

# David S. Dickey, Ph.D.

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## 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  
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### Major Areas of Professional Specialization

Mixing Processes and Equipment for Fluids Mixing, Powder Mixing, and Combinations of Fluids and Powders. Equipment Components and Design, Process Engineering and Applications, Product Engineering and Marketing.

### 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

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

### Professional Societies

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

### Technical Publications and Presentations

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

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**Summary of Experience**

More than twenty-five 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.

**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.

**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.

**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.

**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.

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

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

**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, and related technology. Also actively teaching short courses on aspects of mixing. Applied technical expertise to evaluate equipment and processes related to mixing.

## PUBLICATIONS

- Dickey, D. S.**, "A Study of a Parabolic Partial Differential Equation for a Pulse Flow Catalytic Reactor," M.S. Thesis, Purdue University, January 1971.
- Dickey, D. S.**, "A Pulse Flow Reactor Model Used to Study Nonlinear Series Kinetics," Ph.D. Thesis, Purdue University, June 1972.
- Dickey, D. S.**, "Gas Phase Effects in a Monolith Converter Model," SAE Paper 750175, presented at Automotive Engineering Congress, Detroit, MI, February 1975.
- Dickey, D. S.**, and Fenic, J. G., "Dimensional Analysis for Fluid Agitation Systems," *Chemical Engineering*, pp. 139-145, January 5, 1976.
- Dickey, D. S.**, and Hicks, R. W., "Fundamentals of Agitation," *Chemical Engineering*, pp. 93-100, February 2, 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.
- Hicks, R. W. and **Dickey, D. S.**, "Applications Analysis for Turbine Agitators," *Chemical Engineering*, pp. 127-133, November 8, 1976.
- Gates, L. E., Hicks, R. W., and **Dickey, D. S.**, "Application Guidelines for Turbine Agitators," *Chemical Engineering*, pp. 165-170, December 6, 1976.
- Rautzen, R. R., Benz, G. T., and **Dickey, D. S.**, "Design and Scale-up of Agitators for Gas Dispersion in Fermentors," presented at Engineering Foundation Conference on *Mass Transfer and Scale-up of Fermentors*, Henniker, NH, July 1977.
- Dickey, D. S.**, "Scale-up," 'Research Needs and Opportunities in Mixing, Including Particles', *National Science Foundation Workshop*, August 21-26, 1977.
- Corpstein, R. R., Dove, R. A., and **Dickey, D. S.**, "Stirred Tank Reactor Design," *Chemical Engineering Progress*, pp. 66-74, February 1979.
- Dickey, D. S.**, "Turbine Agitated Gas Dispersion - Power, Flooding, and Hold-up," presented at AIChE, 72nd Annual Meeting, San Francisco, CA, November 1979.
- Aktar, W., Mathur, G. P., and **Dickey, D. S.**, "Mixing Design for Air Agitated Rectangular Tanks," *Water Pollution Res. J. of Canada*, Vol. 15, No. 1, pp. 1-15, 1980.
- 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.
- 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.
- 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.
- 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.
- Dickey, D. S.**, "Program Chooses Agitator," *Chemical Engineering*, p. 73-81, January 9, 1984.
- Dickey, D. S.**, "Liquid Agitation," **Handbook of Chemical Engineering Calculations**, Editors: N. P. Chopey and T. G. Hicks, McGraw-Hill, New York, 1984.

- Dickey, D. S.**, "Practical Aspects of Three Phase Agitation," presented at AIChE 1984 Annual Meeting, San Francisco, CA, November, 1984.
- Coble, R. A. and **D. S. Dickey**, Chairmen Revision Committee, "AIChE Equipment Testing Procedure, **Mixing Equipment, Impeller Type**, 2<sup>nd</sup> Edition" Equipment Testing Procedures Committee, American Institute of Chemical Engineers, New York, 1987.
- Dickey, D. S.**, "Practical Formulas Calculate Water Properties, Part 1," *Chemical Engineering*, pp. 207-208, September 1991.
- Dickey, D. S.**, "Practical Formulas Calculate Water Properties, Part 2," *Chemical Engineering*, pp. 235-236, November 1991.
- Dickey, D. S.**, "Succeed at Stirred-Tank-Reactor Design," *Chemical Engineering Progress*, pp. 22-31, December, 1991.
- Dickey, D. S.** and Hemrajani, R. R., "Recipes for Fluid Mixing," *Chemical Engineering*, pp. 82-89, March 1992.
- Hill, R. S. and **Dickey, D. S.**, "Pilot-Plant Reactors for Specialty-Polymer Development," presented at AIChE 1992 Spring National Meeting, New Orleans, LA, March 1992.
- Dickey, D. S.**, "Dimensional Analysis, Similarity and Scale-up," presented at AIChE 1992 Annual Meeting, Miami Beach, FL, November, 1992.
- 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.
- 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.**, SECTION 12 "Liquid Agitation," **Handbook of Chemical Engineering Calculations**, Second Edition, Editor: N. P. Chohey, McGraw-Hill, New York, 1994.
- 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.
- Tatterson, G. B., and **Dickey, D. S.**, "Mixing Pastes & Powders," *Chemical Processing*, pp. 32-38, March, 1999.
- Dickey, D. S.**, "Facing the Challenge of Mixing Problem Fluids," *Chemical Engineering*, pp. 68-75, May 2000.
- Dickey, D. S.**, Chairman Revision Committee, "AIChE Equipment Testing Procedure, **Mixing Equipment, Impeller Type**, 3<sup>rd</sup> Edition" Equipment Testing Procedures Committee, American Institute of Chemical Engineers, New York, 2001.
- Dickey, D. S.**, "Specifying Mixers for Maximum Performance", *Chemical Processing*, pp. 22-25, May, 2001.
- Dickey, D. S.**, "Liquid Mixing", *Chemical Engineering Progress*, pp. 74-75, November, 2001.
- Dickey, D. S.**, "Equipment, Technology, People - Mixing", *Chemical Engineering*, pp. 88-89, August, 2002.

## Recent 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 15-16, 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

### ***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

### ***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

### ***Mixing in Glass-Lined Reactors***

Department of Engineering Professional Development, University of Wisconsin  
March 4-5, 2002, Philadelphia, PA

### ***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

### ***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

## **Technical Society Participation**

Chairman (1980-1982), Member (1976-1986), Equipment Testing Procedure  
Committee, American Institute of Chemical Engineers

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

North American Mixing Forum  
Executive Council, 1999-  
Meeting Organizer, Mixing XVIII, June 24-29, 2001  
Secretary, 2001-

## **Expert Experience**

**David S. Dickey**  
**MixTech, Inc.**

### Case: ***Napp Technologies Litigation***

Superior Court of New Jersey  
Bergen County, Law Division  
Docket Nos. L4233-95, et al.

Date: Expert Report - July 13, 2000  
Deposition - August 28, 2000

### 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.

Case: ***Bratel v. Andritz***

United States District Court  
Eastern District of Wisconsin  
Case No. 00-C-1010

Date: Expert Report - October 9, 2001

Deposition - October 26, 2001

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.