Batch Tumbling Blenders**
Fernando J. Muzzio, Paulo E. Arratia, Hang Duong, Osama Sudah, Rutgers University, USA
- 2.7 Qualitative Description of Solids Distribution in Model Process Tank with Triple Bank Cooling Coils**
Neguib M. Hassan and Frank R. Weitz, Westinghouse Savannah River Company
- 2.8 A Numerical Study on the Scale-up of Agglomeration in Stirred Vessels**
E. Hollander, J. J. Derksen and H. E. A. Van den Akker, Delft University of Technology
- 2.9 CFD Simulation of Gas Flooding in a Rushton Turbine Stirred Vessel**
Maethee Chandavimol and Gary Patterson, University of Missouri-Rolla

5:00 p.m. to 6:00 p.m.	Social Hour Stone Room
6:00 p.m. to 7:30 p.m.	Dinner Dining Room
7:30 p.m. to 10:00 p.m.	Technical Session Terrace Ballroom

3 Viscous and Motionless Mixing

Chairs: Julian Fasano, Chemineer and Fernando Muzzio, Rutgers University

- 3.1 Performance of Axial Flow Impellers with Power Law Fluids**
William J. Kelly, Villanova University, and Bernie Gigas, LIGHTNIN
- 3.2 Optimization of Helical Ribbon Geometry for Blending in the Laminar Regime**
Richard K. Grenville, DuPont Engineering Technology, and Todd M. Hutchinson, Philadelphia Mixers Corp.

- 3.3 Laminar Mixing in Kenics-type Static Mixer**
Shiping Liu, A. N. Arymak, and P. E. Wood, McMaster University
- 3.4 CFD Modeling of Viscous Fluid Mixing in a Stirred Tank with Complex Impellers**
Minye Liu, Andrea Wick, and Ken Heitzmann, Procter & Gamble, and André Bakker, Fluent
- 3.5 Numerical Study of Flow and Mixing Performance in Static and Dynamic Mixers**
A. J. S. Rodrigo, J. P. B. Mota, Universidade Nova De Lisboa, Portugal, E. Saadjan, CNRS GDR 681: Chaos Lagrangien 3-D, France

10:00 p.m. to 11:30 p.m. Social Hour
Stone Room

Tuesday, June 26, 2001

7:00 a.m. to 8:30 a.m. Breakfast
Dining Room

8:30 a.m. to Noon Technical Session
Terrace Ballroom

4 Solids-Liquid Mixing

Chairs: Suzanne Kresta, University of Alberta and Adam Tunis, Procter & Gamble

- 4.1 Slurry Make-down in a Coaxial Mixer**
Kumar Perumal and Philippe Tanguy, Ecole Polytechnique, and Dominique Denoel and Pierre Henric, Rayneri (Groupe VMI), France
- 4.2 Ultrasonic Characterization of Low Volume Fraction Solid-liquid Slurries**
Mark Hedges, Kionix Inc., A. S. Sangani, and L. L. Tavlarides, Syracuse, NY, USA
- 4.3 Mixing and Crystallization: a Discussion of the Interactions That May Be Critical in Development and Scale-up of Organic Crystallization Operations**
Edward L. Paul and Michael Midler, Merck & Co.
- 4.4 Drawing Down Solids with Different Impeller Diameters**
Gul Ozcan-Taskin, Mike Musgrove, and David Wei, FMP BHRGroup
- 4.5 Collision and Agglomeration Rates of Small Particles in Turbulent Fluid**
Jerzy Baldyga, Magdalena Jasinska, Andrzej Krasinski, and Dominik Kubicki, Warsaw University of Technology
- 4.6 Segregation Effects on the Performance of Continuous Crystallization Processes**
Mario M. Alvarez, Matthew A. Brown, and San Kiang, Bristol-Myers Squibb.

4.7 On the CFD Simulation of Solid Concentration Distribution in Multiple-impeller Stirred Vessels

G. Montante, University of Bologna, G. Micale, University College of London, F. Magelli, University of Bologna, and A. Brucato, University of Palermo

12:00 Noon to 1:30 p.m.

Lunch

Dining Room

4:30 p.m. to 6:00 p.m.

Poster Session

Terrace Ballroom

5 Mixing in Different Flow Regimes

Poster Session

5.1 CFD Simulation of an Inline Rotor-stator Mixer: Effect of Shear Gap Width on Flow Field and Turbulent Kinetic Energy

Karl R. Kevala, Ved. P. Mishra, and Richard Calabrese, University of Maryland

5.2 Characterization of Blending in Static Mixers

Mark F. Reeder and Julian B. Fasano, Chemineer, and Kevin J. Myers, University of Dayton

5.3 One-dimensional Turbulence: Vector Formulation and Application to Free Shear Flows

William T. Ashurst, Alan R. Kerstein, and Scott Wunsch, Sandia National Laboratories

5.4 Influence of Mycelia Morphology over Oil Dispersion in a Proto-bioreactor as Measured by Image Analysis

Savidra Lucatero-Chavez, C. Patricia Larralde-Corona, Gabriel Corklidl, and Enrique Galindo, Universidad Nacional Autonoma de Mexico

5.5 Prediction of Striation Thickness Distribution and Intermaterial Area Density in Steady 3D Chaotic Flows

Edit S. Ambrozy and Fernando J. Muzzio, Rutgers University

5.6 Flow and Mixing in a Model Twin-screw Extruder

Ronglin Ma, Andrew N. Hrymak, and Philip E. Wood, McMaster University

5.7 Chemical Processing and Micromixing in Confined Impinging Jets

Brian K. Johnson and Robert K. Prud'Homme, Princeton University

5.8 Effects of Mixing in Supercritical Antisolvent Precipitation in Turbulent Flow

Jerzy Baldyga and Marek Henczka, Warsaw University of Technology, B. Yu. Shekunov, E. Astrakcharchik, Y. Sun, and P. York, University of Bradford

5.9 Non-intrusive Measurements of Agglomeration Rate Constants in a Couette Flow Device

E. Hollander, J. J. Derksen, and H. E. A. Van den Akker, Delft University of Technology

5.10 Yield Predictions in Large-Eddy Simulations Using a Filtered Density Function Approach

E. E. Van Vliet, J. J. Derksen, and H. E. A. Van den Akker, Delft University of Technology

5:00 p.m. to 6:00 p.m.

Social Hour
Stone Room

6:00 p.m. to 7:30 p.m.

Dinner
Dining Room

7:30 p.m. to 10:00 p.m.

Technical Session
Terrace Ballroom

6 Scale-up and Measurement Methods

Chairs: Tom Post, Consultant, and Gary Tatterson, North Carolina A&T State University

6.1 Scale-up Tools for Complex Mixing Tasks

Peter Forschner and Werner Himmelsbach, EKATO, and Joe Hannon, PFD

6.2 Methodology for Characterization of Reaction Systems and Scale-up Based on Lab Data and Dynamic Simulation

Kathy Barton and Erwin Irdam, Pharmacia and Eoin Casey, Joe Hannon, and Steve Hearn, PFD

6.3 Non-intrusive Mixing Using Fluid Diodes

Julian B. Fasano and Mark F. Reeder, Chemineer Inc., Kevin J. Myers, University of Dayton

6.4 CFD Modeling of Scalar Mean and Variance Using Simultaneous PIV/PLIF Measurements

Kuo Chen Tsai, Rob Larkins, and Paul Gillis, Dow Chemical

6.5 Recent Developments in Electrical Tomographic Sensing Techniques

G. T. Bolton and F. J. W. Podd, Industrial Tomography Systems

10:00 p.m. to 11:30 p.m.

Social Hour
Stone Room

Wednesday, June 27, 2001

7:00 a.m. to 8:30 a.m. Breakfast
 Dining Room

8:30 a.m. to Noon Technical Session
 Terrace Ballroom

7 Solutions to Mixing Problems

Chairs: Richard Grenville, Du Pont and Erwin Irdam, Pharmacia

7.1 The Effect of Mixing on the Generation of Selected Pulping and Bleaching Chemicals Used in the Pulp and Paper Industry

C. P. J. Bennington, M. Shaharuzzaman, and H.A. Dobson, University of British Columbia

7.2 Prediction of Turbulent Static Mixer Performance Using Large-eddy Simulation

Richard D. LaRoche and Arthur W. Etchells, DuPont Engineering Technology

7.3 Study of Dynamic Stress Affecting a Radial Baffle in a Mechanically Agitated System with Standard Rushton Turbine Impeller

Jiri Kratena, Ivan Fort, Oldrich Bruha, and Milan Ruzicka, Czech Technical University

7.4 What is "Well Mixed?" - A CFD Perspective

Kevin Fontenot, Eastman Chemical, and Sriram Ramanathan, AEA Technology

7.5 A Dynamic Systems Approach to Mixing in Stirred Tanks

M. Hari and Reginald B. H. Tan, National University of Singapore

7.6 CFD Simulation of a Rushton Turbine Stirred Vessel with Detailed Assessment of Model Predictions

Randall N. Robinson and Richard V. Calabrese, University of Maryland

7.7 A Novel Agitation System for Oxidation Ditches

Kevin J. Myers, University of Dayton, Julian B. Fasano, Mark F. Reeder, and David D. Dean, Chemineer

12:00 Noon to 1:30 p.m. Lunch
 Dining Room

4:30 p.m. to 6:00 p.m. Poster Session
 Terrace Ballroom

8 Mixing in Stirred Reactors

Poster Session

- 8.1 3-D Chaotic Mixing Between Eccentric Elliptic Annuli**
A. J. S. Rodrigo, J. P. B. Mota, University of Lisbon, and E. Saadjan, Chaos Lagrangien 3-D
- 8.2 Modeling Jet Mixing with Computational Fluid Dynamics**
Christine M. Hughes, Richard K. Grenville, Richard D. LaRoche, DuPont Engineering Technology
- 8.3 The Dynamics of Laminar Mixing in CSTR's**
Fernando J. Muzzio, Paulo E. Arratia, and Justin Lacombe, Rutgers University
- 8.4 Effects of Mixing on Chemical Reactions in Stirred Reactors**
Jerzy Baldyga, Marek Henczka, and Lukasz Makowski, Warsaw University of Technology
- 8.5 The Effect of Impeller and Tank Geometry on Power Number**
Dallas Chapple, Artin Afacan, Suzanne Kresta, University of Alberta
- 8.6 What Customers Can Expect from Mixing Vendors**
Ronald J. Weetman, LIGHTNIN
- 8.7 Modeling Particle Collisions in an Industrial Crystalliser by Using Lattice-Boltzmann Methods**
A. Ten Cate, J. J. Derksen, H. J. M. Kramer, and H. E. A. Van den Akker, Delft University of Technology
- 8.8 4-D Laser Induced Fluorescence Measurements of Micromixing in a Tubular Reactor**
E. E. Van Vliet, J. J. Derksen, and H. E. A. Van den Akker, Delft University of Technology
- 8.9 Drop Break-up and Deformation in Stirred Tanks in the Laminar Regime**
Heather Clark and Gul Ozcan-Taskin, FMP BHRGroup

5:00 p.m. to 6:00 p.m.	Social Hour Stone Room
6:00 p.m. to 7:30 p.m.	Dinner Dining Room
7:30 p.m. to 10:00 p.m.	Technical Session Terrace Ballroom

9 Liquid Mixing and Dispersion

Chairs: Mark Meili, Procter & Gamble, and Karl Knable, Pharmacia

- 9.1 Blending in Stirred Tanks under Batch and Continuous Conditions - Combining Experimental and CFD Results**
Pip Jones, David Wei, and Gul Ozcan-Taskin, FMP BHRGroup

10.4 Using Large Eddy Simulation to Capture Micromixing Effects in a Concentric Mixer

Jennifer P. Spinti and Philip J. Smith, University of Utah

10.5 Problems in Multi-component Diffusion and the Need for Multi-scale Modeling to Understand the Fundamentals of Mixing

E. B. Nauman, Rensselaer Polytechnic Institute

10.6 Micromixing and Trailing Vortices

M. Hoefken and W. Steidl, INVENT, and M. Schäfer, University of Erlangen-Nuremberg

10.7 Modeling Stirred Vessel Hydrodynamics Using Large Eddy Simulation

André Bakker, Ahmad Haidari, and Elizabeth M. Marshall, Fluent

12:00 Noon to 1:30 p.m. Lunch
Dining Room

5:00 p.m. to 6:00 p.m. Social Hour
Stone Room

6:00 p.m. to 8:00 p.m. Awards Dinner
Dining Room

8:00 p.m. to 10:00 p.m. Technical Session
Terrace Ballroom

11 New Developments in Mixing

Chairs: Art Etchells, DuPont, and I-Hwa Midey Chang-Mateu, Rohm & Haas

11.1 Winner of Research Students Award

Fluid Mixing Processes Subject Group, IChemE

11.2 Rotated Arc Mixer: A Novel Device for Viscous Applications

Guy Metcalfe, Murray Rudman, and Dilip Manuel, CSIRO Australia

11.3 A Quest for the Perfect Mixing Diagnostic

Lynn A. Melton, University of Texas at Dallas, Chuck Lipp, Kouchen Tsai, and Paul W. Gillis, Dow Chemical

11.4 Mixing in Microchannels

C. Tsouris, D. W. DePaoli, V. F. de Almeida, C. T. Culbertson, S. C. Jacobson, and J. M. Ramsey, Oak Ridge National Laboratory

10:00 p.m. to 11:30 p.m. Social Hour
Stone Room

Friday, June 27, 2001

7:00 a.m. to 8:30 a.m. Breakfast
 Dining Room

8:30 a.m. to Noon Technical Session
 Terrace Ballroom

12 Gas-Liquid Mixing

Chairs: Alvin Nienow, University of Birmingham, and John Von Essen, Philadelphia Mixers

12.1 Impact of Bubble Dynamics and Reactor Flow Field on Reactive Mixing Processes

Johannes Khinast, Rutgers University

12.2 Void Fraction and its Distribution in Sparged and Boiling Gas-liquid Reactors

J. M. Smith, University of Surrey, D. Zhao, Beijing University of Chemical Engineering, and N.F. Kirkby, University of Surrey

12.3 Stirring as Foam Disruption (SAFD)

Alvin W. Nienow and Lotte A. Boon, University of Birmingham, and Frans W. J. M. M. Hoeks, Lonza AG, Switzerland

12.4 Flow and Suspension Characteristics of Gas-liquid-solid Suspensions

Gary Patterson and Maethee Chandavimol, University of Missouri-Rolla, and Nenad Kuzmanic, University of Split, Croatia

12.5 Detection of Two-phase Flow Hydrodynamics in Industrial Scale Bioreactors

H. Patel, University of Birmingham, P.A. Armstrong, Eli Lilly, P. Mohan, Eli Lilly, J. McKemie, Hayward Tyler Fluid Handling, and W. Bujalski, University of Birmingham

12.6 Surface Aerators and Gas Inducing Reactors for Aerobic Biological Wastewater Treatment: Mass Transfer Characteristics and Simulation of Commercial Plants

S. S. Patil and J. B. Joshi, University of Mumbai

12.7 Mass Transfer Capability Study of Multiple Up-pumping High-efficiency Hydrofoil Impellers

Bernd Gigas, LIGHTNIN, Kishore Kar, Dow Chemical Company, Midland, Juergen Lueske, Dow Deutschland, Luciano Piras, INCA International, Italy, and Tim Geiger, Mattoon-Lee Co.

12:00 Noon to 1:30 p.m. Lunch
 Dining Room