

David S. Dickey, Ph.D.

Chemical Engineering Consultant Specialist in Mixing Equipment and Processes

Position

President MixTech, Inc.
454 Ramsgate Drive
Dayton, OH 45430-2097

Tel: (937) 431-1446
Fax: (937) 431-1447
d.dickey@mixtech.com
www.mixtech.com

Major Areas of Professional Specialization

Mixing Processes and Mixing Equipment, Liquid Mixing, Powder Blending, Equipment Components and Design, Process Engineering and Applications, Product Engineering and Marketing, and Expert Witness.

Education

University of Illinois, Urbana, IL
B.S. in Chemical Engineering, 1968

Purdue University, West Lafayette, IN
M.S. in Chemical Engineering
Ph.D. in Chemical Engineering, 1972

Professional Experience

1998- MixTech, Inc., Dayton, OH (Consulting & Teaching, Mixing)
1994-1998 Chemineer, Inc., Dayton, OH (Liquid Mixing Equipment)
1992-1994 Moyno, Springfield, OH (Liquid Mixing Equipment)
1990-1992 American Reactor Corporation, New Carlisle, OH (Reactors)
1985-1990 Patterson-Kelley, East Stroudsburg, PA (Dry Solids Mixing)
1975-1985 Chemineer, Inc., Dayton, OH (Liquid Mixing Equipment)
1972-1975 General Motors Research Laboratories, Warren, MI (Converters)
Details in accompanying list.

Professional Societies

Fellow American Institute of Chemical Engineers
Member American Chemical Society
Member American Society of Mechanical Engineers
Member Canadian Society of Chemical Engineers

Technical Publications and Presentations

More than thirty publications on mixing and related chemical processes.
Short courses offered through the Department of Engineering Professional
Development, University of Wisconsin, Madison.
Details available.

DAVID S. DICKEY, Ph.D.

MixTech, Inc.
454 Ramsgate Drive
Dayton, Ohio 45430-2097

Phone: (937) 431-1446
Fax: (937) 431-1447
E-mail: d.dickey@mixtech.com

Summary of Experience

More than thirty years of experience in chemical engineering, applied research, and creative development for the design of process equipment and applications. Extensive engineering experience in liquid mixing applications and equipment. Additional experience in solids mixing, heat transfer, distillation, and mass transfer, plus combustion, catalytic and reaction kinetics. Also strong background in computer utilization for design, simulation, analysis, and word processing.

MixTech, Inc., Dayton, OH (1998-Present) A self-founded consulting firm able to provide mixing technology and other process equipment support to the chemical process industries. Consulting emphasis on liquid mixing, reactor scale-up, powder mixing, and teaching related technical seminars. Also capable of providing guidance or specification assistance on other processes equipment. Applied technical expertise to evaluate equipment and processes involved in injury litigation and patent infringement.

Chemineer, Inc., Dayton, OH (1994-1998) Manager of Application Engineering and Product Director for Chemineer® mixing equipment. Extensive process engineering and mechanical design experience with standard and custom mixers and applications.

Robbins & Myers, Inc., Springfield, OH (1992-1994) Technical Director responsible for technology and engineering of Prochem® mixers and Moyno® progressing cavity pumps.

American Reactor Corporation, New Carlisle, OH (1990-1992) Vice President of Engineering, responsible for design, engineering, marketing, and sales of small, stirred reactors and systems for pilot plants in the chemical process industries.

Patterson-Kelley Co., East Stroudsburg, PA (1985-1990) Director of Technology for manufacturer of dry solids mixing and drying equipment, commercial water heaters and hot water boilers, corrosion resistant cementitious linings, air cooled heat exchangers, and distillation trays and packing.

Chemineer Inc., Dayton, Ohio (1975-1985) Technical Director for mixing and agitation equipment used in the chemical process industries. Major contributions to the development of new impeller designs and enhanced processes using mixing equipment. Performed laboratory tests and scale-up of customer applications and new process technology. Wrote technical publications and product literature for marketing.

General Motors Research Laboratories, Warren, MI (1972-1975) Associate Senior Research Engineer doing computer modeling and engine testing of catalytic converters for automobile exhaust emission control.

MIXING PUBLICATIONS

- Dickey, D. S.**, "Fundamentals of High-Shear Dispersers," *Chemical Engineering*, pp. 24-31, February, 2015.
- Dickey, D. S.**, "Ten Things You May Not Know About Liquid Mixing Scaleup," *Chemical Engineering*, pp. 32-39, August, 2013.
- Dickey, D. S.**, "Advice for Sampling Powder Blends," *Powder and Bulk Engineering*, pp. 55-59, January, 2011.
- Dickey, D. S.**, "Pulse Jet Mixers - The Known and Unknown about Solids Suspension," AIChE Annual Meeting, Salt Lake City, November 2010.
- Dickey, D. S.**, "Minimize Blending Time," *Chemical Processing*, pp. 37-42, July, 2009.
- Dickey, D. S.**, "Mixing Scale-up," **Food Mixing, Principles and Applications**, pp. 92-106, P. J. Cullen, Ed., Wiley-Blackwell, Ames, Iowa, 2009.
- Dickey, D. S.**, "Mixing Equipment," **Food Mixing, Principles and Applications**, pp. 73-89, P. J. Cullen, Ed., Wiley-Blackwell, Ames, Iowa, 2009.
- Dickey, D. S.**, and Patterson, G. K., "Fluid Mixing Success Through Failures, Part 2," *Chemical Engineering Progress*, pp. 48-56, December 2008.
- Dickey, D. S.**, and Patterson, G. K., "Fluid Mixing Success Through Failures, Part 1," *Chemical Engineering Progress*, pp. 40-47, October 2008.
- Dickey, D. S.**, "Mixing of Viscous Fluids, Pastes and Doughs" section of Chapter 18 "Liquid-Solid Operations and Equipment" of **Perry's Chemical Engineers' Handbook**, Eighth Edition, Don W. Green, Editor in Chief, pp 18-27 - 18-39, McGraw-Hill, New York, 2008.
- Dickey, D. S.**, and Fenley, L. B., "Make Your Portable Mixer Work for You," *Chemical Processing*, pp. 34-38, March 2007.
- Dickey, D. S.**, "Tip Portable Mixers in Your Favor," *Food Processing*, pp. 64-68, August, 2006.
- Dickey, D. S.**, "Mind Mixer Mechanical Design," *Chemical Processing*, pp. 40-43, May, 2006.
- Dickey, D. S.**, "Don't Get Mixed Up by Scale-up," *Chemical Processing*, pp. 24-29, August, 2005.
- Dickey, D. S.**, Kevin J. Bittorf, Christopher J. Ramsey, and Keith E. Johnson, "Understand Flow Patterns in Glass-Lined Reactors," *Chemical Engineering Progress*, pp. 21-25, November, 2004.
- Dickey, D. S.**, "How to Work with a Mixing Consultant," *Powder and Bulk Engineering*, pp. 109-113, May, 2004.
- Dickey, D. S.**, and J. B. Fasano, "How Geometry & Viscosity Influence Mixing," *Chemical Engineering*, pp. 42-46, February, 2004.
- Dickey, D. S.**, and J. B. Fasano, "Mechanical Design of Mixing Equipment," **Handbook of Industrial Mixing, Science and Practice**, Editors: E. L. Paul, et al., John Wiley & Sons, New Jersey, 2004.
- Dickey, D. S.**, Section 12 "Liquid Agitation," **Handbook of Chemical Engineering Calculations**, Third Edition, Editor: N. P. Chopey, McGraw-Hill, New York, 2004.
- Dickey, D. S.**, and E. Souza, "Take Mixing to the Max," *Chemical Processing*, pp. 48-51, June, 2003.
- Dickey, D. S.**, "Equipment, Technology, People - Mixing", *Chemical Engineering*, pp. 88-89, August, 2002.

- Dickey, D. S.**, "Liquid Mixing, What do I need to know to apply a mixer properly," (Ask the Experts), *Chemical Engineering Progress*, pp. 74-75, November, 2001.
- Dickey, D. S.**, "Facing the Challenge of Mixing Problem Fluids," *Chemical Engineering*, pp. 68-75, May, 2000.
- Tatterson, G. B., and **Dickey, D. S.**, "Mixing Pastes & Powders," *Chemical Processing*, pp. 32-38, March, 1999.
- Myers, K. J., Reeder, M. F., Bakker, A., and **Dickey, D. S.**, "A Parametric Study of the Performance of the Prochem Maxflo T Impeller," *Recents Progres en Genie des Procedes*, Vol. 11, No. 52, pp 115-122, 1997.
- Dickey, D. S.**, Section 12 "Liquid Agitation," **Handbook of Chemical Engineering Calculations**, Second Edition, Editor: N. P. Chohey, McGraw-Hill, New York, 1994.
- Hill, R. S. and **Dickey, D. S.**, "Use the Right Specialty-Polymer Pilot Plant," *Chemical Engineering Progress*, pp. 22-29, June, 1993.
- Dickey, D. S.**, "Dimensional Analysis, Similarity and Scale-up," *Process Mixing, Chemical and Biochemical Applications: Part ii*, pp. 143-150, Gary B. Tatterson, volume editor, AIChE Symposium Series, Number 293, AIChE, New York, 1993.
- Dickey, D. S.** and Hemrajani, R. R., "Recipes for Fluid Mixing," *Chemical Engineering*, pp. 82-89, March 1992.
- Dickey, D. S.**, "Succeed at Stirred-Tank-Reactor Design," *Chemical Engineering Progress*, pp. 22-31, December, 1991.
- Dickey, D. S.**, Section 12 "Liquid Agitation," **Handbook of Chemical Engineering Calculations**, Editors: N. P. Chohey and T. G. Hicks, McGraw-Hill, New York, 1984.
- Dickey, D. S.**, "Program Chooses Agitator," *Chemical Engineering*, p. 73-81, January 9, 1984.
- Sheu, Y.-H. E., Chang, T. P. K., Tatterson, G. B., and **Dickey, D. S.**, "A Three-Dimensional Measurement Technique for Turbulent Flows," *Chemical Engineering Communications*, Vol. 17, pp. 67-83, 1982.
- Chang, T. P. K., Sheu, Y.-H. E., Tatterson, G. B., and **Dickey, D. S.**, "Liquid Dispersion Mechanisms in Agitated Tanks: Part II. Straight Blade and Disc Style Turbines," *Chemical Engineering Communications*, Vol. 10, pp. 215-222, 1981.
- Ali, A. M. Yaun, H. H. S., **Dickey, D. S.**, and Tatterson, G. B., "Liquid Dispersion Mechanisms in Agitated Tanks: Part I. Pitched Blade Turbines," *Chemical Engineering Communications*, Vol. 10, pp. 205-213, 1981.
- Dickey, D. S.**, "Turbine Agitated Gas Dispersion: Power, Flooding and Hold-up," **Advances in Biotechnology**, Vol. 1, *Scientific and Engineering Principles*, Pergamon Press, 1981, pp. 483-488.
- Corpstein, R. R., Dove, R. A., and **Dickey, D. S.**, "Stirred Tank Reactor Design," *Chemical Engineering Progress*, pp. 66-74, February 1979.
- Gates, L. E., Hicks, R. W., and **Dickey, D. S.**, "Application Guidelines for Turbine Agitators," *Chemical Engineering*, pp. 165-170, December 6, 1976.
- Hicks, R. W. and **Dickey, D. S.**, "Applications Analysis for Turbine Agitators," *Chemical Engineering*, pp. 127-133, November 8, 1976.
- Rautzen, R. R., Corpstein, R. R., and **Dickey, D. S.**, "How to Use Scale-up Methods for Turbine Agitators," *Chemical Engineering*, pp. 119-126, October 25, 1976.
- Dickey, D. S.**, and Hicks, R. W., "Fundamentals of Agitation," *Chemical Engineering*, pp. 93-100, February 2, 1976.

Dickey, D. S., and Fenic, J. G., "Dimensional Analysis for Fluid Agitation Systems," *Chemical Engineering*, pp. 139-145, January 5, 1976.

Short Courses, Seminars, and Technical Presentations

How to Specify Mixing Equipment

Department of Engineering Professional Development, University of Wisconsin
May 25-26, 1999, Madison, WI
March 22-23, 2000, Madison, WI
October 25-26, 2000, Madison, WI
March 27-28, 2001, Madison, WI
October 16-17, 2001, Madison, WI

Consistent Mixing: The Key to Uniform Quality

Department of Engineering Professional Development, University of Wisconsin
April 30 - May 2, 2002, Madison, WI
May 6-8, 2003, Madison, WI
October 28-30, 2003, Madison, WI
May 18-20, 2004, Madison, WI
October 19-21, 2004, Madison, WI

Art & Science of Industrial Mixing

Department of Engineering Professional Development, University of Wisconsin
April 12-14, 2005, Houston, TX
May 17-19, 2005, Madison, WI
October 4-6, 2005, Philadelphia, PA
March 21-23, 2006, Las Vegas, NV
May 16-18, 2006, Madison, WI
October 3-5, 2006, Philadelphia, PA
March 20-22, 2007, Houston, TX
October 2-4, 2007, Las Vegas, NV
April 21-23, 2008, Philadelphia, PA
March 17-19, 2009, Houston, TX
September 22-24, 2009, Las Vegas, NV
April 5-7, 2011, Charlotte, NC
April 24-26, 2012, Raleigh-Durham, NC
April 23-25, 2013, Chicago, IL
April 29 - May 1, 2014, Chicago, IL

Advanced Mixing Technology: Practical Applications

Department of Engineering Professional Development, University of Wisconsin
February 5-7, 2002, Philadelphia, PA
February 4-6, 2003, Philadelphia, PA
September 21-23, 2004, Las Vegas, NV
September 27-29, 2005, Las Vegas, NV
October 17-19, 2006, Las Vegas, NV

Pilot Plant and Scale-up Methods for Industrial Mixing

Department of Engineering Professional Development, University of Wisconsin

July 24-26, 2000, Princeton, NJ
January 8-10, 2001, Orlando, FL
July 24-26, 2001, Philadelphia, PA
January 7-9, 2002, Orlando, FL
June 18-20, 2002, Philadelphia, PA
January 6-8, 2003, Orlando, FL
July 15-17, 2003, Philadelphia, PA
January 6-8, 2004, Orlando, FL
June 15-17, 2004, Philadelphia, PA
January 25-27, 2005, Orlando, FL
June 14-16, 2006, Philadelphia, PA
January 24-26, 2006, Orlando, FL
June 13-15, 2006, Philadelphia, PA
January 23-25, 2007, Orlando, FL
June 12-14, 2007, Philadelphia, PA

Scale-up Methods for Liquid Mixing Processes

January 13-15, 2009, Orlando, FL

Successful Liquid Mixing Scale-up Methods

January 12-14, 2010, Orlando, FL
January 11-13, 2011, Orlando, FL
February 7-9, 2012, Orlando, FL
February 5-7, 2013, Orlando, FL
February 4-6, 2014, Orlando, FL
February 10-12, 2015, Orlando, FL

Powder and Bulk Mixing: Processes, Applications and Equipment

Department of Engineering Professional Development, University of Wisconsin

November 13-14, 2002, Philadelphia, PA
April 29-30, 2003, Philadelphia, PA
November 12-13, 2003, Philadelphia, PA
April 20-21, 2004, Philadelphia, PA
November 16-17, 2004, Philadelphia, PA
April 19-20, 2005, Philadelphia, PA
November 15-16, 2005, Madison, WI
April 19-20, 2006, Philadelphia, PA
October 31 - November 1, 2006, Philadelphia, PA
May 8-9, 2007, Philadelphia, PA
November 14-15, 2007, Philadelphia, PA
May 20-22, 2008, Philadelphia, PA
November 3-5, 2008, Philadelphia, PA
May 5-7, 2009, Philadelphia, PA
November 16-18, 2010, Charlotte, NC
November 15-17, 2011, Madison, WI
September 25-27, 2012, Austin, TX
September 17-19, 2013, Dallas, TX
September 23-25, 2014, Chicago, IL

Mixing in Glass-Lined Reactors

Department of Engineering Professional Development, University of Wisconsin

March 4-5, 2002, Philadelphia, PA

Art and Science of Mixing

April 20, 1999, Parkersburg, WV
April 22, 1999, Cincinnati, OH

Mixing Scale-up, Methods for Innovation Transfer

American Institute of Chemical Engineers
Spring 2000 National Meeting
March 5, 2000, Atlanta, GA

Impeller Design and Mixing Efficiency

Chemical Engineering EXPO
June 9, 1999, Houston, TX

Various Other Short Courses and Training

on-site for other University of Wisconsin and consulting clients

Technical Society and Panel Participation

Member, **Equipment Testing Procedure Committee**, 1976-1987, 2007-Present
Committee Chair 1980-1983,
American Institute of Chemical Engineers

Evaluation Panel, **National Bureau of Standards**, 1983-1984
Chemical Engineering

North American Mixing Forum

NAMF Award for Excellence and Sustained Contributions
to Mixing Research and Practice, 2005

Executive Council, 1999-

Secretary, 2001-2005

Vice-President, 2005-2007

President, 2007-2010

Past President, 2010-Present

Meeting Organizer, Mixing XVIII, June 24-29, 2001

External Flowsheet Review Team (EFRT) for the **Hanford Waste Treatment and Immobilization Plant**, 2005-2006

Issue Resolution Team (IRT) for the Hanford Waste Treatment and Immobilization Plant, 2006-Present

Expert Experience

David S. Dickey
MixTech, Inc.

Case: ***Napp Technologies Litigation***
Docket Nos. L4233-95, et al.

Superior Court of New Jersey
Bergen County, Law Division

Date: Expert Report - July 13, 2000
Deposition - August 28, 2000
Trial - none

Legal Firm Represented:
McGovern, Noel & Benik, Inc.
One Bank Boston Plaza
Providence, RI 02903
Tel: 401-824-5100
Fax: 401-824-5175
R. Daniel Prentiss
Robin L. Main

Expert for:
Technic, Incorporated (Defendant)

Description of Litigation:
Death of five workers at Napp Technologies caused by deflagration of chemicals being processed in blending equipment. Claims of inhalation and respiratory problems by emergency response workers and nearby residents.

Results:
Favorable (for Technic) assignment of blame among defendants and negotiated settlement of all claims.

Expert Experience

David S. Dickey
MixTech, Inc.

Case: ***Bratel v. Andritz***
Case No. 00-C-1010

United States District Court
Eastern District of Wisconsin

Date: Expert Report - October 9, 2001
Deposition - October 26, 2001
Trial - none

Legal Firm Represented:
Swanson, Martin & Bell
2100 Manchester Road
Building C, Suite 1420
Wheaton, IL 60187
Tel. 630-653-2266
Fax. 630-653-2292
Edward T. Butt, Jr.

Expert for:
Andritz Sprout-Bauer (Defendant)
Allianz Insurance Company (Defendant)

Description of Litigation:
Personal injury to Kurt Bratel by scalding water from Andritz Sprout-Bauer system.

Results:
Negotiated settlement for injuries with limited consequences for defendants.

Expert Experience

David S. Dickey
MixTech, Inc.

Case: *Dmitri Jelvakov v. AHL Processing Equipment Co., Inc., et al.*

Case No.

ALH Processing Equipment Co., Inc., EMI Inc., WellsFargo Equipment Finance, Inc., a/k/a Northwest Equipment Finance, Inc., Ashley Polymers Inc., and "John Does 1-4" (such names being fictitious)

Supreme Court of the State of New York
County of Kings

Date: Expert Report - July 6, 2002

Deposition - None

Trial - None

Legal Firm Represented:

Quirk and Bakalor, P.C.

845 Third Avenue

New York, NY 10022-6601

Tel. 212-319-1000

Fax. 212-319-1065

Steve M. S. Madra

Expert for: EMI, Inc. (Defendant)

Description of Litigation:

Personal injury to Dimitri Jelvakov as a result of Cleveland Mixer (EMI, Inc.)
being started while he was cleaning inside the mixer.

Results:

Case abandoned

Expert Experience

David S. Dickey
MixTech, Inc.

Case: ***Barthany-Smith, et al., v. APV, et al.***

Case No. 01-10-5054

Vance v. APV, et al.

Case No. 01-03-1120

James v. APV, et al.

Case No. 01-11-5573

The Court of Common Pleas
Summit County, Ohio

Date: Expert Report - January 14, 2003

Deposition - August 8, 2003

Trial - None

Legal Firm Represented:

Lane, Alton & Hoerst, L.L.C.

175 South Third Street, Suite 700

Columbus, OH 43215-5100

Tel. 614-228-6885

Fax. 614-228-0146

James K. Reuss

Beth Anne Lashuk

Expert for:

Reynolds Industries, Inc. (Defendant)

Description of Litigation:

Death of one worker and serious injury to two other workers at APV (Akron Paint & Varnish) caused by explosion (deflagration) of chemicals being processed in mixer.

Results:

Negotiated settlement for injuries with limited consequences for defendants.

Expert Experience

David S. Dickey
MixTech, Inc.

Case: ***Jerry Brickner et al. v URS Corporation et al.***
Case No. 03-CVB-03-2723

The Court of Common Pleas
Franklin County Ohio

Date: Site Visit - June 6, 2006
Expert Report - None
Deposition - None
Trial - None

Legal Firm Represented:
Vorys, Sater, Seymour and Pease LLP.
52 East Gay Street
P.O. Box 1008
Columbus, OH 43261-1008
Tel. 614-464-6400
Fax. 614-464-6350
William G. Porter II
Gina R. Russo

Expert for: URS Corporation (Defendant)

Description of Litigation:
Worker injured (chemical burn) caused by caustic splashed from lime slaker.

Results:
Negotiated settlement for injuries with limited consequences for defendants.

Expert Experience

David S. Dickey
MixTech, Inc.

Case: ***Pedro Gonzalez Diego v. H.C. Davis Sons Manufacturing Co., Inc.***
Case No. 05CV1345

The District Court of Wyandotte County, Kansas
Civil Court Department

Date: Expert Report - None
Deposition - February 1, 2007
Trial - None

Legal Firm Represented:
Foland, Wickens, Eisfelder, Roper & Hofer, p.c.
911 Main Street, 30th Floor
Kansas City, MO 64105
Tel. 816-472-7474
Fax. 816-472-6262
Kyle N. Roehler

Expert for:
H.C. Davis Sons Manufacturing Co., Inc. (Defendant)

Description of Litigation:
Worker suffered serious injuries to his legs as a result of the ribbon-style blender being started while he was standing in it to clear an overload condition.

Results:
Negotiated settlement for injuries with limited consequences for defendant.

Expert Experience

David S. Dickey
MixTech, Inc.

Case: ***John R. Klos v. APV North America, Inc., Honeywell International, Inc.***
Case No. 2:05CV01052

The United States District Court
District of Utah, Central Division

Date: Expert Report - March 24, 2008
Deposition - April 7, 2009
Trial -

Legal Firm Represented:
Morton - Millard Trial Lawyers
Kearns Building Suite 400
136 South Main Street
Salt Lake City, UT 84101
Tel. 801-708-7000
Toll Free. 888-753-7324
Fax. 810-401-7887
S. Brook Millard

Expert for:
John R. Klos (Plaintiff)

Description of Litigation
Worker suffered 3rd degree burns over 40% of his body as a result of process liquid being ejected from stirred process tank.

Results:
Negotiated settlement for injuries.