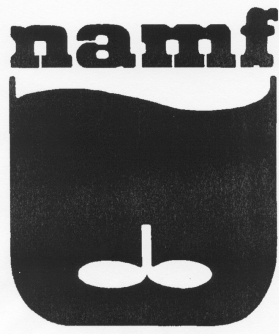


Technical Program

Mixing XIX

19TH BIENNIAL CONFERENCE ON MIXING

JUNE 15-20, 2003
HILTON LAKE PLACID RESORT
LAKE PLACID, NEW YORK, USA



Sponsored by

North American Mixing Forum

American Institute of Chemical Engineers

Chair: Julian B. Fasano, Chemineer, Inc.

Sunday, June 15, 2003

3:00 p.m. to 8:00 p.m.

Check-in - Front Desk
Conference Registration - JC Room

3:00 p.m. to 5:30 p.m.

NAMF Executive Council Meeting
Terrace Room 3

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

Dinner
Terrace Room 1, 2, and 4

Sunday, June 15, 2003, cont'd.

8:00 p.m. to 9:00 p.m. Speakers and Session Chairs Meeting
Dancing Bears Lounge

9:00 p.m. to 11:00 p.m. Welcome Reception
Dancing Bears Lounge

Monday, June 16, 2003

7:00 a.m. to 8:30 a.m. Breakfast
Terrace Room 1, 2, and 4

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

8:30-8:40 a. m. Greeting and Introduction
Julian B. Fasano, Chemineer, Inc.

8:40 a. m. - Noon 1 Blending, Reactive Mixing & Flow Patterns, I
Chairs: James N. Tilton, E. I. Du Pont de Nemours & Co., Phippe A.
Tanguy, Ecole Polytechnique

8:40-9:10 a. m. 1.1 Alternate Feed Strategies for Stirred Tank Reactors, Sujit
Bhattacharya and Suzanne M. Kresta, University of Alberta, and Ron
Weetman, Lightnin

**9:10-9:40 a. m. 1.2 Macro-instability Uncovered in a Rushton Turbine Stirred Tank
by Means of LES**, Hugo Hartmann, J. J. Derksen and H. E. A. van
den Akker, Delft University of Technology

**9:40-10:10 a. m. 1.4 Design of Horizontal Vessels Operated as CSTR - Basic Mixing
Tasks, RTD, Productivity**, Peter Forschner, David Houlton, Ron
Klepper, EKATO Corporation

10:10-10:40 a. m. **Break**
Promenade

**10:40-11:10 a. m. 1.5 Effects of Inlet and Tab Design on Mixing Performance in HEV
Static Mixers**, Miney Liu, DuPont, Richard LaRoche, Fluent, Arthur
Echells, Retired from DuPont

Monday, June 16, 2003, cont'd.

- 11:10-11:35 a. m. **1.6 Quantitative Study on the Relative Importance of Macromixing and Micromixing in Biological Reactions**, Mario M. Alvarez, Centro de Biotecnologia Instituto Tecnologico y de Estudios Superiores de Monterey
- 11:35-noon **1.7 Application of Oscillatory Flow Mixing for Rapid Mixing**, Yanmin Zhang, Sarah Moore, Andrew Wetherill and Martin Tillotson, Yorkshire Water Services Limited
- Noon to 1:00 p.m. Lunch
Terrace Room 1, 2, and 4
- 5:00 p.m. to 6:00 p.m. Social Hour
Promenade
- 6:00 p.m. to 7:30 p.m. Dinner
Terrace Room 1, 2, and 4
- 7:30 p.m. to 10:05 p.m. Technical Session
Medallion Ballroom
- 7:30-10:05 p. m. 2 Blending, Reactive Mixing & Flow Patterns, II**
Chairs: Ramesh Hemrajani, ExxonMobil, Suzanne Kresta, University of Alberta
- 7:30-7:55 p. m. 2.1 CFD Modelling of Glass-Lined Reactors**, David Dickey, Mixtech, Kevin Bittorf and Keith Johnson, Dantec Dynamics, and Chris Ramsey, Applied Process Technology
- 7:55-8:20 p. m. 2.2 Optimization of Mixing Protocol in Three-Dimensional Periodic Flows**, A. J. S. Rodrigo, J. P. B. Mota, Universidade Nova de Lisboa
- 8;20-8:45 p. m. 2.3 Using CFD to Understand How Power Law Fluid Rheology Effects Heat Transfer at Helical Cooling Coils Using Axial Flow Impellers in the Transitional Flow Regime**, William J. Kelly, Eric Ricci, Villanova University
- 8:45-915 p. m. Break**
Promenade
- 9:15-9:40 p. m. 2.4 3D CFD Simulations of Non-Newtonian Mixing with Off-Centered Impellers**, Philippe A. Tanguy, Gabriel Ascanio, Christian Rivera, Mourad heniche, and Teodoro Espinosa-Solares, Ecole Polytechnique

Monday, June 16, 2003, cont'd.

- 9:40-10:05 p. m. 2.5 **Achieving Mixing via Twin Screw Extruders**, David B. Todd,
Polymer Processing Institute NJIT
- 10:05-11:30 p.m. Social
Promenade
-

Tuesday, June 17, 2003

- 7:00 a.m. to 8:30 a.m. Breakfast
Terrace Room 1, 2, and 4
- 8:30 a.m. to Noon Technical Session
Medallion Ballroom
- 8:30 a. m.- Noon 3 **Gas-Liquid Mixing**
Chairs:Kathleen P. Barton, Pharmacia, Ronald J. Weetman, Lightnin
- 8:30-9:00 a. m. 3.1 **Power Characteristics and Liquid Phase Mixing Times in Sparged and Boiling Reactors with Multiple-Impeller Agitators**, D. Zhao, N. F. Kirby, H. Juller-Steinhagen and J. M. Smith, University of Surrey
- 9:00-9:30 a. m. 3.2 **Evaluation of Shallow and Deep Tank Areas in Aeration of Waste Liquors**, James Y. Oldshue, Oldshue Technologies International
- 9:30-10:00 a. m. 3.3 **Mixing Studies Related to the Cleaning of Molten Aluminum**, M. Kimata, Yamagata University, W. Bujalski, J. Song and M. R. Jolly, University of Birmingham
- 10:00-10:30 a. m. **Break**
Promenade
- 10:30-11:00 a. m. 3.4 **Experimental and Computational Analysis of Mass Transfer and Blending Performance in a 2.4 m Bioreactor Model**, Bernd Gigas, Paul Kubera, Lightnin, and Kumar M. Dhanasekharan, Fluent
- 11:00-11:30 a. m. 3.5 **Distribution of Air Bubbles and Castor Oil Drops in a Simulated Fermentation System as a function of Viscosity of the Aqueous Phase**, Ma Soledad Cordova-Aguilar and Enrique Galindo, National University of Mexico
- 11:30 a. m. - noon 3.6 **An Experimental Study on Gas Dispersion in a Mixing Tank**, Jie Wu, Nabil Noui and Y. Zhu, CSIRO Div. of Manufacturing and Infrastructure

Tuesday, June 17, 2003, cont'd.

12:00 Noon to 1:00 p.m. Lunch
Terrace Room 1, 2, and 4

5:00 p.m. to 6:00 p.m. Social Hour
Promenade

6:00 p.m. to 7:30 p.m. Dinner
Terrace Room 1, 2, and 4

7:30 p.m. to 10:00 p.m. Technical Session
Medallion Ballroom

7:30-10:05 p. m. 4 New Mixers and Processes

Chairs: Chad Bennington, University of British Columbia, Arthur Etchells, retired DuPont

7:30-7:55 p. m. 4.1 A New Approach to Hermetically Sealed Mixing, Mark Reeder, AFIT, Julian Fasano and Eric Janz, Chemineer, Inc.

7:55-8:20 4.2 A Novel Gas-Liquid Contacting and Mixing System Design, Prakash Balan and John McWhirter, m²t Technologies

8:20-8:45 4.3 New Surface Aerator Impellers with Increased Oxygen Transfer Efficiencies, Ronald J. Weetman, Lightnin

8:45-9:15 Break
Promenade

9:15-9:40 4.4 Mixing Characteristics of Large Paddle Type Impeller MAXBLEND, Ryuichi Yatomi, Mamoru Mishima, Masafumi Kuratsu, and Shoji Morinaga, Sumitomo Heavy Industries

9:40-10:05 4.5 The Hyperboloid Mixer/Aerator - Functional Principle, Characterization and Applications in Wastewater Treatment, Marcus Höfken, Walter Steidl and Torsten Frey, Invent

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

Wednesday, June 18, 2003

7:00 a.m. to 8:30 a.m. Breakfast
Terrace Room 1, 2, and 4

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

8:30 a. m. - Noon 5 Experimental Techniques

Chairs: E. Bruce Nauman, Rensselaer Polytechnic, W. Roy Penney, University of Arkansas

8:30-8:55 a. m. 5.1 Development of Mixing Models for Continuous Flow Chemical Processes and Their Application Using Dynamic Process Simulation Software, Pip N. Jones, BHR, Richard K. Grenville, Arthur W. Etchells III and George C. Bentinck, DuPont

8:55-9:15 a. m. 5.2 A Comparison Between Computational Fluid Dynamics and Electrical Tomography Results for Stirred Tanks and Packed Bed Reactors, K. M. Primrose and G.T. Bolton, Industrial Tomography Systems, A. Rose, Rose Consulting Engineers.

9:15-9:35 a. m. 5.3 Power Draw and Flow Characteristics of Reciprocating Agitators, Eric E. Janz and Julian B. Fasano, Chemineer, Inc., Mark F. Reeder, AFIT

9:35-9:55 a. m. 5.4 Development of "Analytical" confined Continuous Mixers for Characterization of Rapid Processes, Brian K. Johnson, Merck & Co., Robert K. Prud'homme, Princeton University

9:55-10:20 a. m. Break
Promenade

10:20-10:45 a. m. 5.5 Numerical Prediction of KU Viscosity for Newtonian and Non-Newtonian Fluids, May Y. M. Wu, Midey Chang-Mateu, Rohm and Haas Company

10:45-11:10 a. m. 5.6 Measurement of Solids Concentration in the Presence of Bubbles Using Acoustic Monitoring Techniques, Lawrence L. Tavlarides, A. Shcherbakov, and E. Dievendorf, Syracuse University

11:10-11:35 a. m. 5.7 Experimental Techniques for Contacting of Solids with Heavy Hydrocarbon Liquids for High Temperature Conversion in Co-Rotating Twin Screw Mixers, Ramesh R. Hemrajani, ExxonMobil Research and Engineering Company

Wednesday, June 18, 2003, cont'd.

- 11:35-noon **5.8 Scale-Up of a Multi-Impeller Stirred Vessel Polymerizer Using CFD**, John C. Middleton, S. E. Leefe and D. Wei, BHRG
- 12:00 Noon to 1:00 p.m. Lunch
Terrace Room 1, 2, and 4
- 5:00 p.m. to 6:00 p.m. Social Hour
Promenade
- 6:00 p.m. to 7:30 p.m. Dinner
Terrace Room 1, 2, and 4
- 7:30 p.m. to 10:05 p.m. Technical Session
Medallion Ballroom
- 7:30-10:05 p. m. 6 Student Contest Papers and Nano-scale Mixing**
Chairs: Victor Atiemo-Obeng, Dow Chemical Co., I-Hwa Midey
Chang-Mateu, Rohm and Haas Co.
- 7:30-8:00 p. m. 6.1 Study of oil and fungal biomass dispersion and distribution of air bubbles in a stirred tank containing a simulated fermentation broth**, Soledad Córdova-Aguilar, Leobardo Serrano-Carreón, Patricia Larralde and Enrique Galindo Depto. Ingeniería Celular y Biocatálisis Instituto de Biotecnología - UNAM
- 8:00-8:30 p. m. 6.2 Measurements of Particle Mean Velocity Profiles in a Stirred Vessel at Just-Suspended Impeller Speed**, Chandavimol, Maethee and Patterson, Gary, Department of Chemical and Biochemical Engineering, University of Missouri-Rolla
- 8:30-8:50 p.m.** Discussion on NAMF's Mixing Handbook by editors Suzanne Kresta, Ed Paul and Victor Atiemo-Obeng
- 8:50-9:05 p. m. Break**
Promenade
- 9:05-9:35 p. m. 6.3 Mixing in Sub-Micron Ducts**, E. Bruce Nauman and Ashish Nigam, Rensselaer Polytechnic Institute
- 9:35-10:05 p. m. 6.4 Mixing in Microchannels**, Abe Stroock, Cornell University
- 10:05 p.m. to 11:30 p.m. Social Hour
Promenade

Thursday, June 19, 2003

- 7:00 a.m. to 8:30 a.m. Breakfast
Terrace Room 1, 2, and 4
- 8:30 a.m. to Noon Technical Session
Medallion Ballroom
- 8:30 a. m. - Noon 7 Mixing Fundamentals and Industrial Mixing**
Chairs: David S. Dickey, Mixtech, Edward L. Paul, retired Merck
- 8:30-9:00 a. m. 7.1 The Versatility of Up-Pumping, Hydrofoil Agitators**, Alvin W. Nienow, University of Birmingham
- 9:00-9:30 a. m. 7.2 Mixing Pulp Suspensions in Agitated Stock Chests**, C. P. J. Bennington, F. Ein-Mozaffari and G. A. Dumont, The University of British Columbia
- 9:30-10:00 a. m. 7.3 A Floating Confined Agitator for Oxygenation in the Vicinity of the Liquid Surface**, R. Sardeing, M. Poux, J. Bertrand, and C. Xuereb, Laboratoire de Genie Chimique UMR CNRS, P. Avriillier, Air Liquide
- 10:00-10:30 a. m. Break**
Promenade
- 10:30-11:00 a. m. 7.4 Application Report: Rail Car Mixing**, Robert Sandoz, Pulsair Systems, Inc.
- 11:00-11:30 a. m. 7.5 Static Mixing with Minimized Space Requirement**, Markus Fleischii, Marcel Suhner, Sulzer Chemtech Ltd.
- 11:30 a. m. - Noon 7.6 Computer Simulation of Mixing in Uranium Storage and Blending Tanks**, Neguib M. Hassan, Westinghouse Savannah River Co., L. J. Forney and A. G. Gjiorges, Georgia Institute of Technology
- 12:00 Noon to 1:00 p.m. Lunch
Terrace Room 1, 2, and 4
- 5:00 p.m. to 6:00 p.m. Social Hour
Promenade
- 6:00 p.m. to 8:00 p.m. Awards Dinner
Terrace Room 1, 2, and 4
- 8:00 p.m. to 10:00 p.m. Technical Session
Medallion Ballroom

Thursday, June 19, 2003, cont'd.

- 8:00-10:05 p. m. **8 Solid-Liquid Mixing**
Chairs: Tom Post, Consultant, Piero M. Armenante, New Jersey Institute of Technology
- 8:00-8:20 p. m. **8.1 Solids Suspension in Stirred Tanks: A Comparison of CFD models to Experimental Data**, Liz Marshall and Christine Wolf, Fluent Inc.
- 8:20-8:40 p. m. **8.2 Vortex Depths in Partially Baffled Vessels - An Experimental and Correlational Study**, W. Roy Penney, Gabriele S. Spanel, and James F. Butler, University of Arkansas
- 8:40-9:00 p. m. **8.3 Unsteady Behavior of Continuous Stirred Vessels with Slurries - Some Unusual Results**, Keisha Wilson, Richard Grenville, Carmon J. Ramone, and Kenneth H. McCourt, DuPont Company, Arthur Etchells, DuPont Company Retired
- 9:00-9:20 p. m. **8.4 Use of Characteristic Times in Correlating Yields in Solid-Liquid Reaction Systems**, Gary K. Patterson, University of Missouri-Rolla
- 9:20-9:40 p. m. **8.5 Some Comments on Scale-Up Criteria for Equal Solids Distributioin in Slurry Reactors**, G. Montante, D. Pinelli, F. Magelli, University of Bologna
- 9:40-10:00 p. m. **8.6 Influence of Particle Properties on the Yield and Selectivity of Fast Heterogeneously Catalyzed Gas-Liquid Reactions**, Jodi Raffensberger, Ben Glasser, and Johannes Khinast, Rutgers University (Note: Johannes Khinast is the winner of the 2nd NAMF Start-up Grant in Mixing)
- 10:00 p.m. to 11:30 p.m. Social Hour
Promenade
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Friday, June 20, 2003

- 7:00 a.m. to 8:30 a.m. Breakfast
Terrace Room 1, 2, and 4
- 8:30 a.m. to Noon Technical Session
Medallion Ballroom
- 8:30 a. m. - Noon **9 Liquid-Liquid Mixing, Mixing with Mass Transfer, and Solids-Liquid Mixing**
Chairs: Alvin Nienow, University of Birmingham, Shaffiq A. Jaffer, Procter and Gamble

Friday, June 20, 2003, cont'd.

- 8:30-9:00 a. m. 9.1 **Liquid-Liquid Mixing in Stirred Tanks with Different Height-to-Tank Diameter Ratios**, Sunil Mehta and Piero Armenante, New Jersey Institute of Technology
- 9:00-9:30 a. m. 9.2 **Development and Testing of a Liquid-Liquid Noncoalescing System in Agitated Vessels**, Sarah A. Priddy and Thomas R. Hanley University of Louisville
- 9:30-10:00 a. m 9.3 **Modern Dispersion Technology: The Right Spin**, Stewart Rissley, Morehouse-COWLES
- 10:00-10:30 a. m. **Break**
Promenade
- 10:30-11:00 a. m. 9.4 **Simulation of Liquid-Liquid Dispersion in Turbine Stirred Vessels**, Kumar M. Dhanasekharan and Ahmed Haidari, Fluent Inc., Richard V. Calabrese, University of Maryland
- 11:00-11:30 a. m. 9.5 **Euler/Lagrange Large-Eddy Simulations of Solids Suspension in a Stirred Tank**, Jos Derksen, Hugo Hartmann, Harrie van den Akker, Delft University
- 11:30 a. m. - Noon 9.6 **Oxygen Transfer and Fluid Flow Simulations of a Spinner Flask Bioreactor**, Yinkun Wan, Mohammad Shafie and Thomas Hanley, University of Louisville
- 12:00 Noon to 1:00 p.m. Lunch
Terrace Room 1, 2, and 4

Poster Papers
Displayed from Monday Noon to Thursday at 6:00 pm
Promenade

10 Poster Papers

- 10.1 A Case for Mixer Thrust**, Laars Uby, ITT Flygt
- 10.2 Pin Mixers, Turbulators and Their Power Equations**, Gary B. Tatterson, North Carolina A&T
- 10.3 Experimental Study of Non-Newtonian Mixing with Off-Centered Impellers**, Gabriel Ascanio, Philippe A. Tanguy, and Maritrini Jimenez Garza, Ecole Polytechnique and Mario Alvarez, ITESM
- 10.4 Assessment of CFD Models for Particle Distribution in Newtonian and Pseudoplastic Fluids in Stirred Vessels**, G. Mantante and F. Magelli, University of Bologna
- 10.5 Rheological Property Determination of corn Stover Suspensions Using a Helical Impeller**, Natalia V. Pimenova and Thomas R. Hanley, University of Louisville
- 10.6 Development and Testing of a Liquid-Liquid Noncoalescing System in Static Mixers**, Sarah A. Priddy and Thomas R. Hanley, University of Louisville.
- 10.7 An Improved Correlation to Predict “Just Suspension” Speed for Solid-Liquid Mixtures in Stirred Tanks**, Richard K. Grenville, DuPont Engineering Technology, Andrew T. C. Mak, Air Products Asia Inc., David A. R. Brown, British Hydromechanics Research Group.
- 10.8 Gas-Gas Mixing and How It Applies Specifically to SCR Systems for DeNOx**, Mughis Naqvi, Sulzer Chemtech USA, Inc.
- 10.9 About the Design of Mixing Systems for Anaerobic and Anoxic Basins for Large Wastewater Treatment Plants**, Marcus Höfken, Walter Steidl, Peter Huber, INVENT