

Mixing XX

Sponsored by the North American Mixing Forum

Technical Program

Tigh-Na-Mara Seaside Spa Resort

Parksville, British Columbia

June 26 – July 1, 2005

MIXING SHORT COURSE: Sunday, 8:00 – noon, Moriarity Room

Lunch for short course instructors and participants: noon – 1:30 pm, Location TBA

NAMF Council Meeting: Sunday, 2:00 – 4:00 pm, Maquilla Conference Room

Exhibit Set-up: Sunday, 1:00 – 4:00 pm, Moriarity Room

REGISTRATION: Sunday, 2:00 – 6:00 pm, Lower Foyer

WELCOME RECEPTION, EXHIBIT, AND SALMON BBQ: Sunday, 4:30 – 7:30 pm

Grand Moriarity Room for Reception and Exhibit and BBQ on the Patio

SESSION 1: FUNDAMENTALS OF MIXING TECHNOLOGY

Sunday, 7:30 – 10:00 pm, Walbran

Co-Chairs: David Dickey and Midey Chang-Mateu

7:30 Opening comments from Conference Chair

Prof. Suzanne Kresta, University of Alberta

7:35 Can We Use CFD to Predict Mixing Time in Stirred Tanks?

Minye Liu and Richard Grenville, DuPont.

8:00 Mixing Times Deduced from CFD Results Using a New Eigenvalue Approach

Fabio Chiti, Waldemar Bujalski, Ed Wynn, Don Jones, Univ. Birmingham, UK

8:25 Low-Frequency Acoustic Mixing for Process Intensification

Scott Coguill, Harold Howe, Todd McAdams, Joel Pierce, Resodyn Corp.; Tom Post, consultant.

8:50 A Different Approach to Low Shear Mixing

Christine Wolfe, Fluent; Sanjida Tamanna and Wojciech Wyczalkowski, Philadelphia Mixing Solutions.

9:15 Modeling Dissolution Kinetics of Liquid-Liquid Dispersion Systems Using Local Rates of Turbulent Dissipation

Solomon Ibermere and Suzanne Kresta, Univ. of Alberta.

9:40 Numerical Simulation of a Solubility Process in a Stirred Tank Reactor

Hugo Hartmann, Jos Derksen, H.E.A. van den Akker, Kramers Laboratorium voor Fysische Technologie, TU Delft.

SOCIAL HOUR AND EXHIBIT: Sunday, 10:05 – 11:30 pm, Grand Moriarity

MONDAY Breakfast: 7:00 – 8:00 am, Cedar Dining Room

SESSION 2: STATIC MIXERS

Monday, 8:00 – 11:50 am, Walbran

Co-Chairs: Al Taweel and Steve Strand

8:00 INVITED PLENARY

Current State of the Art: Design, Application and Research of Static Mixers

Art Etchells, DuPont Fellow; Shaffiq Jaffer, Procter & Gamble; Chris Meyer, Sulzer.

9:00 CFD Calculation of the Striation Thinning in a Static Mixer Under Laminar Flow Conditions

Mårten Regner, Karin Östergren, Christian Trägårdh, Lund Univ., Sweden.

9:25 The Influence of Initial Coefficient of Variation (CoV₀) on Turbulent Liquid Blending in Static Mixers

R. Wadley and Mic Dawson, BHR Group.

9:50 Break

10:20 NAMF Student Finalist: Drop Breakup in an SMX Static Mixer in Laminar Flow, Shiping Liu, Andrew Hrymak and Philip Wood, McMaster University

10:45 A Novel Technique to Support the Optimization of Static Mixers in Turbulent Regimes

Sabine Sulzer and Felix Moser, Sulzer.

11:10 A Miscible Liquid-Liquid Non-Intrusive Injector for Static Mixers in Turbulent Flow

Julian Fasano, Mixer Engineering Co.; Eric Janz, Chemineer; Kevin Myers, Univ. of Dayton.

11:35 Evaluation of Static Mixers for Rapid Mixing in a Potable Water Treatment Works

Yanming Zhang and Jose Ferandes, Yorkshire Water Services Ltd.

Lunch: noon – 1:00 pm, Cedar Dining Room

SOCIAL HOUR AND EXHIBIT: Monday, 5:00 – 5:40 pm, Grand Moriarity

DINNER: Monday, 5:40 – 7:00 pm, Cedar Dining Room

SESSION 3: MODEL NON-NEWTONIAN FLUIDS

Monday: 7:00 – 10:00 pm, Walbran

Co-Chairs: Patrick Spicer and Bernie Gigas

7:00 Mixer Power Revisited: Effects of Viscoelasticity

Gary Patterson, Univ. Missouri-Rolla.

7:25 Measuring the Viscosity of Viscous Two-Phase Mixtures

David Todd, Polymer Processing Institute, NJIT.

7:50 Technical Basis for Testing Scaled Pulsed Jet Mixing Systems in Non-Newtonian Slurries

Perry Meyer, Battelle and Arthur Etchells, DuPont Fellow.

8:15 Break

8:45 Mixing Non-Newtonian Slurry Using an Air Sparging System

Chris Barringer, Feng Wen, Brigette Rosendall, Jonathan Berkoe, Bechtel.

9:10 Two-Phase Gas/Solvent Injector for Viscous Liquids

Steven Strand, The Dow Chemical Company.

9:35 The Use of Enzymes to Determine Mixing Efficiency in a Viscous Slurry

Eric Berson and Ellen Brehob, Univ. of Louisville, KY; Thomas Hanley, Auburn Univ., AL.

SOCIAL HOUR AND EXHIBIT: Monday, 10:00 – 11:30 pm, Grand Moriarity

TUESDAY Breakfast: 7:00 – 8:00 am, Cedar Dining Room

SESSION 4: MIXING AND REACTION, MICROREACTORS

Tuesday: 8:00 – 11:50 am, Walbran

Co-Chairs: Philippe Tanguy and Brian Johnson

- 8:00 The Use of Reactive Flow Modeling in the Initial Design Scale-Up and the Subsequent Plant Start-Up of an Industrial Pre-Mixed Gaseous Reactor**
Paul Gillis and Kuochen Tsai, The Dow Chemical Company.
- 8:25 Feasibility of Cartesian Methods for Reacting Mixing Tank Simulations**
Jeremy Thornock and Philip Smith, Univ. of Utah.
- 8:50 NAMF Student Finalist: High Velocity Surface Feed for Competitive Reactions**
Sujit Bhattacharya and Suzanne Kresta, University of Alberta.
- 9:15 Multi-phase Plumes: Mixing and Chemical Reaction, FMPSG/ICHEME Student Competition Winner**
Sean McHugh, Univ. of Cambridge.
- 9:40 CFD Analysis of Reactive Flows in a Confined Impinging-Jets Reactor**
Ying Liu and Rodney Fox, Iowa State Univ.
- 10:05 Break**
- 10:30 Experimental Study of Confined Jet Mixing with Excitation**
David Kamau and John Turner, Univ. of Manchester, UK.
- 10:55 Experimental Investigation of Mixing in Rectangular Micromixers Using μ -LIF and μ -PIV**
Marko Hoffmann, Michael Schlüter, Norbert Rübiger, Univ. Bremen, Germany.
- 11:20 Split-and-Recombine Micro Mixers for High and Low Reynolds Number Applications**
P. Löb, V. Hessel, C. Hofmann, H. Löwe, F. Schönfeld, Institut für Mikrotechnik Mainz.
- 11:45 Laminar Mixing for Improved Transport to Reactive Boundaries in Microchannels**
Abraham Stroock, NAMF Start-up Grant Holder, and Joseph Kirtland, Cornell Univ.

Lunch: 12:10 – 1:30 pm, Cedar Dining Room

INFORMAL DISCUSSION, Model Fluids for non-Newtonian Fluids

Maquilla+McBride, 3:30 – 5:00 pm, Chaired by Art Etchells and Will Hartt

SOCIAL HOUR AND EXHIBIT: Tuesday, 4:30 – 5:40 pm, Grand Moriarity

DINNER: Tuesday, 5:40 – 7:00 pm, Cedar Dining Room

SESSION 5: MULTIPHASE MIXING

Tuesday: 7:00-10:00 pm, Walbran

Co-Chairs: Chad Bennington and Abe Strook

- 7:00 Particle motions in and around closed streamline regions and the impact on mixing and demixing**
 Jeff Morris, NAMF Start-up Grant Holder, Levich Institute and Dept. of Chemical Engineering, City College of New York
- 7:25 Advanced Image-Analysis Techniques for the Characterization of the Complex Dispersions Occurring in Bioreactors**
 Enrique Galindo, Teresa Brito, Ma. Soledad Córdova-Aguilar, Blanca Taboada, Leticia Vega-Alvarado, Gabriel Corkidi, Universidad Autonoma de Mexico; Patricia Larralde-Corona, Centro de Biotecnología Genómica IPN.
- 7:50 Judicious Design of Liquid-Liquid Contactors/Reactors**
 F. Azizi and A.M. Al Taweel, Dalhousie Univ. Halifax, NS.
- 8:15 Break**
- 8:45 NAMF Student Finalist: Effect of Surfactant Concentration on Drop Size Distribution for Dilute Liquid-Liquid Dispersions in a Batch Rotor Stator**
 Richard Calabrese and Gustavo Padron, Univ. of Maryland.
- 9:10 Achieving Optimal Residence Time Distribution of Powder Flowing Through a Hopper**
 Werner Himmelsbach and Wolfgang Keller, EKATO, Germany.
- 9:35 Mixing Characteristics of New Continuous Mixer for Advanced Wet-Grinding System**
 Hiroyuki Matsumoto and Mutsuo Kuramoto, Kansai Paint, Japan.

SOCIAL HOUR AND EXHIBIT: Tuesday, 10:00 – 11:30 pm, Grand Moriarity

WEDNESDAY Breakfast: 7:00 – 8:30 am, Cedar Dining Room

SESSION 6: INDUSTRIAL MIXING

Wednesday: 8:30 – 11:50 am, Walbran

Session Chairs: Ramesh Hemrajani and Minye Liu

- 8:30 Mixing Dynamics in Agitated Pulp Stock Chests**
 Chad Bennington, UBC.
- 8:55 Mixing Performance of Laboratory Process Development Equipment**
 Otute Akiti, Agnes Yeboah, Victor Rosso, Erik Rubin, John Venit, Bristol Myers Squibb Co.
- 9:20 KT-3: A Novel Tickler for Solids Removal From Slurry Storage Tanks and Reactors**
 Richard Cope and Kishore Kar, Dow.
- 9:45 Hydrodynamic Performance and Industrial Applications of MAXBLEND for Polymerization Reactors**
 Katsuhide Takenaka, Ryuichi Yatomi, Shoji Morinaga, SHI Mechanical & Equipment Inc., Japan.
- 10:10 Break**
- 10:35 Characterization of the Retreat Curve Agitator in Glass-Lined Vessels**
 David Willcox and Dave Murphey, Abbott Laboratories, IL.
- 11:00 Numerical and Physical Investigations of the Mixing Characteristics of the MAXBLEND Impeller**

Philippe Tanguy, Arash Iranshahi, Mourad Heniche, Louis Fradette, Ecole Polytechnique, Montreal; Ryuichi Yatomi, Shoji Morinaga, Katsuhide Takenaka, SHI Mechanical & Equipment Inc., Ehime, Japan.

11:25 Effect of Operating and Geometric Factors on the Hydrodynamics of the USP Dissolution Apparatus II

Ge Bai and Piero Armenante, NJIT; Russell Plank, Michael Gentzler, Kenneth Ford, Paul Harmon, Merck.

11:50 Call for nominations for NAMF Council

Lunch: noon – 1:00 pm, Cedar Dining Room

POSTER SESSION, SOCIAL HOUR AND EXHIBIT:

Wednesday, 4:30 – 5:40 pm, Grand Moriarity

Chair: Hanh Vo

P1 Using Ultrasonic Doppler Velocimetry (UDV) to Measure Local Flow Velocities in Pulp Mixing Chests

Farhad Ein-Mozaffari, David Buckingham, Chad Bennington, Guy Dumont, UBC.

P2 Computational Simulation of Confined Jet Mixing

David Kamau and John Turner, Univ. of Manchester, UK.

P3 The Influence of Additive Viscosity on Turbulent Liquid Blending in Static Mixers

M.K. Dawson, BHR Group, UK.

P4 Better Understanding of Mixing Processes in the Fine Chemicals and Pharmaceutical Industries. FMP Addresses Industrial Needs

David Brown, BHR Group, UK and Francois Ricard, GSK, UK.

P5 Measurement and Simulation of Turbulent Flow in an In-line Rotor-Stator Mixer

Richard Calabrese, Karl Kevala, Kenneth Kiger, Univ. of Maryland.

P6 Fluid Dynamics and Mixing in Large Scale Gas to Liquid Reactors

Alex Bakopoulos, Germany.

P7 Using Optical Methods for the Identification and Characterization of Complex Structures Occurring in Multiphase Dispersions

Othón Escobar, Jean Brière, Blanca Taboada, Gabriel Corkidi, Rufino Díaz-Uribe, Enrique Galindo, Ma. Soledad Córdova-Aguilar, Universidad Nacional Autónoma de Mexico.

P8 Application of the Interfacial Energy Balance to Compute Interfacial Area Concentration Distribution

Richard Long, New Mexico State University.

P9 CFD Simulations of Liquid Homogenization in Tanks Stirred with Different Number of Rushton Turbines

Milan Jahoda, M. Moštěk, Alena Kukuková and Vaclav Machoň, Prague Institute of Chemical Technology, Czech Republic.

P10 Contour™ – A New Mixer Concept for Gas Mixing in Large Ducts

Felix Moser and Sabine Sulzer, Chemtech, Switzerland

P11 Simulation of Mixing Dynamics in Agitated Pulp Stock Chests Using CFD

C. Ford, F. Ein-Mozaffari, F. Taghipour, Chad Bennington, UBC.

DINNER: Wednesday, 5:40 – 7:00 pm, Cedar Dining Room

SESSION 7 IN HONOR OF PROF. ALVIN NIENOW:

TURBULENCE CHARACTERIZATION

Wednesday: 7:00 – 10:00 pm, Walbran

Co-Chairs: Bob Brodkey and Richard Calabrese

7:00 INVITED PLENARY

Viscous Dissipation Rate of Turbulent Energy in Stirred Reactors: Improved Estimation from Direct Measurements

Michael Yianneskis, King's College London, UK.

8:00 Micromixing in a Baffled in an Unbaffled Vessel with a Rushton Turbine

Alvin Nienow, Melissa Assirelli, Waldemar Bujalski, Ed Wynn, Univ. of Birmingham; Archie Eaglesham, Huntsman Polyurethanes, Belgium.

8:25 Break

8:45 Trailing Vortices Study in a Rushton Turbine Flow Using Proper Orthogonal Decomposition

Julien Moreau, Institut de Mécanique des Fluides de Toulouse and Alain Liné, INSA Toulouse.

9:10 A Review of Turbulence Models and their Applicability to Different Mixing Problems

Liz Marshall, Christine Wolfe, André Bakker, Sergio Vasquez, Fluent Inc.

9:35 Computational Reactor Engineering for Increased Sustainability

Harry van den Akker, TU Delft.

SOCIAL HOUR AND EXHIBIT: Wednesday, 10:00 – 11:30 pm, Grand Moriarity

THURSDAY Breakfast: 7:00 – 8:30 am, Cedar Dining Room

SESSION 8: SOLID-LIQUID MIXING

Thursday: 8:30 – 11:50 am, Walbran

Co-Chairs: Liz Marshall and Mike Yianneskis

8:30 High Speed, High Resolution Resistance Tomography Visualisation of Solid-Liquid Mixing

Ken Primrose, Industrial Tomography Systems (ITOMS), UK.

8:55 Solids Suspension Agitation in Non-Standard Geometries

Emily Mitchell and Kevin Myers, Univ. of Dayton; Eric Janz, Chemineer; Julian Fasano, Mixer Engineering Co.

9:20 Extension of an Improved Correlation for “Just Suspended” Speed

Lars Uby, ITT Flygt, Sweden.

9:45 Solids Suspension in Agitated Vessels with Single and Multiple Impellers

Kurt Svihla, Hong Xu, Anup Paul, Chokri Guetari, ANSYS, USA; Ian Hamill ANYSYS, UK.

10:10 Break

10:35 Acoustic Monitor for Solids Measurements in Liquid Slurries

A. Scherbakov, E. Dievendorf, Y. Sehgal, A.S. Sangani, L.L. Tavlarides, Syracuse Univ., NY.

11:00 Dispersion of Floating Solid Particles in Aerated Stirred Tank Reactors

Yoshinori Kawase and Atsushi Tagawa, Toyo Univ.; Naoki Dohi, Mitsubishi Chemical Engineering Co; Japan.

11:25 Some Effects of Equipment and Process Variables on the Suspension of Buoyant Particles in Gas Sparged Vessels

Yuyun Bao, Zhengming (Bruce) Gao, Zhigang Hao, Jiangang Long, Litian Shi, Beijing Univ. of Chem. Tech.; John Smith, Univ. of Surrey, UK.

11:50 NAMF Council Election Ballot

Lunch: noon – 1:00 pm, Cedar Dining Room

NAMF GENERAL MEETING: Thursday, 4:30 – 5:30 pm, Grand Moriarity
SOCIAL HOUR AND EXHIBIT: Thursday, 5:30 – 6:00 pm, Grand Moriarity
AWARDS DINNER: Thursday, 6:00-7:30 pm, Walbran

SESSION 9: MIXING IN BIOLOGICAL SYSTEMS

Thursday: 8:00 – 9:15 pm, Walbran

Session Chairs: Enrique Galindo and Piero Armenante

8:00 Design of a Thermophilic Treatment Process for Sewage Sludge

Bruce Nauman and Mathew Armstrong, Rensselaer Polytechnic Institute, NY.

8:25 Innovative Bioreactor Mixing System: Disposable Bag and Cryogenic Levitating Impeller

Ronald J. Weetman, consultant; Jeff Craig and Alexander Terentiev, LevTech, KY.

8:50 Dynamic Modelling of Local Reaction Conditions in an Agitated Aerobic Fermenter

Marko Laakkonen, Pasi Moilanen, Ville Alopaeus, Juhani Aittamaa, Helsinki Univ. of Tech., Finland.

SESSION 10: LIQUID-LIQUID SYSTEMS: Just when you thought you understood...

Thursday: 9:20 – 10:00 pm, Walbran

Session Chair: Shaffiq Jaffer

9:20 Continuous Phase Viscosity: The Liquid-Liquid Pot Thickens

David Brown, BHR Group, UK

9:40 Single Pass Drop Size Distributions: Equilibrium Lost.

Richard Calabrese, Karl Kevala, Kenneth Kiger, Univ. of Maryland.

SOCIAL HOUR AND EXHIBIT: Thursday, 10:00 – 11:30 pm, Grand Moriarity

FAREWELL BRUNCH: Friday, 8:30 – 10:30 am, Cedar Dining Room

PLEASE SIGN UP BY MONDAY NOON