

## School of Chemical, Biological and Environmental Engineering

OREGON STATE UNIVERSITY

College of Engineering

### **LEVIEN, Keith L.**

Associate Professor

### **DEGREES**

B.S., Engineering Science, Iowa State University, 1970

B.S., Chemical Engineering, University of Wisconsin, 1975

Ph.D., Chemical Engineering, University of Wisconsin, 1985

### **ACADEMIC POSITIONS**

Assistant Professor, Oregon State University, 1985-1994

Visiting Scholar, Centre for Chemical Process Systems, Imperial College, London 1999-2000

Associate Professor, Oregon State University, 1994-present

### **NON-ACADEMIC POSITIONS**

Lieutenant, United States Navy - Resources Management Officer, Aircraft Maintenance Officer, Assistant Administrative Officer, 1970-1973

Development Engineer - Polymer Production Reactors, Separations and Processing, Standard Oil Company of Ohio, 1975-1977

Senior Economic Analyst - Polymer Production, Oil Refining and Fixed/Fluidized Bed Catalysis and Process Development, Standard Oil Company of Ohio, 1977-1979

### **CURRENT FIELDS OF SPECIALIZATION**

Process Control

Supercritical Fluid Technology

Batch Process Simulation, Operations and Optimization

Separation Process Simulation - Staged and Continuous Contact

### **PROFESSIONAL ACTIVITIES**

#### **Registration**

Registered Professional Engineer, Ohio #41592

#### **Professional Societies**

American Institute of Chemical Engineers (also Computing and Systems Technology Division)

American Chemical Society

American Society for Engineering Education

#### **Professional Recognition**

Tau Beta Pi (Wisconsin Alpha Chapter, 1975)

Chevron Chemical Engineering Fellow, University of Wisconsin - Madison, 1982-1983

3M Untenured Faculty Grant Award, 1986-1989

**Patents**

Process for Removing Chemical Preservative from Wood Using Supercritical Fluid Extraction, US Patent # 5,364,475, with J.J. Morrell, E. Sahle-Demessie, and S. Kumar, issued November 15, 1994

**Peview Panel Membership**

Process for Removing Chemical Preservative from Wood Using Supercritical Fluid Extraction, US Patent # 5,364,475, with J.J. Morrell, E. Sahle-Demessie, and S. Kumar, issued November 15, 1994

NSF Review Panel for "Instrumentation and Laboratory Improvement Program", 1991, 1993, 1994, 1997, 1998.

NSF Workshop "ChE Laboratory Computer Simulation Workshop", School of Chemical Engineering, Purdue University, July 26-28, 1991.

NSF Review Panel for "Undergraduate Faculty Enhancement Program", June 17-19, 1992.

NSF Reviewer for Directorate for Engineering Programs

NSF Review Panel for "Instrumentation and Laboratory Improvement Program", Feb. 5-8, 1997.

NSF SBIR/SST Review Panels: 2002, 2003, 2004

**Journal Referee**

*AICHE Journal*

ACS Industrial & Engineering Chemistry Research

*Chemical Engineering Science*

*Canadian Journal of Chemical Engineering*

*Chemical Engineering Communications*

*Optimal Control B Applications and Methods*

**Invited Seminars**

University of Stuttgart, Institut fur Systemdynamik und Regelungstechnik, July 24, 1985

Technical Seminar Series, 3M Plant, White City, OR, August 28, 1986

Chemical Process Research and Development Group, 3M Research Center, Minneapolis, MN, July 2, 1987, and August 27, 1988

**Technical Short Courses/Workshops Attended**

Liquid Mixing, Center for Professional Management, 1976

Polymer Reaction Engineering, McMaster University, 1977

Structure of the Chemical Process Industries, AIChE, 1977

Process Design for Energy Conservation, AIChE, 1978

Industrial Process Control, AIChE, 1978

IFAC Workshop on Model Error Concepts and Compensation, 1985

**PUBLICATIONS****Refereed Technical Journals**

W.E. Stewart, K.L. Levien, and M. Morari, "Simulation of Fractionation by Orthogonal Collocation," *Chem. Eng. Sci.*, 40, No. 3, pp. 409-421, 1985.

K.L. Levien and M. Morari, "Internal Model Control of Coupled Distillation Columns," *AICHE Journal*, 27, pp. 83-98, 1987.

K.L. Levien, C. Chapat, and M. Morari, "RTCP: A Software Package for Experiments in Process Control Research," *Comput. Chem. Eng.*, 11, No. 3, pp. 227-232, 1987.

- K.L. Levien and A. Al-Zahrani, "A Magnetically Staged Fluidized Bed for Counter Current Gas/Solids Contacting," *Powder Tech.*, 64, No. 1-2, pp. 133-143, 1991.
- A.K. Wallace, V.A. Ranawake, and K.L. Levien, "Experimental Feasibility Study of a Magnetic Elevator for Particles," *Powder Tech.*, 64, No. 1-2, pp. 125-132, 1991.
- E. Sahle-Demessie, K.L. Levien, J.J. Morrell, and M. Newbill, "Modeling Internal Temperature Changes of Timber Poles during ACA Treatment," *Wood Science Technology*, 26, pp. 227-240, 1992.
- K.L. Levien, "Maximizing the Product Distribution in Batch Reactors: Reactions in Parallel," *Chemical Engineering Science*, 47, No. 7, pp. 1751-1760, 1992.
- S.M. Smith, J.J. Morrell, E. Sahle-Demessie, and K.L. Levien, "Supercritical Fluid Treatment: Effects on Bending Strength of White Spruce Heartwood," International Research Group on Wood Preservation, Document No. IRG/WP/93-20008, Stockholm, Sweden, 1993, 6 pp.
- S.M. Smith, E. Sahle-Demessie, J.J. Morrell, K.L. Levien and H. Ng, "Supercritical Fluid (SCF) Treatment: Its Effect on Bending Strength and Stiffness of Ponderosa Pine Sapwood," *Wood and Fiber Science*, 25, No. 3, pp. 119-123, 1993.
- V.M. Coonce, K.L. Levien, and J.A. Torres, "Mathematical Models for Drying Rates and Quality Indicator Changes During Barley Malt Kilning," *Cereal Foods World*, 38, pp. 822-826, 828-830, November/December 1993.
- J.J. Morrell, K.L. Levien, E. Sahle-Demessie, and H.M. Barnes, "Impregnation of Wood Poles Using Supercritical Fluid Treatment Processes," *Proceedings, International Pole and Piling Conference*, Ft. Collins, CO, pp. 325-337, 1994.
- E. Sahle-Demessie, A. Hassan, K.L. Levien, S. Kumar, and J.J. Morrell, "Supercritical Carbon Dioxide Treatment: Effect on Permeability of Douglas-Fir Heartwood," *Wood and Fiber Science*, 27, No. 3, pp. 296-300, 1995.
- A. Hassan, K.L. Levien, and J.J. Morrell, "Phase Behavior of Binary and Ternary Mixtures of Wood Preservatives in Supercritical Carbon Dioxide with Cosolvents," Chapter 27 in *Innovations in Supercritical Fluids Science and Technology*, ACS Symposia Series Vol. 608, pp. 402-414, ACS, 1995.
- E. Sahle-Demessie, K.L. Levien, and J.J. Morrell, "Impregnation of Wood with Biocides Using Supercritical Fluid Carriers," Chapter 28 in *Innovations in Supercritical Fluids Science and Technology*, ACS Symposia Series Vol. 608, pp. 415-428, ACS, 1995.
- M.N. Acda, J.J. Morrell and K.L. Levien, "Decay Resistance of Composites following Supercritical Fluid Impregnation with Tebuconazole," *Material und Organismen*, 30, No. 4, pgs 293-300, 1996.
- M.N. Acda, J.J. Morrell and K.L. Levien, "Effects of Supercritical Fluid Treatments on Physical Properties of Wood-based Composites," *Wood and Fiber Science*, 29(2), pgs 121-130, 1997.
- M.N. Acda, J.J. Morrell and K.L. Levien, "Effects of Process Variables on Supercritical Fluid Impregnation of Composites with Tebuconazole," *Wood and Fiber Science*, 29(3), pgs 282-290, 1997.

- G.-H. Kim, S. Kumar, E. Sahle-Demessie, K.L. Levien and J.J. Morrell, "Bending Properties of TCMTB-treated Southern Pine Sapwood Using Supercritical Carbon Dioxide Impregnation Process. International Research Group on Wood Preservation. Document No. IRG/WP/97-40080. Stockholm, Sweden, 7 pages, 1997.
- E. Sahle-Demessie, Jung Seok Yi, K.L. Levien and J.J. Morrell, "Supercritical Fluid Extraction of Pentachlorophenol from Pressure Treated Wood," *Sep. Sci. Technol.*, 32(6), pgs. 1067-1085, 1997.
- E. Sahle-Demessie, K.L. Levien, and J.J. Morrell, "Using Supercritical Fluids to Deposit Chemical in Porous Solids," *CHEMTECH*, (ACS publication - invited contribution), 28(3), pgs 12-18, 1998.
- M.N. Acda, J.J. Morrell, A. Silva, K.L. Levien and J. Karchesy, "Using Supercritical Carbon Dioxide for Extraction of Western Juniper and Alaska-Cedar," *Holzforschung*, 52 (5), pgs 472 - 480 , 1998.
- K.L. Levien and O. Levenspiel, "Optimal Product Distribution from Laminar Flow Reactors: Newtonian and Other Power-law Fluids," *Chemical Engineering Science*, **54**, No. 13, pp. 2453-2458, 1999.
- J.J. Morrell and K.L. Levien, "Extraction of Biologically Active Substances from Wood", pgs 221-226, Chap. 29 in *Supercritical Fluid Methods and Protocols*, J.R. Williams and A.A. Clifford, eds, a book in the Methods in Molecular Biology series, Hymana Press Inc., Totowa, NJ, 2000.
- J.J. Morrell and K.L. Levien, "The Deposition of a Biocide in Wood-Based Material", pgs 227-234, Chap. 30 in *Supercritical Fluid Methods and Protocols*, J.R. Williams and A.A. Clifford, eds, a book in the Methods in Molecular Biology series, Hymana Press Inc., Totowa, NJ, 2000.
- M.N. Acda, J.J. Morrell and K.L. Levien, "Supercritical Fluid Impregnation of Selected Wood Species with Tebuconazole," *Wood Science and Technology*, **35**, 127-136, 2001.
- A. Hassan, K.L. Levien and J.J. Morrell, "Modeling Phase Behavior of Multicomponent Mixtures of Wood Preservatives in Supercritical Carbon Dioxide with Cosolvents," *Fluid Phase Equilibria*, **179**, No. 1-2, pp. 5-22, 2001.
- J.J. Morrell, P. Forsyth, E. Sahle-Demessie, and K.L. Levien, "Sterilization to Limit Pretreatment Decay: Internal Temperature during Kiln Drying of Douglas-fir Poles. International Research Group on Wood Preservation. Document No. IRG/WP/01-40206. Stockholm, Sweden. 10pp., 2001.
- P.F. Schneider, K.L. Levien and J.J. Morrell, "Internal Pressure Measurement Techniques and Pressure Response in Wood during Treating Processes," *Wood and Fiber Science*, 35(2), pgs 282-292, 2003.
- E. Sahle-Demessie, U.R. Pillai, S. Junsophonsri, and K.L. Levien, "Solubility of Organic Biocides in Supercritical CO<sub>2</sub> and CO<sub>2</sub> + Cosolvent Mixtures", *J. Chem. Eng. Data*, 48, pgs 541-547, 2003.
- P.F. Schneider, K.L. Levien and J.J. Morrell, "Internal Pressure Measurement Techniques and Pressure Response in Wood during Treating Processes," *Wood and Fiber Science*, 35(2), pgs 282-292, 2003.
- E. Sahle-Demessie, U.R. Pillai, S. Junsophonsri, and K.L. Levien, "Solubility of Organic Biocides in Supercritical CO<sub>2</sub> and CO<sub>2</sub> + Cosolvent Mixtures", *J. Chem. Eng. Data*, 48, pgs 541-547, 2003.
- S.M. Kang, S.M., K.L. Levien, and J.J. Morrell, "Supercritical Fluid Impregnation of Wood with Biocides using Temperature Reduction to Induce Deposition," *Wood Science and Technology*, 39(5), pgs 328-338, 2005.

P.F. Schneider, J.J. Morrell, and K.L. Levien, "Internal Pressure Development during Supercritical Fluid Impregnation of Wood", *Wood and Fiber Science*, 37(3), pgs 413-423, 2005.

S.M. Kang, K.L. Levien, and J.J. Morrell, "Developing Diffusion Coefficients for SCF Impregnation of Douglas Fir Heartwood with Cyproconazole", *J. of Wood Chemistry and Technology*, 26(2), pgs 111-124, 2006.

S.M. Kang, K.L. Levien, and J.J. Morrell, "Effect of Process Variations during Supercritical Fluid Impregnation on Cyproconazole Retention and Distribution in Ponderosa Pine Sapwood", *Wood and Fiber Science* 38(1), pgs 64-73, 2006.

P.F. Schneider, J.J. Morrell, and K.L. Levien, "Effect of Wood Characteristics on Pressure Responses during Supercritical Carbon Dioxide Treatment", *Wood and Fiber Science* 38(4), pgs 660-671, 2006.

C. Barker, A. Badowski, B. Whitefield, K.L. Levien and M.D. Koretsky, "Factors Affecting Thickness Variation of SiO<sub>2</sub> Thin Films Grown by Wet Oxidation", *IEEE Transactions on Semiconductor Manufacturing*, accepted Feb. 2011.

### **Conference Proceedings**

W.E. Stewart, K.L. Levien, and M. Morari, "Collocation Methods in Distillation," *Proceedings of the Second International Conference on Foundation of Computer-Aided Process Design (FOCAPD'83)*, Westerberg, A.W. and H.H. Chien, Eds., CACHE Corp., Ann Arbor MI, 1984, pp. 535-569, conference was held at Snow Mass, CO, June 1983.

K.L. Levien and M. Morari, "Internal Model Control of Distillation Columns," American Control Conference, pp. 1066-1071, June 1985, Boston, MA.

M.A. Newbill, J.J. Morrell, and K.L. Levien, "Internal Temperature in Douglas Fir Poles During Treatment with Ammoniacal Copper Arsenate or Pentachlorophenol," *Proceedings*, American Wood Preservers' Association, Minneapolis, MN, May 9-11, 1988, Vol. 84, pp. 48-54.

J.J. Morrell, K.L. Levien, E. Sahle-Demessie, S. Kumar, S. Smith and H.M. Barnes, "Treatment of Wood Using Supercritical Fluid Processes," 14th Annual Meeting of the Canadian Wood Preservation Association, Vancouver, B.C., Nov. 2-4, 1993, **14**, pp. 6-25.

M.N. Acda, J.J. Morrell and K.L. Levien, "Impregnation of Wood-based Composites using Supercritical Fluids: A Preliminary Report," *Proceedings Canadian Wood Preservation Association*, **16**, pgs 9-28, 1995.

J.J. Morrell, K.L. Levien, M.N. Acda and E. Sahle-Demessie "Impregnating Wood with Biocides using Supercritical Carbon Dioxide: Process Parameters, Performance and Effects on Wood Properties," *Proceedings*, American Wood Preservers' Association, Pittsburgh, PA, 1997, Vol. 93, pp. 367-384.

### **Meeting Papers**

W.E. Stewart, K.L. Levien, and M. Morari, "A New Model Reduction Technique for Staged Separation Operations," 1981 Annual AIChE Meeting, New Orleans, 24 pgs.

C. Chapat, K. Levien, and M. Morari, "RTCP, A Real-Time-Control-Program for Process Control Research," 1984 AIChE National Meeting, Anaheim, CA, 11 pgs.

- P.L. Lee and K.L. Levien, "Performance Comparisons of Internal Model Control and Predictive Controllers," 1986 Annual AIChE Meeting, Miami Beach, 22 pgs.
- A.A. Al-Zahrani and K.L. Levien, "Control of the Flow Rate of Solids through Vertical Pipes," Third Saudi Engineering Conference, December 1991, 22 pgs.
- S.M. Smith, J.J. Morrell, E. Sahle-Demessie and K.L. Levien, "Supercritical Fluid Treatment: Effects on Bending Strength of White Spruce Heartwood," 24th Annual Meeting of the International Research Group on Wood Preservation, Greenleaf Resort, Orlando, Florida.
- A. Hassan, K.L. Levien, and J.J. Morrell, "Phase Behavior of Binary and Ternary Mixtures of Wood Preservatives in Supercritical Carbon Dioxide with Cosolvents," 1994 Annual AIChE Meeting, San Francisco, paper 117h, 21 pgs.
- E. Sahle-Demessie, K.L. Levien, and J.J. Morrell, "Deposition of Chemicals in Semi-porous Solids using Supercritical Fluid Carriers," 1994 Annual AIChE Meeting, San Francisco, paper 122a, 21 pgs.
- E. Sahle-Demessie, J.S. Yi, K.L. Levien, and J.J. Morrell, "Remediation of Pentachlorophenol Treated Wood using Supercritical Fluid Extraction," 1995 Summer AIChE Meeting, Boston, paper 41a, 17 pgs.
- J.J. Morrell, K.L. Levien, and M. Acda, "Biocide Impregnation of Wood-based Materials with Supercritical Carbon Dioxide," 212th American Chemical Society National Meeting, Orlando, FL, Aug. 25-29, 1996.
- A. Hassan, K.L. Levien, and J.J. Morrell, "Modeling Phase Behavior of Multicomponent Mixtures of Wood Preservatives in Supercritical Carbon Dioxide with Cosolvents," 1996 Annual AIChE Meeting, Chicago, paper 78h, 12 pgs.
- K.L. Levien, O. Levenspiel, "Optimal Product Distribution from Laminar Flow Reactors: Newtonian and Other Power-law Fluids," Fifteenth International Symposium on Chemical Reaction Engineering (ISCRE15), Sept. 13-16, 1998, Newport Beach, CA.
- K.L. Levien and W.E. Rochefort, "Lesson with LEGO - Engaging Students in Chemical Engineering Courses," 2002 ASEE Annual Conference - Montreal, June 2002
- W.E. Rochefort, E. Ford, K.L. Levien and E. Momsen, "Everything I Know I Learned in Kindergarten: Examples of Synergisms between K-12 Outreach and Recruitment and Retention of Women and Minorities in Engineering. ASEE Annual Conference - Salt Lake City, June 2004.
- W.E. Rochefort, M. Bothwell, and K.L. Levien, "Use of Wireless Laptops to Enhance a First-year Chemical, Biological and Environmental Engineering Orientation Course. ASEE Annual Conference - Portland, OR, June 2005.
- K.L. Levien, "Practical Implementation of Data Acquisition to Enhance Problem Based Learning in Chemical Engineering Labs," 2008 Annual AIChE Meeting, Philadelphia, paper 412c.