The Department of

Chemical Engineering

Fifty-First
Annual Report to the Alumni

1999

THE OHIO STATE UNIVERSITY

College of Engineering
The Ohio State University
Columbus, Ohio

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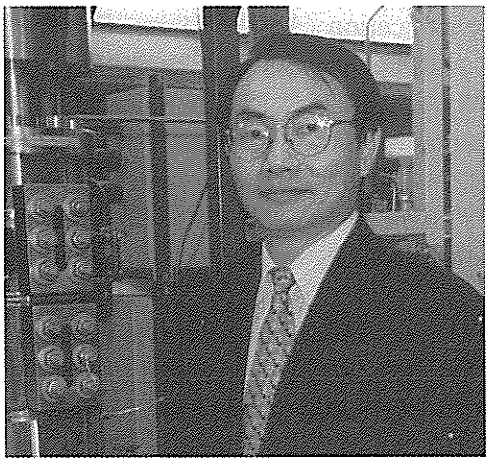


It is once again my great pleasure to update you on the activities of our faculty and students during 1998. It was another productive year for our faculty and students. This year only, we are sending the Annual Report out at a different time. The Annual Report has traditionally been published in Spring and the newsletter in late Fall. Next year we will return to our usual schedule. I also wanted to let you know that Karen Hendricks (B.S., ChE 1971) was named to the OSU Board of Trustees. Karen is the President, Chair of the Board and CEO of Baldwin Piano and Organ. Karen and her husband, Milton, are establishing The Milton H. and Karen L. Hendricks Scholarship Fund. We would all like to congratulate Karen and thank her for her devotion and service to OSU and the Department.

We have been hard at work preparing for the ABET accreditation team that will visit us very soon. Professor Jim Rathman has taken the lead in this endeavor and we feel well prepared. I would like to mention that the annual AIChE meeting will be held in Dallas, Texas, this year at the Wyndham Anatole Hotel, October 31 through November 5. The Department will sponsor a reception at the Wyndham on Wednesday, November 3, from 6:30 to 8:30 pm in Atrium I. All Alumni in the Dallas area or attending the meeting are encouraged to stop by and visit us there. For the local alumni in the Columbus area, I would like to remind you that the College has a tailgate before each home game and the Department student chapter of AIChE sponsors one for each home game after school starts. Alumni are very welcome to stop by at either of these events. As always, if you happen to be in the Columbus area, please consider stopping by and visiting us.

Professor Umit S. Ozkan had an amazing year. She was awarded the Professional Progress in Engineering Award (PPEA) from the Iowa State University of Science and Technology in April of 1999, the OSU Emerging Academic Leaders Program Award, the 1998 Award for Excellence in Catalysis Research from the Cleveland-Pittsburgh Catalysis Society, and the prestigious OSU Distinguished Scholar Award. The Distinguished Scholar Award was presented during a visit to her class by President Kirwan. Her students have also been quite successful. Junko Mitome received a Best Poster Award at the 16th North American Meeting of the Catalysis Society. At the Tri-State Catalysis Society Annual meeting, Rick Watson, received the First Place Award and Junko Mitome and Enrique Aceves, received third place awards in the poster competition.

Professor Bhavik Bakshi was promoted to Associate Professor with tenure and he received an OSU College of Engineering Lumley Engineering Research Award and the National Science Foundation Faculty Early Career Enhancement Award. Emeritus Professor Robert S. Brodkey was honored with a session in honor of his 70th birthday at the AIChE Fluid Mechanics section in November. Professor Jeffrey J. Chalmers was promoted to full Professor and received a Research Accomplishment Award from the College of Engineering. Prof. Chalmers also filed two patents in 1998. In the next alumni newsletter we will highlight his invention as I am sure you will find it very interesting. Professor Kenneth Cox was Chair of the Programming Group on Chemical Engineering Fundamentals at AIChE. He is instrumental in implementing a new design software (HYSIS) in the teaching of four ChE design courses. Professor James F. Davis was named Interim Chief Information Officer for the Ohio State University and received a software license. Professor Liang-Shih Fan received a Lumley Research Award in 1998 from the College of Engineering, and in 1999 received the Peter L. Scott Faculty

Award for Excellence in Engineering Education. He also recently received the American Association for Engineering Education (ASEE) Union Carbide Lectureship Award. Professor Martin Feinberg was Chair of the Department Faculty Search Committee. His personal efforts have been instrumental in successfully recruiting two exceptionally outstanding faculty members. He also received the MacQuigg Outstanding Teaching Award. His graduate course, "Applied Mathematics in Chemical Engineering" has now become a required course for graduate students. Professor James Rathman is the first ChE Professor to teach *Introduction to Engineering*, a new freshman core course in the College of Engineering. In addition, Prof. Rathman has devoted a large amount of time to preparing the Department ABET accreditation materials and other proposals.

The new CAPCE (Center for Advanced Polymer and Composite Engineering) continues to prosper. Professor L. James Lee, the Director, received the 1998 Best Paper Award, Processing Category, at the 53rd Annual Conference of the Society of the Plastics Industry held in Nashville, Tennessee. He, along with Professor David Tomasko, received the Maro Future Technology Award at the 1998 SPE ANTEC Meeting, and he received an Honorary Professorship at the East China University of Science and Technology, Shanghai, China. He will be taking charge of this year's faculty search committee, a job that requires much time and thought. Professor Kurt Koelling, Associate Director of the Center, received the National Science Fellowship/Lucent Technologies Industrial Ecology Research Fellowship. Professor Koelling is also the AIChE Student Chapter advisor, and under his leadership they have been active and quite successful. One of our student chapter members, Lori Burgess, received the Central Ohio Section Outstanding Student Award, and another student, Tim Dennison, received the first place paper award at the Regional Student Conference. He has been invited to give his paper at the upcoming AIChE meeting this fall for the National competition. The student have regular meetings and other fellowship activities. The President represents the group to the ChE Alumni Association.

Professor Tomasko shared the Maro Future Technology Award with Jim Lee and received both a 1999 Lumley Research Award and a MacQuigg Outstanding Teaching Award. An undergraduate researcher in his group, Tim Denison, received first prize in the Denman Undergraduate Research Forum. In addition, he provides significant services to the Department in the areas of curriculum, students needing special assistance, academic probation, etc. He is also in charge of our diversity efforts in recruitment and retention.

Professor S.T. Yang has been particularly active in the Department in setting the seminar schedules, directing the publication of a new graduate brochure, revamping the graduate recruiting effort program, etc. In addition he has kept an active research role and was appointed Visiting Professor, Swiss Federal Institute of Technology at Lausanne, where he spent March to June 1998 as part of his sabbatical. He is the 1999 Chair of the Graduate Studies Committee in charge of Teaching Assistant recruitment and development and graduate student recruitment.

Professor Jacques Zakin is active in many areas. He was the first recipient of the OSU College of Engineering Career Services Award in 1998. He also received the Distinguished Visiting Professor Award from the Mexican Academy of Sciences and the Mexico-USA Foundation for Science, 1998-99, a 1999 Engineering Research Accomplishment Award, and was US Coordinator for a Turkey-Israel-US Workshop to promote collaborative research, held at the Technion in Haifa, Israel in March.

We are also proud of the following undergraduate students who received Undergraduate Research Scholar Awards. The Department has been encouraging students to get involved in research at the undergraduate level in order to foster their interest in research and/or academic careers and to make them better prepared for the workplace. The 1998 award winners were Nicholas Riyanto (Weavers), Fery Pranadi (Koelling), Shawn Brueggemeier (Tomasko),

Gunartiris Karim (Yang), Todd Gibson (Chalmers), and Fang Yang (Zakin). We congratulate these students and their advisors (in parentheses) for putting forth this extra effort.

In the next newsletter we will inform you of the number of members of the "Jewels Club." I thank all of you who so generously contribute to our efforts here. Although we must congratulate Ron Harris on his tremendous opportunity to join Nabisco as Vice President in charge of Research, we are going to sorely miss all of the service activities he was involved in while living in Columbus after retiring from Kraft. Ron recently received a Distinguished Meritorious Service Award, which is given to individuals "whose sustained and extraordinary personal service has had significant and lasting effect on the advancement of the College of Engineering." Paul Bates received the Distinguished Alumnus Award. These award winners will be highlighted in our next newsletter.

On another note, I would like to encourage those of you that are able to approach your companies about making student awards. These awards do not have to be large, they can range from $100 to $1,000 and be named after the Company making the award. This type of encouragement is truly helpful to students and lets them know that the world cares about producing fine chemical engineers.

I will close noting that two new faculty members will join us over the next two years. We will be highlighting their careers thus far so that you can understand how pleased we are that they are joining us. The Department is prospering and growing and this is due, in no small part, to the encouragement from our Alumni and friends. Thank you all again for the important part you play in our continued success.

Best Regards,

Liang-Shih Fan, Chair, and
Distinguished University Professor

LSF:kd

P.S. It is not too late to fill out the form to be a founding member of the Jewels Club. If you have lost your coupon just write Account 54019 and make the check payable to Chemical Engineering. We would like to remind everyone that it is necessary to put "chemical engineering" on all funds sent to the University (and also on matching gift forms) in order that we receive your donation. If you have any questions about this please call us at 614-292-7907. Thank you again for your help in making this an outstanding department.

Texnikoi Outstanding Alumna Award

Texnikoi is an organization of undergraduate students in the College of Engineering whose purpose is to recognize qualities of leadership, integrity, and personality as exemplified by active participation and leadership in extracurricular activities.

1998 Recipient
Nancy C. Dawes

Nancy C. Dawes is currently a Principal Scientist for Procter & Gamble. She received her bachelor's degree in chemical engineering from Ohio State in 1981, Magna Cum Laude.

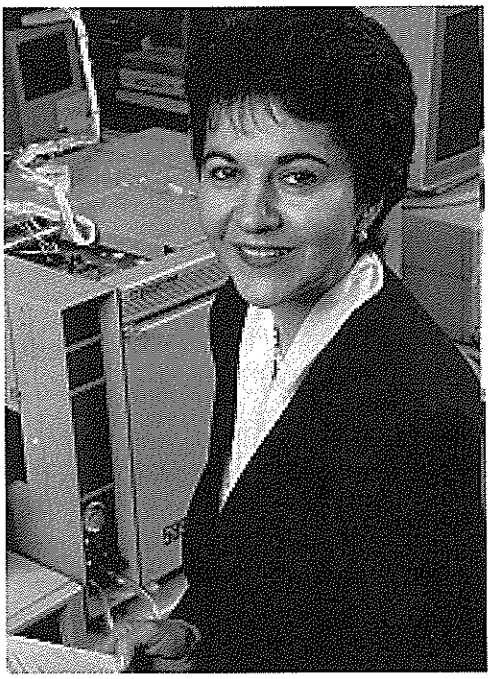
Nancy has devoted her entire career to Procter & Gamble. She began working for P&G immediately following graduation in 1981 as an engineer in research and food product development. In 1989 she was promoted to Section Head of Salted Snacks Product Development, and presently is Principal Scientist in P&G's Skin Care Product Development.

Nancy, active in the Girl Scouts of America, has an extensive record of service to OSU. She was the recruiter assigned to OSU from 1989-1993, was awarded P&G's Recruiter of the Year Award and has belonged to the OSU Chemical Engineering Industrial Advisory Committee since 1993.

Photo and announcement provided by *News in Engineering* (Spring 1999), a production of the Ohio State University College of Engineering.

The Distinguished Scholar Award recognizes exceptional scholarly accomplishments by senior professors who have compiled a substantial body of research, as well as the work of younger faculty members who have demonstrated great scholarly potential. Recipients are nominated by their departments and chosen by a committee of senior faculty, including several past recipients of the awards. Distinguished Scholars receive a $3,000 honorarium and a $20,000 research grant to be used during the next three years.

Since joining Ohio State in 1985, Dr. Umit Ozkan has become an international leader in heterogeneous catalysis—the modification of chemical reactions between gases, liquids, or both at the surface of a material that acts as a catalyst. She has garnered government and commercial funding to build a state-of-the-art laboratory that supports one of the strongest heterogeneous catalysis programs in the nation. Students appreciate the high-caliber work they are able to perform in the laboratory. Her work affects many societal and economic issues, in particular energy, the environment and the economics of chemical processes. "Creative scholarship should be judged by its quality rather than by how much it weighs," wrote one of Ozkan's colleagues. "In this regard Umit has performed some really seminal research." Among her numerous awards, she has received the National Science Foundation Woman Faculty Award for Excellence in Teaching and Research.



1998 Recipient
Dr. Umit Ozkan

Dr. Ozkan says: "Our research studies reactions that take place on the surfaces of solid catalysts, which are materials that can change the reaction rate or reaction pathway without being consumed during the process. The most gratifying aspect about doing research is working with a group of young researchers who, through their enthusiasm, curiosity, energy, and dedication, keep inspiring me and motivating me. I consider my research group to be my family, and they remain part of my family even after they graduate and leave Ohio State. There is nothing more gratifying than seeing my students prosper in their careers and in their lives."

Photo and announcement provided by *Ohio State Alumni Magazine* (June/July/August 1999) and *On Campus* (May 13, 1999)

Faculty and Research Areas

Bakshi, Bhavik, Assistant Professor, Ph.D., M.I.T. 1992. Process Modeling, Multiscale Methods, Ecologically-Conscious Design.

Brodkey, Robert S., Professor Emeritus, Ph.D., University of Wisconsin 1952. Turbulent Motion, Mixing and Kinetics, Image Processing and Analysis, Reactor Design, and Rheology.

Chalmers, Jeffery J., Associate Professor, Ph.D., Cornell University 1988. Biochemical Engineering, Hydrodynamic Effects on Cells, Cell Separations, Biodegradation/Bioremediation.

Cox, Kenneth R., Associate Professor, P.E., Ph.D., University of Illinois at Urbana 1979. Molecular Thermodynamics, Colloid and Interface Science, Physical Chemistry of Aqueous Systems, Polymer Phase Behavior, and Computational Chemistry.

Davis, James F., Professor, Ph.D., Northwestern University 1981. Artificial Intelligence in Diagnosis and Control, Intelligent Control, Data Interpretation, Pattern Recognition, Neural Networks, Systems Integration, Model Integration.

Fan, Liang-Shih, Distinguished University Professor and Chair, Ph.D., West Virginia University 1975. Fluidization, Powder Technology, Multiphase and Particulate Reaction Engineering, and Mathematical Modeling.

Feinberg, Martin, The Richard M. Morrow Professor of Chemical Engineering, Ph.D., Princeton University 1968. Chemical Reaction Network Theory, Reactor Design with Complex Chemistry.

Friedman, Morton H., Professor, Ph.D., Michigan University 1961. Biomedical Engineering and Hemodynamics.

Hershey, Harry C., Professor Emeritus, Ph.D., University of Missouri-Rolla 1965. Thermodynamics and Environmental Engineering.

Koelling, Kurt W., Associate Professor, Ph.D., Princeton University, 1992. Polymer Processing, Rheology of Complex Fluids, Biocompatible Polymers.

Lee, L. James, Professor, Ph.D., University of Minnesota 1979. Novel Polymer Processing, Composite Manufacturing, Microfabrication Thermoset Polymers.

Ozkan, Umit S., Professor, Ph.D., Iowa State University 1984. Application of Heterogeneous Catalysis to Energy and Environmental Issues, Catalytic Materials, and Heterogeneous Kinetics.

Rathman, James F., Associate Professor, Ph.D., University of Oklahoma 1987. Chemical Reactions in Surfactant Solutions, Thermodynamics of Micelle Formation, Wetting and Adhesion, Interfacial Adsorption and Transport.

Tomasko, David L., Assistant Professor, Ph.D., University of Illinois at Urbana 1992. Intermolecular Interactions in Supercritical Fluids, Supercritical Fluid Extraction, and Molecular Thermodynamics.

Yang, Shang-Tian, Professor, Ph.D., Purdue University 1984. Biochemical Engineering and Biotechnology, Fermentation and Cell Culture Processes, and Tissue Engineering.

Zakin, Jacques L., The Helen C. Kurtz Professor, D.Eng.Sc., New York University 1959. Surfactant and Polymer Drag Reduction, Micellar Structures, Rheology, and Emulsions.

Professors
Robert S. Brodkey (Emeritus)
Jeffrey J. Chalmers
James F. Davis
Liang-Shih Fan
Martin Feinberg
Morton H. Friedman (Biomed. Eng.)
Harry C. Hershey (Emeritus)
L. James Lee
Umit S. Ozkan
H.C. (Slip) Slider (Emeritus)
Edwin E. Smith (Emeritus)
Thomas L. Sweeney (Emeritus)
Jacques L. Zakin

Associate Professors
Bhavik R. Bakshi
Kenneth R. Cox
Kurt W. Koelling
James F. Rathman
David L. Tomasko

Visiting Scholars
Michelle Almendrala
Noel Cabigon
Marilou Dalida
Perfecto Dizon
Antonio Mateo
Masayuki Nakamura
Jian Ni
Geraldo Talisic
Selman Torlar
Boming Yu

Research Scientist
Peijun Jiang

Post Doctoral Research Associates
Rajeev Agnihotri
Phillip Ellison
Yu-Liang Huang
Yoon-Seob Lee
Xukun Luo
David Miller
Yang Zhao

Department Administrative Staff

Academic Advisor
Sherry McDonald

Assistant to the Department Chair
Kathleen Doddroe

Assistant to the Graduate Chair
Kathleen Monegan

Administrative Associate, Fiscal
Nancy Jacobs

Administrative Associate, Human Resources
Nadine Lineback

Administrative Associate, CAPCE
Paula Stevenson

Office Assistant
Paul Gudde

Graduate Administrative Assistant, Editorial
Karen Gonser

Design Engineer
Chris Gecik

Instrument Makers
Carl Scott
Paul Green

Program Assistant
Lisa Brown

Director, KCGL
Geoff Hulse

Systems Analyst
Mike Davis

Systems Engineer
Dave Jones

Publications and Proceedings

PUBLICATIONS
Books and Book Chapters

Bakshi, B.R. and G. Stephanopoulos. *Multiscale Analysis and Modeling for Chemical Process Operation and Control*. Academic Press, in preparation.

Brodkey, R.S., and Y. Zhao. "Chapter 8: Full-Field, Time-Resolved, Vector Measurements." *Instrumentation for Fluid-Particle Flow*. Ed. S.L. Soo. Noyes Publication, in press.

Davis, J.F., M.L. Piovoso, K. Kosanovich, and B. Bakshi. "Process Data Analysis and Data Interpretation." *Advances in Chemical Engineering* 25 (1998). Academic Press, in print. Invited.

Fan, L.-S., and C. Zhu. *Principles of Gas-Solid Flows*, a textbook (553 pages). Cambridge University Press, 1998.

Fan, L.-S., C. Zhu, and J. Zhang. *Solution Manual for Principles of Gas-Solid Flows*, (150 pages). Cambridge University Press, 1998.

Fan, L.-S., and T. Knowlton, eds. *Fluidization-IX*, (850 pages). Engineering Foundation Publication, 1998.

Fan, L.-S., and S. Chauk. "Heat Transfer in Fluidized and Packed Beds." *Handbook of Heat Transfer*. Eds. W.M. Rohsenow, J.P. Hartnett, and Y.I. Cho. 3rd ed. McGraw-Hill, 1998.

Fan, L.-S., and C. Zhu. "Chapter 18: Multiphase Flow-Gas/Solid." *The Handbook of Fluid Dynamics*. Ed. R.W. Johnson. CRC Press, 1998. 18-1—18-48.

Fan, L.-S., and R.-H. Jean. "Chapter 19: Multiphase Flow-Liquid/Solid." *The Handbook of Fluid Dynamics*. Ed. R.W. Johnson. CRC Press, 1998. 19-1 X 19-25.

Fan, L.-S., J.R. Kadambi, M. Prudich, S.J. Khang, and T.C. Keener. "Chapter 1: Flue Gas Desulfurization for Acid Rain Control." *Dry Scrubbing Technologies for Flue Gas Desulfurization*. Boston: Kluwer Academic Publishers, 1998. 1-114.

Fan, L.-S., E. Abou-Zeida, S.-C. Liang, and X. Luo. "Chapter 4: Sorbent Transport and Dispersion." *Dry Scrubbing Technologies for Flue Gas Desulfurization*. Boston: Kluwer Academic Publishers, 1998. 255-342.

Fan, L.-S., A. Ghosh-Dastidar, S. Mahuli, and R. Agnihotri. "Chapter 6: High Temperature Desulfurization of Flue Gas Using Calcium-Based Sorbents." *Dry Scrubbing Technologies for Flue Gas Desulfurization*. Boston: Kluwer Academic Publishers, 1998. 421-528.

Lee, L.J., and V. Rohatgi. "Chapter 6: Overview of Fiber Preforming in Resin Transfer Molding." *Resin Transfer Molding for Aerospace Structures*. Ed. T. Kruckenberg and R. Paton. Sydney: Chapman & Hall, 1998. 148-176.

Ozkan, U.S., and J.J. Spivey, eds. "Recent Advances in NO_x and SO_x Reduction from Combustion Sources." Special Issue of *Catalysis Today*. Amsterdam: Spivery, Elsevier, 1998.

Yang, S.-T., J. Reese, E.M. Silva, and L.-S. Fan. "Industrial Applications of Three-Phase Fluidization Systems." *Selected Topics of Fluidization, Solids Handling and Processing*. Ed. W.-C. Yang. Noyes Publications, 1998, in press.

Refereed Papers

Bakshi, B.R. "Multiscale PCA with Application to Multivariate Statistical Process Monitoring." *AIChE J.* 44.7 (1998): 1596-1610.

Bakshi, B.R., and R. Chatterjee. "Unification of Neural and Statistical Methods as Applied to Materials Structure-Property Mapping." *J. Alloys & Compounds* 279 (1998): 39-46.

Bakshi, B.R., and U. Utojo. "Unification of Neural and Statistical Modeling Methods that Combine Inputs by Linear Projection." *Computers & Chemical Engineering* 22.12 (1998): 1859-78.

Bakshi, B.R., and U. Utojo. "Neural and Statistical Methods for Empirical Modeling: A Common Framework and Overview." *Analytica Chimica Acta*, in press. Special issue on neural networks.

Bakshi, B.R. "Multiscale Analysis and Modeling Using Wavelets." *J. Chemometrics*, in press.

Bakshi, B.R., and M.N. Nounou. "On-Line Multiscale Rectification of Random and Gross Errors without Process Models." *AIChE J.*, accepted.

Brodkey, R.S., and Y. Zhao. "Particle Paths in Three-Dimensional Flow Fields as a Means of Study: Opposing Jet Mixing System." *Powder Technology* 100 (1998): 161-65.

Brodkey, R.S., and Y. Zhao. "Averaged and Time-Resolved, Full-Field (Three-Dimensional) Measurements of Unsteady Opposed Jets." *Can. J. Chem. Engr.* 76 (1998): 546-55.

Brodkey, R.S., D.R. Unger, and F.J. Muzzio. "Experimental and Numerical Characterization of Viscous Flow and Mixing in an Impinging Jet Contactor." *Can. J. Chem. Engr.* 76 (1998): 546-55.

Brodkey, R.S., S. Haam, I. Fort, L. Klaboch, M. Placnik, and V. Vanecek. "Laser Doppler Anemometry Measurements in an Index of Refraction Matched Column in the Presence of Dispersed Beads, Part I." *Int. J. Multiphase Flow*, in press.

Brodkey, R.S., and S. Haam. "Motions or Dispersed Beads Obtained by Particle Tracking Velocimetry Measurements, Part II." *Int. J. Multiphase Flow*, in press.

Chalmers, J.J., S. Mandal, B. Fang, L. Sun, and M. Zborowski. "Theoretical Analysis of Cell Separation Based on Cell Surface Marker Density." *Biotechnology & Bioengineering* 59 (1998): 10-20.

Chalmers, J.J., L.R. Moore, M. Zborowski, and L. Sun. "Lymphocyte Fractionation Using Immunomagnetic Colloid and Dipole Magnet Flow Cell Sorter." *J. Biochemical & Biophysical Methods* 37 (1998): 11-33.

Chalmers, J.J., L. Sun, and M. Zborowski. "Contnuous, Flow-Through Immunomagnetic Cell Separation in a Quadrupole Field." *Cytometry* 33 (1998): 469-75.

Chalmers, J.J., M. Agarwal, and K. Koelling. "Characterization of the Degradation of Poly-Lactic Acid in a Well-Controlled Composting System." *Biotechnology Progress* 14 (1998): 517-26.

Chalmers, J.J., M. Zborowski, L. Sun, and L. Moore. "Flow Through Immunomagnetic Cell Separation." *Biotechnology Progress* 14 (1998): 141-48.

Chalmers, J.J. "Gas Bubbles and Their Influence on Microorganisms." *Applied Mechanics Review* 51 (1998): 113-21.

Chalmers, J.J., G. Wheeler, and D. Tomasko. "A Linked Supercritical Extraction-Biodegradation System to Extract and Degrade Phenol." *Chem. Eng. Sci.* 53 (1998): 189-201.

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Davis, J.F., P.R. Prasad, Y. Jirapinyo, M. Bhalodia, and J.R. Josephson. "Structuring Diagnostic Knowledge for Large-Scale Process Systems." *Computers & Chemical Engineering* 22.22 (1997): 1897-1905.

Fan, L.-S., J. Zhang, and P. Jiang. "Flow Characteristics of Coal Ash in a Circulating Fluidized Bed." *I&EC Research* 37(1998): 1499-1509.

Fan, L.-S., T. Lin, and K. Tsuchiya. "Bubble Rise and Flow Characteristics in Bubble Columns at Elevated Pressure and Temperature." *AIChE J.* 44.3 (1998): 545-60.

Fan, L.-S. "Distribution Effects on Hydrodynamics of High Pressure Bubble Columns." *Chem. Eng. Sci.*, in press.

Fan, L.-S., and R. Davis. "Teaching Fluid-Particle Processes: A Workshop Report." *Chem. Eng. Ed.* 32.2 (1998): 94-97.

Fan, L.-S., T. Hong, and D.J. Lee. "Force Variations on Particle Induced by Bubble-Particle Collision." *Int. J. Multiphase Flow*, 25 (1999): 477-500.

Fan, L.-S., R. Agnihotri, and S. Chauk. "Selenium Removal Using Calcium-Based Sorbent: Reaction Kinetics." *Environmental Science & Technology* 32 (1998): 1841-46.

Fan, L.-S., P. Jiang, R. Agnihotri, and S. Chauk. "Dispersion and Ultrafast Reaction of Calcium Based Sorbent in a Circulating Fluidized Bed." *Chem. Eng. Sci. X CES Symposium in Print: CFBX Past, Present and Future*, in press.

Fan, L.-S., R. Agnihotri, S. Chauk, and S. Mahuli. "Sorbent Reactivation for Enhanced SO_2 Capture Using a Novel Carbonation Technique." *I&EC Research*, 38.3 (1999): 812-19. Festschrift issue in honor of Prof. Roy Jackson.

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Fan, L.-S., X. Luo, G. Yang, and D.J. Lee. "Single Bubble Formation in High Pressure Liquid-Solid Suspensions." *Powder Technology*, 100 (1998): 103-12. Festschrift issue in honor of Prof. L.S. Fan.

Fan, L.-S., D.J. Lee, and X. Luo. "Gas Disengagement Technique in a Slurry Bubble Column Operated in the Coalesced Bubble Regime." *Chem. Eng. Sci.*, ISCRE-15, 54 (1999): 2227-36.

Fan, L.-S., S. Chauk, and R. Agnihotri. "Sulfidation Kinetics of Calcium Based Sorbents at High Pressure." *Chem. Eng. Sci.*, ISCRE-15, 54 (1999): 3443-3454.

Fan, L.-S., J. Chen, A. Kemoun, M.H. Al-Dahhan, and M.P. Dudukovic. "Comparative Hydrodynamics Study in a Bubble Column Using Computer Automated Radioactive Particle Tracking (CARPT)/ Computed Tomography (CT) and Particle Image Velocimetry (PIV)." *Chem. Eng. Sci.*, ISCRE-15, 54 (1999): 2199-208.

Fan, L.-S., X. Luo, and K. Tsuchiya. "Gas Jetting and Bubble Formation in High Pressure Liquid-Solid Suspensions." *Fluidization-IX*. Eds. L.S. Fan and T. Knowlton. 1998. pp. 637-44.

Fan, L.-S., J. Zhang, and P. Jiang. "Dynamic Behavior in Transients of Solids Flow Rates in a Circulating Fluidized Bed System." *Fluidization-IX*. Eds. L.S. Fan and T. Knowlton. 1998. pp. 245-52.

Fan, L.-S. "On the Turbulent Radial Transfer of Particles in a CFB Riser." *Circulating Fluidized Beds – VI*. Eds. J. Werther and K. Wirth. 1998. In review.

Fan, L.-S. "Letter to the Editor: Moving Packed Bed Phenomenon in Three-Phase Fluidization." *Powder Technology*. 103 (1999): 300-01.

Feinberg, M. "Recent Results in Optimal Reactor Synthesis via Attainable Region Theory." *Chem. Eng. Sci.* 54 (1999): 2535-43.

Feinberg, M. "Optimal Reactor Design from a Geometric Viewpoint: II. Critical Sidestream Reactors." *Chem. Eng. Sci.*, in press.

Feinberg, M. "Optimal Reactor Design from a Geometric Viewpoint: III. Critical CFSTRs." *Chem. Eng. Sci.*, submitted.

Koelling, K.W., M. Agarwal, and J.J. Chalmers. "Characterization of the Degradation of Poly-lactic Acid Polymer in a Well Controlled Composting Environment." *Biotechnology Progress* 14 (1998): 517-26.

Koelling, K.W., and V. Gauri. "Gas-Assisted Displacement of Viscoelastic Fluids: Flow Dynamics at the Bubble Front." *J. Non-Newtonian Fluid Mechanics* 83 (1999): 183-203.

Lee, L.J., S.J. Tsai, and S.J. Li. "Microstructural Analysis of Composite Tubes Made by Braided Fiber Preform and Resin Transfer Molding." *J. Composite Materials* 32.9 (1998): 829-50.

Lee, L.J., and J-Y Nieh. "Analysis of Hot Plate Welding of PP, Part I-Crystallization Kinetics." *Polymer Engineering & Science* 38.7 (1998): 1121-32.

Lee, L.J., J-Y Nieh, and J. Ni. "Analysis of Hot Plate Welding of PP, Part II-Process Simulation." *Polymer Engineering & Science* 38.7 (1998): 1133-41.

Lee, L.J., Y. Wu, and R. Shivpuri. "Effect of Macro and Micro Voids on Elastic Properties of Polymer Composites." *J. Reinforced Plastics & Composites* 17.15 (1998): 1391-1402.

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Lee, L.J., X. Sun, and S. Li. "Mold Filling and Curing Analysis in Vacuum-Assisted Resin Transfer Molding." Session 2-C, Proc. of the 53rd SPI Annual Conference. Nashville, Tennessee. January 1998.

Lee, L.J., and J. Ni. "Forming and Curing Analysis of Compression Molding of SMC/BMC." Session 15-D, Proc. of the 53rd SPI Annual Conference. Nashville, Tennessee. January 1998.

Lee, L.J., and L. Li. "Cure of Vinyl Ester Resins for Low Temperature Applications: Kinetic and Rheological Changes." Session 20-A, Proc. of the 53rd SPI Annual Conference. Nashville, Tennessee. January 1998.

Lee, L.J., and W. Li. "Effect of LPA and Resin Type on Shrinkage Control of Unsaturated Polyester Cured at Low Temperature." Session 20-B, Proc. of the 53rd SPI Annual Conference. Nashville, Tennessee. January 1998.

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Koelling, K.W., and A. Scott. "Extensional and Shear Rheology of Dilute and Semi-Dilute Bimodal Polymer Solutions." OSU Center for Advanced Polymer and Composite Engineering Technical Report. A-98-03, 1998.

Zakin, J.L. "Reducing Energy Costs in District Heating Systems." USAID Management Report. January 1998.

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Patents and Software Licenses

Chalmers, J.J., M. Zborowski, and L. Moore. "System and Device for Determining Particle Characteristics." US Patent, submitted.

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Davis, J.F. "Licensed State Estimator Software Developed at Ohio State University to Honeywell."

Fan, L.-S., A. Ghosh-Dastidar, and S. Mahuli. "Development of Calcium-Based Super Sorbent for Sulfur Dioxide Removal from Hot Flue Gas." US Patent 5779464, 1998.

Fan, L.-S., S. Mahuli, and R. Agnihotri. "Sorbent Reactivation for Enhanced Sulfur Dioxide Capture Using Novel Carbonation Technique." US Patent, in review.

Invited Lectures, Seminars, and Short Courses

Bakshi, B.R. "Multiscale Analysis and Modeling Using Wavelets." Kyoto University, Kyoto, Japan. February 1998.

Bakshi, B.R. "Multiscale Analysis and Modeling Using Wavelets." Mitsubishi Chemical, Kurashiki, Japan. February 1998.

Bakshi, B.R. "Multiscale Analysis and Modeling Using Wavelets." Joint meeting of Japan Energy Co. Toshiba, Nippon Steel, Tokyo, Japan. February 1998.

Bakshi, B.R. "Multiscale Analysis and Modeling Using Wavelets." Second International Chemometrics Research Meeting. Veldhoven, Netherlands. May 1998.

Bakshi, B.R. "Multiscale Analysis and Modeling Using Wavelets." Elf Atochem, King of Prussia, Pennsylvania. June 1998.

Chalmers, J.J. "The Impact of Interfaces on Cells and Proteins." ASME Bioprocess Equipment Seminar. Boston, Massachusetts. November 2-6, 1998.

Chalmers, J.J. "Immunomagnetic Cell Separation." Department of Chemical & Biochemical Engineering, University of Iowa. October 16, 1998.

Chalmers, J.J. "Issues Surrounding the Scale-Up of Animal Cell Culture." Biogen Inc. June 22, 1998.

Cox, K.R. "Applications of Computational Molecular Modeling." Joint Meeting of Columbus Area AIChE and ACS. December 8, 1998.

Cox, K.R. "Macroscopic Insight for Molecular Systems." Rice University. November 5, 1998.

Cox, K.R. "Macroscopic Insight for Molecular Systems." Michigan State University. October 1, 1998.

Davis, J.F. "Construction of the PRM: Roles, Sources of Information and Builder." Honeywell ASM Consortium Quarterly Meeting. Phoenix, Arizona. January 1998.

Davis, J.F. "Configuration and Optimal Performance of State Estimators for Abnormal Situation Management." Honeywell ASM Consortium Quarterly Meeting. Phoenix, Arizona. January 1998.

Davis, J.F. "Functional Representation and Hazard Assessment." Seminar, Universal Oil Products. Chicago, Illinois. January 1998.

Fan, L.-S. "Particle Dynamics of Gas-Liquid-Solid Fluidization." Department of Chemical Engineering, Purdue University. February 1999.

Fan, L.-S. "Particle Dynamics of Gas-Liquid-Solid Fluidization." Department of Chemical Engineering, University of Missouri, Columbia. March 1999.

Fan, L.-S. "Particle Dynamics of Gas-Liquid-Solid Fluidization." University of Pennsylvania. March 1999. Special Invited Lecture in honor of Dan Joseph.

Fan, L.-S. "Particle Dynamics of Gas-Liquid-Solid Fluidization." Department of Chemical Engineering, Kansas State University. April 1999.

Feinberg, M. "Ray Jackson as an Architect of Chemical Reaction Network Theory." Department of Chemical Engineering, Princeton University. April 1997. Special invited lecture in honor of the retirement of Professor Roy Jackson.

Feinberg, M. "An Introduction to Chemical Reaction Network Theory." Department of Mathematics, The Ohio State University. May 1998.

Feinberg, M. "An Introduction to Chemical Reaction Network Theory." Department of Chemical Engineering, University of Cincinnati. December 1998.

Koelling, K.W. "Extensional Rheology and Dynamic Surface Tension of Dilute and Semi-Dilute Polymer Solutions." International Specialty Products. Wayne, New Jersey. December 1998.

Koelling, K.W., and T. Cleland. "Sheet Cooling, Theory and Practice." Plastics USA Exhibit and Conference. Chicago, Illinois. October 6, 1998.

Koelling, K.W. "Gas Bubble Dynamics in Viscoelastic Fluids." Invited Seminar. Department of Chemical Engineering, University of Toledo. Toledo, Ohio. April 24, 1998.

Koelling, K.W. "Gas Bubble Dynamics in Viscoelastic Fluids." Invited Seminar. Department of Chemical Engineering, Michigan State University. East Lansing, Michigan. April 23, 1998.

Koelling, K.W. "Influence of Polymer Rheology on the Gas-Assisted Injection Molding Process." Joint Meeting of the AIChE Central Ohio Section and SPE Local Section. Columbus, Ohio. January 14, 1998.

Lee, L.J. "Recent Development in Liquid Composite Molding." Chung Yuan Christian University. Chung Li, Taiwan. June 1998.

Publications and Proceedings

Lee, L.J. "Phase Separation and Shrinkage Control of Low Profile Unsaturated Polyester Resins." National Taiwan University of Science & Technology. Taipei, Taiwan. 1998.

Lee, L.J. "Liquid Composite Molding." College of Polymer Science & Engineering, University of Akron. Akron, Ohio. August 1998.

Lee, L.J. "Processing of Polymeric Composites from Nano-particles to Long Fiber Reinforcement." US-Israel-Turkey Chemical Engineering Conference. Haifa, Israel. March 1999.

Lee, L.J. "Analysis and Simulation of Mold Filling, Heat Transfer and Curing in Liquid Composite Molding." Gordon Research Conference on Computer Aided Engineering in Polymer Processing. Ventura, California. March 1999.

Ozkan, U.S. "Reduction of NO with Methane over Supported Pd Catalysts." Department of Chemistry, The Ohio State University. Columbus, Ohio. January 1998.

Ozkan, U.S. "Hydrodenitrogenation Reactions over Sulfide and Nitride Catalysts." Exxon Chemical Corporation. Baton Rouge, Louisianna. March 1998.

Ozkan, U.S. "Catalytic Hydrodenitrogenation of Heterocyclic Compounds on Sulfide and Nitride Catalysts." Department of Chemistry, Tunghai University. Taichung, Taiwan. December 1998.

Ozkan, U.S. "Environmental Catalysis: Catalytic Reduction of NO_X." Department of Chemical Engineering, Tunghai University. Taichung, Taiwan. December 1998.

Ozkan, U.S. "Catalytic Reduction of Nitric Oxide with Methane over Supported Pd Catalysts." National Taiwan. Taipei, Taiwan. December 1998.

Tomasko, D.L. "Supercritical Fluid Assisted Polymer Blending." 8th International Symposium on Supercritical Fluids. St. Louis, Missouri. July 1998.

Tomasko, D.L. "Supercritical Fluid Processing of Pharmaceuticals." Department of Chemistry, Otterbein University. Columbus, Ohio. May 1998.

Yang, S.-T. "Production of Acetate Deicers from Cheese Whey by Extractive Fermentation." Swiss Federal Institute of Technology at Lausanne (EPFL). Lausanne, Switzerland. May 1, 1998.

Yang, S.-T. "Metabolic Engineering and Extractive Fermentation for Enhanced Propionic Acid Production from Glucose." 1998 Corn Utilization & Technology Conference. St. Louis, Missouri. June 1-3, 1998.

Yang, S.-T. "A Fibrous Bed Bioreactor for Animal Cell and Tissue Cultures." Swiss Federal Institute of Technology at Lausanne (EPFL). Lausanne, Switzerland. June 12, 1998.

Yang, S.-T. "Novel Bioprocesses for Chemical Production from Renewable Resources." Great Lakes Chinese American Chemical Society Second Annual Conference. Chicago, Illinois. August 1-3, 1998.

Yang, S.-T. "Fibrous Bed Bioreactor for Fermentation and Mammalian Cell Cultures." Biochemical Engineering Symposium, Ohio University. Athens, Ohio. September 25-26, 1998.

Zakin, J.L. "Drag Reduction – A Method to Reduce Turbulent Pumping Energy Losses." Ohio Wesleyan University. January 22, 1998.

Zakin, J.L. "Drag Reduction – Reducing Energy Losses in Turbulent Flows." University of Missouri-Rolla. March 11, 1998.

Additional Paper Presentations

Bakshi, B.R., and S. Top. "Multiscale Statistical Process Control Using Wavelets." Fall Technical Meeting, American Statistical Association/ American Society for Quality. Corning, New York. October 1998.

Bakshi, B.R., and S. Top. "Multiscale Statistical Process Monitoring and Diagnosis of Univariate and Multivariate Processes." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Nounou, M.N., and B.R. Bakshi. "Multiscale Linear Modeling with Application to Inferential Modeling and System Identification." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Bakshi, B.R., M.N. Nounou, P. Goel, and X. Shen. "Multiscale Data Reconciliation with Steady State Process Models." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Brodkey, R.S., and Y. Zhao. "Poster Presentation: On Representations of Complex Flow." AIChE 1998 Annual Meeting. Miami, Florida. November 15-20, 1998.

Chalmers, J.J., L. Moore, M. Zborowski, K. McCloskey, and Y. Zhao. "Theoretical and Experimental Measurements of the Distribution of Cell Surface Markers Densities Using Immunomagnetic Colloids (Nanometer Scale)." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Chalmers, J.J., P. Frink, and K.R. Cox. "Impact of Media Phase Microstructuring on Intercellular Interactions." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Chalmers, J.J., L. Sun, L. Moore, and M. Zborowski. "Rapid Cell Isolation by Magnetic Flow Sorting Using Immunomagnetic Labels in the Nanometer Scale." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Chalmers, J.J., S. Haam, Y. Zhou, K. McCloskey, L. Moore, and M. Zborowski. "Quantification of Cellular Properties from External Fields and Resulting Induced Velocity: Cellular Hydrodynamic Diameter and Magnetic Susceptibility." 214th ACS National Meeting. Boston, Massachusetts. August 22-27, 1998.

Chalmers, J.J., M. Zborowski, L.R. Moore, and L. Sun. "Rapid Cell Isolation by Magnetic Flow Sorting in Tissue Engineering." ASAIO Annual Meeting. New York, New York. April 23-24, 1998.

Chalmers, J.J., M. Zborowski, L.R. Moore, and L. Sun. "Fast Cell Separation with Immunomagnetic Colloid and Flow-Through Magnetic Sorter." Cell Culture Engineering VI, Engineering Foundation Conference. San Diego, California. February 7-12, 1998.

Chalmers, J.J., S. Haam, Y. Zhou, and K. McCloskey. "Quantification of Cellular Properties from External Fields and Resulting Induced Velocity: Cellular Hydrodynamics Diameter and Magnetic Susceptibility." Cell Culture Engineering VI, Engineering Foundation Conference. San Diego, California. February 7-12, 1998.

Chalmers, J.J., L. Sun, M. Zborowski, and L.R. Moore. "Flow Through, Immunomagnetic Cell Separation." Cell Culture Engineering VI, Engineering Foundation Conference. San Diego, California. February 7-12, 1998.

Cox, K.R., P. Frink, and J.J. Chalmers. "Applications of Media Phase Microstructuring on Intercellular Interactions." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Publications and Proceedings

Cox, K.R. "Heuristic Methods for Computational Chemistry and Molecular Simulation I." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Cox, K.R. "Poster Presentation: Heuristic Methods for Computational Chemistry and Molecular Simulation II." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Feinberg, M. "Recent Results in Optimal Reactor Sythesis via Attainable Region Theory." International Symposium on Chemical Reaction Engineering (ISCRE 15). September 1998.

Feinberg, M. "Recent Results in Optimal Reactor Sythesis via Attainable Region Theory." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Koelling, K.W., and V. Gauri. "Gas-Assisted Displacement in Capillary Tubes: Influence of Viscoelasticity." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Koelling, K.W., Y.J. Juang, and L.J. Lee. "A Method for Assessing the Effect of Sheeting Rheology, Surface Pattern, and Processing Conditions on Glass Lamination." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Koelling, K.W., and D. Shackleford. "The Transient Extensional Viscosity of Dilute and Semi-Dilute Polymer Solutions Measured with a Filament Stretching Rheometer." Society of Rheology Annual Conference. Monterey, California. October 5, 1998.

Koelling, K.W., M. Tendulkar, and V. Gauri. "Penetration of a Long Gas Bubble through Polymeric Fluids under Non-Isothermal Conditions." Polymer Processing Society Annual Meeting. Yokohama, Japan. June 8-12, 1998.

Koelling, K.W., and J. Clay. "Degradation of Monodisperse Polystyrene in a Fast Transient Extensional Flow." Society of Plastics Engineers Annual Technical Conference. Atlanta, Georgia. April 1998.

Koelling, K.W., K. Cutright, and O. Becker. "Effects of Complex Rib Distributions on Mold Filling and Mechanical Properties of Gas-Assisted Parts." Society of Plastics Engineers Annual Technical Conference. Atlanta, Georgia. April 1998.

Lee, L.J. "Analysis and Optimization of Vacuum Assisted Resin Transfer Molding- SCRIMP." NSF Grantees Conference. Mexico. January 1998.

Lee, L.J., and L. Li. "Low Temperature Free Radical Cross-linking Polymerization-Styrene and Vinyl Ester Co-Polymerization." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Lee, L.J., H.Z. Chiu, and B. Yu. "Heat Transfer and Resin Reaction in Flow through a Fiber Reinforcement." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Lee, L.J., Y.J. Juang, and K.W. Koelling. "A Method for Assessing the Effect of Sheeting Rheology, Surface Pattern, and Processing Conditions on Glass Lamination." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Lee, L.J., M. Elkovitch, and D.L. Tomasko. "Supercritical Fluid Assisted Polymer Blending." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Ozkan, U.S., G. Karakas, and S. Ang. "C Hydrocarbon Oxidation." ACS Central Regional Meeting. Cleveland, Ohio. May 1998.

Ozkan, U.S., A.Y. Bunch, and L. Zhang. "Indole Hydrodenitrogenation over Alumina-Supported Ni and Ni-Mo Catalysts." 215th National Meeting of the American Chemical Society. Dallas, Texas. March 1998.

Ozkan, U.S., and J. Mitome. "Catalytic Reduction of Nitric Oxide with Methane over Supported Pd Catalysts." 28th Meeting of Fine Particle Society. Dallas, Texas. Apri, 1998.

Ozkan, U.S., J. Mitome, and G. Karakas. "Selective NO Reduction with Methane in the Presence of H_2O and SO_2: DRIFTS and Isotopic Labeling Studies." 2nd World Congress on Environmental Catalysis. Miami, Florida. November 1998.

Ozkan, U.S., and R.B. Watson. "K-Mo Catalysts Supported over Sol-Gel Silica-Titania in the Oxidative Dehydrogenation of Propane." 217th National Meeting of American Chemical Society. Anaheim, California. March 1999.

Ozkan, U.S., and R.B. Watson. "Alkali-Promoted Molybdena Catalysts Supported over Sol-Gel Silica-Titania in the Oxidative Dehydrogenation of Propane." Spring Symposium of the Tri-State Catalysis Society. Louisville, Kentucky. April 1999.

Rathman, J.F., J. Lawrence, and Y.S. Lee. "Synthesis of Mesoporous Silica Thin Films from Metastable Silicate Gels." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Rathman, J.F., and T. Battal. "Synthesis of Alkylphenyl Ethers in Aqueous Solution by Micellar Phase-Transfer Catalysis." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Rathman, J.F., C. Yang, and M. Caffrey. "The Effect of Octylglycopyranoside on Mesophase Behavior of Neutral Lipids – Monolein and Monotridecenoin." ACE Colloid & Surface Science Symposium, Penn State University. State College, Pennsylvania. June 1998.

Rathman, J.F., and T. Battal. "Reactions of Epichlorohydrin in Aqueous Micellar Surfactant Solutions." ACS Colloid & Surface Science Symposium, Penn State University. State College, Pennsylvania. June 1998.

Rathman, J.F., Y.S. Lee, and Y. Angsani. "Structural Design of Mesoporous Materials Using Organic Additives and the Synthesis of Mesoporous Silica Thin Films at a Liquid/Liquid Interface." ACS Colloid & Surface Science Symposium, Penn State University. State College, Pennsylvania. June 1998.

Rathman, J.F., Y. Angsani, and Y.S. Lee. "Structural Design of Mesoporous Materials Using Organic Additives." ACS 30th Central Regional Meeting. Cleveland, Ohio. May 1998.

Rathman, J.F., J. Archer, and C. Yang. "The Effect of Solution Structure on Interactions of PET/POET Polymers with Surfactants: Are Hydrophobic Interactions Important?" ACS 30th Central Regional Meeting. Cleveland, Ohio. May 1998.

Tomasko, D.L., R. Humayun, G. Karakas, and U.S. Ozkan. "Supercritical Fluid Extraction and Temperature Programmed Desorption of Phenol from Activated Carbon." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 1998.

Tomasko, D.L., and Y.H. Chou. "PCA Crystallization of Micron Pharmaceutical Particles." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Tomakso, D.L., and Y.Wang. "Fluorescence Microscopy of Polymer Impregnation Using Supercritical Fluids." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Tomasko, D.L., M. Elkovitch, and L.J. Lee. "Poster Presentation: Supercritical Fluid Assisted Polymer Blending." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Tomasko, D.L., and R. Humayun. "Adsorption Behavior of Supercritical Fluid Solutions." 1998 Midwest Thermodynamics & Statistical Mechanics Conference. Notre Dame, Indiana. May 1998.

Tomasko, D.L., M. Elkovitch, and L.J. Lee. "Supercritical Fluid Assisted Polymer Blending." Society of Plastics Engineers ANTEC. Atlanta, Georgia. April 1998.

Tomasko, D.L., M. Elkovitch, and L.J. Lee. "Viscosity Reduction of Polymers by the Addition of Supercritical Carbon Dioxide in Polymer Processing." Society of Plastics Engineers ANTEC. Atlanta, Georgia. April 1998.

Yang, S.-T., A.L. Kneidel, H. Shim, and W. Baraoidan. "Trichloroethylene Bioremediation by *Mythylosinus trichosporium* Immobilized in a Fibrous-Bed Bioreactor." First International Conference on Remediation of Chlorinated & Recalcitrant Compounds. Monterey, California. May 18-21, 1998.

Yang, S.-T., and Tay. "Fungal Fermentation Process for Production of L(+)-lactic Acid from Starch Using Fibrous Bed Bioreactor." IFT Annual Meeting. Atlanta, Georgia. June 20-24, 1998.

Yang, S.-T., and Y. Huang. "Metabolic Engineering of *Propionibacterium acidipropionici* for Enhanced Propionic Acid Fermentation." ACS Annual Meeting. Boston, Massachusetts. August 23-27, 1998.

Yang, S.-T., T. Ma, and D. Kniss. "Human Trophoblast Tissue Engineering: ECM Formation, Cell Proliferation, and Differentiation in a 3-D Culture System." ACS Annual Meeting. Boston, Massachusetts. August 23-27, 1998.

Yang, S.-T., C. Chen, Y.-L. Huang, M. Black, R. Schatzman, and R. Snodgrass. "Continuous Production of Developmental Endothelial Locus-1 (Del1) in an Optimizer Bioreactor Packed with a Fibrous Matrix." ACS Annual Meeting. Boston, Massachusetts. August 23-27, 1998.

Yang, S.-T., T. Ma, and H. Zhu. "Development and Design Considerations of a Fibrous-Bed Bioreactor for Three-Dimensional Culturing of Mammalian Cells and Tissues." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Yang, S.-T., C. Chen, and Y.L. Huang. "Controlled Cell Immobilization/Adhesion in Fibrous-Bed Bioreator for Selective Cell Retention and Long-Term Culturing." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Yang, S.-T., and L.K. Zhang. "A Continuous Nanofiltration Process for the Separation and Recovery of Galacto-Oligosaccharides Produced from Whey Permeate." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Yang, S.-T., and Y. Huang. "Enhanced Propionic Acid Fermentation by Immobilized Cells of *Propionibacterium acdidpropionici*: Kinetics and Metabolic Engineering." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Yang, S.-T., T. Ma, and D. Kniss. "Development of Artificial Human Placenta Model System for Drug Testing: Tissue Engineering Human Trophoblast Cells in a Fiber-Based Bioreactor System." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Zakin, J.L., Z. Lin, Y. Zheng, Y. Talmon, H.T. Davis, and L.E. Scriven. "Comparison of the Effect of Dimethyl and Dicholoro Benzoate Counterions on Drag Reducing and Rheological Behaviors and Microstructures of a Cationic Surfactant." 70th Annual Meeting of Society of Rheology. Monterey, California. October 4-8, 1998.

Zakin, J.L., Z. Lin, Y. Zheng, Y. Talmon, H.T. Davis, and L.E. Scriven. "Influence of Counterion to Surfactant Ratio on Viscoelasticity Drag Reduction and Microstructure of a Cationic Surfactant System." AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Zakin, J.L., Y. Zheng, Z. Lin, Y. Talmon, L.E. Scriven and H.T. Davis. "Counterion Induced Microstructure Transition in Drag-Reducing Cationic Surfactant CTAC Solution, Seen by Cryo-TEM." American Chemical Society Meeting. Boston, Massachusetts. August 1998.

Zakin, J.L., B. Lu, and Z. Lin. "Transient Stress Behaviors and Microstructures of Drag Reducing Cationic Surfactant Solutions." Mechanics of Non-Linear Materials Symposium. Banff, Alberta, Canada. May 14-15, 1998.

Zakin, J.L., J. Myska and J. Lin. "Similarities and Differences in Drag Reduction Behavior of High Polymer and Surfactant Solutions." International Symposium on Sea Water Drag Reduction. Newport, Rhode Island. July 22-24, 1998.

Zakin, J.L., Z. Lin, Y. Zheng, Y. Talmon, H.T. Davis, and L.E. Scriven. "Comparison of the Effects of Methyl and Chloro Substituted Salicylate Counterions on Drag Reducing and Rheological Behavior and Microstructures of Cationic Surfactants." 5th European Rheology Conference. Portoroy, Slovenia. September 6-11, 1998.

Organizers and Session Chairs of National and International Meetings

Bakshi, B.R. Session Chair, Computer Integrated Manufacturing in the Chemical Process Industries, AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Bakshi, B.R. Session Chair, Chemical Process and Controller Performance Monitoring, AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Brodkey, R.S. Co-Chair, MUFMECH Midwestern Universities Fluid Mechanics Retreat. Rochester, Indiana. April 16-18, 1998.

Chalmers, J.J. Meeting Co-Chair, Cell Culture Engineering VI. San Diego, California. February, 1998.

Chalmers, J.J. Session Co-Chair, Scientific and Clinical Applications of Magnetic Carriers. Cleveland, Ohio. May 28-30, 1998.

Cox, K.R. Topical Conference Co-Chair, Applying Molecular Modeling and Computational Chemistry, AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Cox, K.R. Session Co-Chair, Plenary Session: Advances in Molecular and Materials Modeling, AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Cox, K.R. Session Co-Chair, Poster Session: Applying Molecular Simulation and Computational Chemistry, AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Cox, K.R. Session Chair, Plenary Session: Educational Initiatives in Computational Chemistry, AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Cox, K.R. Session Co-Chair, Plenary Session: Advances in Molecular and Materials Modeling, AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Davis, J.F. Session Chair, Intelligent Systems Process Operations, AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Feinberg, M. Session Chair, Reactor Modelling and Simulation II, International Symposium on Chemical Reaction Engineering ISCRE 15. September 1998.

Koelling, K.W. Co-Chair, MUFMECH 25th Annual Midwestern Universities Fluid Mechanics. Rochester, Indiana. April 16-18, 1998.

Koelling, K.W. Session Co-Chair, Polymer Processing and Rheology, AIChE 1997 Annual Meeting. Miami Beach, Florida. November 1998.

Lee, L.J. Session Co-Organizer and Co-Chair, 14th International Polymer Processing Society Annual Meeting. Yokohama, Japan. June 1998.

Lee, L.J. Session Co-Chair, AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Ozkan, U.S. Chair and Organizer, Hydrodenitrogenation and Hydrodesulfurization Catalysis, 215th National Meeting of the American Chemical Society. Dallas, Texas. March 1998.

Ozkan, U.S. Program Chair and Executive Committee, Second World Congress of Environmental Catalysis. Miami Beach, Florida. November 1998.

Ozkan, U.S. Chair and Organizer, Lower Alkane Oxidation, 217th National Meeting of the American Chemical Society. Anaheim, California. March, 1999.

Ozkan, U.S. Chair and Organizer (in preparation), Fundamentals of Oxide Catalysis, AIChE 1999 Annual Meeting. Dallas, Texas. November 1999.

Tomasko, D.L. Session Co-Chair, Particle Synthesis in Liquid Dispersions and Supercritical Fluids, AIChE 1998 Annual Meeting. Miami Beach, Florida. November 15-20, 1998.

Zakin, J.L. Chair, Two Sessions on Surfactants, 5th European Rheology Conference. Portoroz, Slovenia. September 6-11, 1998.

Editorial Boards, National Committees and Other Professional Activities

Bakshi, B.R. Reviewer: National Science Foundation (CTS), AIChE Journal, Computers & Chemical Engineering, Industrial & Engineering Chemistry Research, Journal of Chemometrics, Journal of Process Control, Technometrics.

Brodkey, R.S. Vice Chair and Treasurer, U.S. National Committee-Theoretical and Applied Mechanics. Retired from membership in September 1998.

Brodkey, R.S. Member, North American Mixing Forum (NAMF).

Chalmers, J.J. NSF SBIR Review Panel. 1998.

Cox, K.R. Editorial Board, Fluid Phase Equilibria. 1991 to present.

Cox, K.R. Chair, AIChE Programming Group I, Fundamentals of Engineering Science. 1996-99.

Cox, K.R. Co-Founder and Discussion Co-Chair, AIChE Discussion Group on Applications of Computational Chemistry. 1992 to present.

Davis, J.F. President, Board of Trustees, CACHE Corporation. Elected 1998.

Davis, J.F. Member, Honeywell Abnormal Situation Management Consortium. Elected 1998.

Davis, J.F. Project Subcommittee, Honeywell Abnormal Situation Management Consortium.

Davis, J.F. 2nd Vice President, Computing and Systems Technology Division, AIChE. Elected 1998.

Fan, L.-S. Regional (USA) Editor, Powder Technology - An International Journal, Elsevier Science Publishers. January 1, 1991, to date.

Fan, L.-S. Consulting Editorial Board, AIChE Journal. January 1994 to date.

Fan, L.-S. Editorial Board, International Journal of Multiphase Flow. July 1997 to date.

Fan, L.-S. Editor-in-Chief, Book Series on Particle Technology, Noyes Publications, Noyes Data Corporation. 1994 to date.

Fan, L.-S. Editor, Handbook Series on Particle Technology, Elsevier Science Publisher, 1998 to date.

Fan, L.-S. Reviewer: AIChE Journal, National Science Foundation, Chemical Engineering Science, Powder Technology, International Journal of Multiphase Flow, U.S. Department of Energy, Industrial &Engineering Chemistry Research, Experiments in Fluid, etc.

Fan, L.-S. Group 7E - Multiphase Flow, Member, 1989-date, Chair, 1992-to date; Group 7C - Multiphase Heat Transfer, Chair, 1994-to date; Particle Technology Forum (PTF), Founding Chairman, 1992-1994; Education Committee, 1996-to date; Fluidization and Multiphase Group of PTF Advisory Subcommittee, Chairman, 1992-to date. Division 7 - Heat Transfer and Energy Conversion, Director, 1992-1998, Division Award Committee, 1993-1995; Donald P. Kern Award Committee, 98-99.

Fan, L.-S. Director, Ohio State University Coal Research Program.1987 to date. (Program theme: Dry sorbent injection technology for air pollution control in coal combustion).

Fan, L.-S. Member, Council for Chemical Research, Inc. July 1994 to date.

Fan, L.-S. Member, Advisory Committee, New Jersey Institute of Technology Particle Technology Center. 1996 to date.

Fan, L.-S. Conference Co-Organizer, 9th International Fluidization Conference. Tamarron Resort, Durango, Colorado. May 17-22, 1998.

Fan, L.-S. Member, Advisory Board to the President and the Provost, The Ohio State University. June 1996 to date.

Fan, L.-S. Judge, State Science Fair (Ohio) for Junior and Senior High Schools in the State of Ohio. April 18, 1998.

Fan, L.-S. Member, NSF Panel: Major Research Instrumentation Program. May 11, 1998.

Fan, L.-S. Member, NSF Panel: Combined Research Curriculum Development Program, July 9-10, 1998.

Fan, L.-S. Chair, Fluidized Bed Reactors Session, 15th International Symposium on Chemical Reaction Engineering (ISCRE-15). September 12-15, 1998.

Feinberg, M. Program Coordinator, 15th International Symposium on Chemical Reaction Engineering (ISCRE-15). September 12-15, 1998.

Lee, L.J. Editorial Board, Journal of International Polymer Processing. 1991 to date.

Lee, L.J. Editorial Board, Science and Engineering of Composite Material Journal. 1992 to date.

Lee, L.J. Director, NSF Center for Advanced Polymer and Composite Engineering. 1997 to date.

Lee, L.J. Member, Board of Trustees, Edison Polymer Innovation Corporation. 1998 to date.

Lee, L.J. U.S. Member, U.S.-Israel-Turkey Chemical Engineering Workshop. March 1999.

Lee, L.J. Panel Reviewer, National Science Foundation.

Lee, L.J. Proposal Reviewer: National Science Foundation, Department of Defense, Army Research Office, ACS Petroleum Foundation, Department of Energy, Ohio Department of Development (Edison Program), Hong Kong Research Grants Council, and Kuwait University Research Office.

Lee, L.J. Paper Reviewer for many technical journals in the field of polymer and chemical engineering.

Ozkan, U.S. Member and USA Representative, International Union of Pure and Applied Chemistry (IUPAC), Commission I.6 on Colloid and Surface Chemistry, including Catalysis. 1995-2000.

Ozkan, U.S. Secretary, Petroleum Chemistry Division, American Chemical Society. 1997-1998.

Ozkan, U.S. Co-Chair, Continuing Symposia in Catalysis, American Chemical Society Colloids and Surface Chemistry Division. 1994-2000.

Ozkan, U.S. Program Chair and Executive Committee, 2nd World Congress on Environmental Catalysis. Miami Beach, Florida. November, 1998.

Ozkan, U.S. Guest Editor, Catalysis Today. 1995-98.

Ozkan, U.S. Panel Reviewer, National Science Foundation POWRE Program.

Ozkan, U.S. Proposal Reviewer: National Science Foundation, Department of Energy, and American Chemical Society Petroleum Research Fund.

Ozkan, U.S. Reviewer: Journal of AIChE, Applied Catalysis, Journal of Catalysis, Chemical Engineering Communications, Catalysis Letters, Journal of Electrochemical Society, Journal of Materials Research, Industrial & Engineering Chemistry Research.

Rathman, J.F. Associate Editor, Journal of American Oil Chemists Society (JAOCS).

Rathman, J.F. Member: AICHE, ACS, ASEE.
Tomasko, D.L. Vice Chair, AIChE Area 1f: High Pressure. Elected 1997.

Tomasko, Member: AIChE, ACS, International Society for the Advancement of Supercritical Fluids.

Yang, S.-T. Director, Ohio Bioprocessing Research Consortium.

Zakin, J.L. ABET Accreditation Panel.

Zakin, J.L. Editorial Board, Chemical Engineering Research Compendium.

Zakin, J.L. Registered Professional Engineer, Ohio.

Honors and Awards

Bakshi, B.R. Faculty Early Career Enhancement (CAREER) Award, National Science Foundation. 1998.

Brodkey, R.S. A session in the fluid mechanics section was held in honor of Prof. Brodkey's 70th Birthday.

Chalmers, J.J. Annual Research Accomplishment Award, College of Engineering. 1998.

Davis, J.F. Promoted to Interim Chief Information Officer, Ohio State University. Management responsibility for central technology operations-550 staff and students, $30+ million annually.

Fan, L.-S. Powder Technology Journal Festschrift, volume 100, nos. 2,3. December 1998.

Fan, L.-S. Lumley Research Award, College of Engineering. 1998.

Fan, L.-S. ASEE Chemical Engineering Division Union Carbide Lectureship Award. 1999.

Fan, L.-S. Clara M. and Peter L. Scott Faculty Award for Excellence in Engineering Education. The Ohio State University. 1999.

Feinberg, M. McQuigg Award for Excellence in Undergraduate Teaching, College of Engineering, The Ohio State University. May 1999.

Koelling, K.W. National Science Fellowship/Lucent Technologies Industrial Ecology Research Fellowship. 1997-99.

Lee, L.J. Best Paper Award, Processing Category, 53rd Annual Conference of the Society of Plastics Industry. Nashville, Tennessee. January 1998.

Lee, L.J. Maro Future Technology Award, 1998 SPE ANTEC Meeting. Atlanta, Georgia. April 27, 1998.

Lee, L.J. Honorary Professor of East China University of Science and Technology. Shanghai, China.

Ozkan, U.S. Distinguished Scholar Award, The Ohio State University. 1999.

Ozkan, U.S. Professional Progress Award, College of Engineering, Iowa State University. 1999.

Ozkan, U.S. Outstanding Research in Catalysis Award, Pittsburgh-Cleveland Catalysis Society. 1998.

Ozkan, U.S. Emerging Academic Leaders Program Award, The Ohio State University. 1998.

Tomasko, D.L. Maro Publications Future Technology Award, 1998 SPE ANTEC Meeting. Atlanta, Georgia. April 27, 1998.

Yang, S.-T. Visiting Professor, Swiss Federal Institute of Technology at Lausanne (EPFL). March 1998 to June 1998.

Zakin, J.L. Distinguished Visiting Professor Award, Mexican Academy of Sciences and the Mexico-USA Foundation for Science. 1998-99.
Zakin, J.L. Career Services Award, The Ohio State University. 1998.

Zakin, J.L. "Chemical Structure Effects on Drag Reduction, Rheology, Micellar Structure and Microstructure of Cationic Surfactants," American Chemical Society Petroleum Research Fund - $60,000. 1998-2000.

Zakin, J.L. "Environmental Studies in Complex Fluids and Urban Runoff" Inderdisciplinary Seed Grant Proposal, ($400,000 with F. Schwartz and J.R. Rathman). Of this, $41, 750 awarded to J.L. Zakin and R.N. Christensen, "Development of Environmentally Benign Surfactant Drag Reducing Additives for Reducing Energy Losses in District Heating or Cooling Systems: Techniques to Improve the Heat Transfer to their Solutions and Correlation of Viscoelastic Character and Microstructures with Drag Reducing Ability." 1997-99

Zakin, J.L. "Turkey-Israel-US Chemical Engineering Workshop," NSF Travel Grant ($60,250 2/1/99-7/31/99) – J.L. Zakin is US Coordinator.

Zakin, J.L. Interdisciplinary Seminar Series, "Probing Complex Fluids: Relationships Between Physical Properties and Microstructures." ($10,000 1997-99).

Zakin, J.L. Interdisciplinary Seminar Series on Environmental Studies in Complex Fluids and Urban Runoff. ($5,000 1997-99).

Zakin, J.L. IPNS Research Award for 6 days of experiments at Argonne's SAND Instrument for "SANS Study of Drag Reducing Cationic Surfactant Systems."

Zakin, J.L. Philippine Overseas Sandwich Program of Engineering and Science Education Project (ESEP).

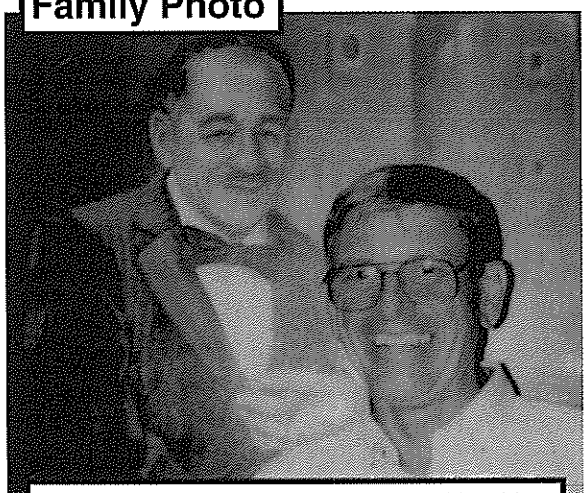
Zakin, J.L. MITI, Mechanical Engineering Lab Grant for Consumeable Chemicals and Software.

Zakin, J.L. "Reducing Energy Costs in District Heating Systems" U.S. Agency for International Development. ($150,000 1991-99).

Zakin, J.L. Student Award: Wilfredo Morales – Owens Corning Senior Honors Research Award.

Zakin, J.L. Invited Keynote Speaker at European Working Party on Drag Reduction Meeting in Prague, September 15-17, 1999.

Family Photo



Tom Koffolt visits the Department and has his photo taken with his father's portrait

Budget	PI/Title/Sponsor	Project Period
$15,000	**Bakshi, B.R.** Multiscale Analysis & Modeling. DuPont Educational Aid Program	07/01/97 – 06/31/98
$210,000	**Bakshi, B.R.** Data Rectification, Process Monitoring, Fault Diagnosis and Their Identification by Multiscale Emperical Modeling. National Science Foundation	06/01/98 – 05/31/02
$80,000	**Brodkey, R.S., and Y. Guezennec** Flow Visualization of Forced and Natural Convection in Internal Cavities. University of Idaho	09/15/97 – 09/14/00
$60,000	**Brodkey, R.S.** Validation of DNS, Development of LES, and CFD Modeling of an Opposed Jet Mixer Based on Time-Resolved, Full-Field, Velocity Vector Measurements And the Extension to Impeller Driven Mixing Vessels Viewed from a Rotating Frame of Reference. ACS-PRF	07/01/99 – 09/30/01
$70,000	**Brodkey, R.S., J.J. Chalmers, and Y. Guezennec** Using Time-Dependent Mixing in Stirred Vessels to Optimize Mixing Processes and to Minimize Waste in Reactive Systems. NSF Combined GOALI Environmental and Equipment Grant	07/01/99 – 09/30/00
$66,000	**Chalmers, J.J., and M. Zborowski** Development of Analog Cell Separation Based on Surface Marker Density. Whitaker Foundation	04/97 – 04/98
$514,902	**Chalmers, J.J., and M. Zborowski** Cell Separation by Magnetic Flow Sorting. National Cancer Institute	03/97 – 01/00

$375,000	**Chalmers, J.J., and M. Zborowski** Magnetic Flow Sorting for Clinical Stem Cell Isolation. NOVAMEDICS	05/98 – 11/98
$460,180	**Chalmers, J.J., and M. Zborowski** Determination of Cellular Properties Based on the Distribution of Cell Velocities Induced by External Fields. NSF	09/98 – 07/01
$70,000	**Chalmers, J.J., R.S. Brodkey, and Y. Guezennec** Using Time-Dependent Mixing in Stirred Vessels to Optimize Mixing Processes and to Minimize Waste in Reactive Systems. NSF Combined GOALI Environmental & Equipment Grant	07/99 – 09/00
$100,000	**Chalmers, J.J., J. Rathman, and K. Cox** Improved Surfactants for Cell Culture. NIH SBIR with Anatrace, Inc.	01/98 – 12/98
$22,360	**Chalmers, J.J.** Characterization of Bench and Pilot Scale Bioreactors with Respect to their Hydrodynamic Environment. Genentech, Inc.	10/97 – 08/98
$750,000	**Fan, L.-S.** Bubble Dynamics at High Pressures and High Temperatures. U.S. DOE/Air Product	09/95 – 09/00
$160,000	**Fan, L.-S.** Flow Structures in Slurry Bubble Columns. U.S. DOE/Washington University	09/95 – 09/98
$300,000	**Fan, L.-S.** Transport Phenomena of High Temperature/High Pressure Gas-Liquid-Solid Fluidized Beds. NSF	04/96 – 04/99
$150,000	**Fan, L.-S.** Particulates and Multiphase Flow Research. Industrial Consortium	01/98 – 12/98
$450,000	**Fan, L.-S.** SO_2 and Air Toxics Control Using Calcium-Based Sorbents. Ohio Coal Development Office	08/97 – 07/99

$135,000	**Fan, L.-S.** Kinetics of $FeCl_2$ Oxidation in Ultrafast Reactor. DuPont Chemicals	03/97 – 02/98
$160,000	**Fan, L.-S.** Hydrodynamics of Slurry Bubble Columns. U.S. DOE/Washington University	09/99 – 09/02
$295,000	**Fan, L.-S.** High Pressure Gas-Liquid-Solid Fluidization. NSF	07/99 – 06/02
$217,356	**Feinberg, M.** The Behavior and Design of Reactors with Complex Chemistry. NSF	09/01/96 – 08/31/99
$50,000	**Feinberg, M.** Optimal Reactor Design from a Geometric Viewpoint. Petroleum Research Fund	08/01/95 – 08/31/99
$1,351,000	**Friedman, M.** Dynamics of Flow-Dependent Arterial Permeability. NIH	04/01/94 – 03/31/00
$1,906,000	**Friedman, M.** Coronary Artery Dynamic Geometry and Atherosclerosis. NIH	04/01/99 – 03/31/04
$5,000	**Friedman, M.** Role of Vessel Geometry and Hemodynamics in Human Coronary Atherogenesis. NATO (Travel Grant)	08/01/96 – 12/31/99
$20,000	**Koelling, K.W.** Extensional Rheology of Polymeric Fluids. DuPont Educational Aid Program	07/01/97 – 06/30/98
$310,000	**Koelling, K.W.** Extensional Rheology of Polymer Melts and Solutions: Impact on Processing. NSF, Faculty Early CAREER Development Program	07/01/96 – 06/30/00

Sponsored Research

$42,442	**Koelling, K.W., and S.E. Bechtel** The Control of Overspray of Agricultural Pesticides: Submillisecond Resolution of Dynamic Surface Tension And Viscosity of Agricultural Surfactant Solutions. OSU Targeted Interdisciplinary Seed Grant Award	03/97 – 12/98
$323,527	**Koelling, K.W., and L.J. Lee** Improvement and Optimization of a Newly Developed Vacuum Infusion Resin Transfer Molding Process (SCRIMP). NSF	06/97 – 05/00
$100,000	**Koelling, K.W., J.A. Stuart and B. Lilly** Models and Instruction for Life Cycle Material Content Decisions. NSF and Lucent Technologies	10/97 – 09/99
$375,000	**Koelling, K.W., L.J. Lee, and T. Luscher** Industry/University Cooperative Research Center (I/UCRC) for Advanced Polymer and Composite Engineering (CAPCE). NSF Industry/University Cooperative Research Center Program	10/97 – 09/02
$25,000	**Koelling, K.W.** Thin Wall Injection Molding of PVC Materials. GEON Company	01/01/98 – 12/31/98
$10,000	**Koelling, K.W.** Advanced Injection Molding of Thermoplastics. Dow Chemical Company	04/98 – 03/99
$190,000	**Koelling, K.W., L.J. Lee, and D.L. Tomasko** Supercritical Fluid Enhanced Polymer and Composite Extrusion. NSF Industry/University Cooperative Research Center Program	10/98 – 09/00
$320,000	**Lee, L.J., and K.W. Koelling** Analysis of Vacuum Infusion Resin Transfer Molding. NSF	07/15/97 – 07/14/00
$60,000	**Lee, L.J., and A. Benatar** Development of Fast Cure Adhesive Materials and Processes. Edison Welding Institute	01/97 – 12/98
$700,000	**Lee, L.J., K.W. Koelling, and T. Luscher** CAPCE Membership Fees Polymer Industry	10/97 – 09/99

$47,000	**Lee, L.J.** Analysis of Prepreg/Autoclave Process. Dow Chemical	08/97 – 07/98
$500,000	**Lee, L.J., K.W. Koelling, and T. Luscher** Operating Grant for an Industry/University Cooperative. NSF	10/01/97 – 09/30/02
$187,500	**Lee, L.J., K. Koelling, and T. Luscher** Center for Advanced Polymer and Composite Engineering. Ohio Board of Regents	10/01/97 – 09/30/99
$60,000	**Lee, L.J.** Study of Polyketones Based LPA. Shell Chemical	02/01/98 – 01/31/99
$250,000	**Lee, L.J., K.W. Koelling, and T. Luscher** Polymer and Composite Engineering. Edison Polymer Innovation Corporation	03/15/98 – 03/14/00
$20,000	**Lee, L.J.** Analysis of Vacuum Infusion Resin Transfer Molding. NSF	04/98 – 03/00
$190,006	**Lee, L.J., D. Tomasko, and K.W. Koelling** Supercritical Fluids Enhanced Polymer Extrusion. NSF	09/98 – 08/00
$350,631	**Lee, L.J., J. Castro, and T. Osswald** A Novel Solventless Approach to Manufacture Pre-preqs And Laminates with Improved Dimensional Consistency For Electronic Applications. NSF	04/99 – 03/02
$203,922	**Lee, L.J., and K.W. Koelling** Analysis of the De-Airing Process in Glass Windshield Lamination. DuPont	09/01/97 – 08/31/00
$5,000	**Lee, L.J.** Interdisciplinary Seminar Series on Frontiers of Polymer and Composite Engineering and Science. OSU Office of Research	1998

Sponsored Research

$330,316	**Ozkan, U.S.** Partial Oxidation of Lower Alkanes. NSF	09/94 – 09/99
$35,000	**Ozkan, U.S.** Lower Alkane Oxidation. Elf-Atochem	10/96 – 04/98
$5,000	**Ozkan, U.S.** Research Experience for Undergraduates. NSF	06/01/97 – 05/31/98
$75,000	**Ozkan, U.S.** Catalytic Simultaneous Reduction of NO_x and SO_2. Ohio Coal Development Office	09/01/98 – 09/01/99
$238,100	**Ozkan, U.S.** Fundamental Studies of OXO Aldehyde Hydrogenation Reactions. Exxon Chemical	12/01/98 – 06/01/00
$240,000	**Rathman, J.** Aqueous Surfactant Solutions as Replacements for Volatile Organic Solvents in Chemical Manufacture. NSF, Environmentally Conscious Manufacturing Program	
$100,000	**Rathman, J., J. Chalmers, and K. Cox** Improved Surfactants for Cell Culture. NIH SBIR with Anatrace, Inc.	01/98 – 12/98
$1,400,000	**Rathman, J., and L.-S. Fan** Consortium for Development and Commercialization of Fine Particle Technologies. Ohio Board of Regents	
$80,000	**Rathman, J., Caffrey, D. Tomasko, and Walker** Environmentally Benign Sorbents for Removal of Toxic Chemicals from Water. OSU Interdisciplinary Seed Grant Program	
$5,000	**Rathman, J., and J.L. Zakin** Interdisciplinary Seminar Series on Environmental Studies in Complex Fluids and Urban Runoff OSU Office of Research	

$108,491	**Tomasko, D.L.** Environmentally Benign Crystallization – Supercritical Fluids As Separable and recoverable Antisolvents, Emission Reduction Research Center. NSF/IUCRC	01/97 – 06/98
$20,000	**Tomasko, D.L.** Crossover Phenomena in Adsorption from Supercritical Fluids. American Chemical Society Petroleum Research Fund	05/96 – 08/98
$190,000	**Tomasko, D.L., L.J. Lee, and K.W. Koelling** Supercritical Fluid Enhanced Polymer and Composite Extrusion. NSF-ECE	10/98 – 09/00
$80,257	**Tomasko, D.L., M. Caffrey, W. Walker, J.F. Rathman** An Environmentally Sensitive Model Using Biocompatible Absorbent Materials for Water Treatment. Ohio State University Targeted Interdisciplinary Seed Grant	04/97 – 12/98
$70,000	**Yang, S.-T.** Novel Metabolic and Process Engineering Approaches for Enhanced Propionic Acid Production from Plant Biomass. Consortium for Plant Biotechnology Research (Dept. of Energy)	09/96 – 08/98
$50,000	**Yang, S.-T.** Development and Scale-Up of an Extractive Fermentation Process for Carboxylic Acids Production from Food Processing Byproducts. Midwest Advanced Food Manufacturing Alliance	10/96 – 02/98
$193,148	**Yang, S.-T.** Artificial Placenta for In Vitro Drug Screening and Toxicology. NIH	04/98 – 03/00
$120,000	**Yang, S.-T.** Galacto-Oligosaccharides Production from Lactose by Immobilized B-Galactosidase. USDA-CSREES	09/98 – 08/00
$20,000	**Yang, S.-T.** Solid-State Fermentation for Amylases Production Using a Novel Spouted-Bed Bioreactor. Midwest Advanced Food Manufacturing Alliance	10/98 – 09/99

Sponsored Research

$60,000	**Zakin, J.L.** Chemical Structure Effects on Drag Reduction, Rheology, Micellar Structure and Microstructure of Cationic Surfactants. American Chemical Society-Petroleum Research Fund	1998-2000
$41,750	**Zakin, J.L., and R.N. Christensen** Development of Environmentally Benign Surfactant Drag Reducing Additives for Reducing Energy Losses in District Heating or Cooling Systems: Techniques to Improve the Heat Transfer to Their Solutions and Correlation of Viscoelastic Character and Microstructures with Drag Reducing Ability. Interdisciplinary Seed Grant Proposal	1997-99
$60,250	**Zakin, J.L.** Turkey-Israel-U.S. Chemical Engineering Workshop. NSF (Travel Grant)	2/1/99 – 7/31/99
$150,00	**Zakin, J.L.** Reducing Energy Costs in District Heating Systems. Agency for International Development	1991-1999

Row 1: Doug Krysiak, Steven Solomon, William Werner, Nicole Voss, Wailok Yee, Gregory Bass, Brian Collett, Erin Conner, Dr. Robert Brodkey

Row 2: Andrew Fisher, Dr. Umit Ozkan, Mike Davis, Amy Bridges, Xiudong Sun, Hung-Tzu Chiu, Gim Pee, Ramya Murali

Row 3: Joshua Looper, Erin Bennett, Shannon Wallace, Imrana Islam, Nicole Johnson, Dr. David Tomasko.

Row 4: Dr. L.-S. Fan, Carrie Chambers, Jeff Craig, Tavip Tobing, Matt Seikel, S.M. Bederul Islam

Row 5: Wen Li, David Bressler, Dr. Jacques Zakin, Todd Yunker, Aravind Asthagiri, Leander Richards

Row 6: Robert Nack, Carl Scott, Jeff Ku, Yani Angsani, Dr. James Rathman

Row 7: Dr. Ken Cox, Shriniwas Chauk, Jang Won Kim, Fadi Idrissi, Fadhel Zammouri, Ed Legenza, Steve Pitrone, Raed Mohamed, Dr. L. James Lee

Chemical Engineering Graduates (1997-98)

Bachelor of Science

August 1997

Nathan A. Albert
Sam S. Ang
James L. Bickett, II
Dawn R. Demko
Paula E. Garcia
Erin L. Glaser (cum laude with distinction)
Prasad A. Gupte
Mitesh A. Kadakia
Wayne A. Pettay, III
Novin Teguh
Jaideep N. Vaidya (cum laude)
She-Chit Wong

December 1997

Jamie A. Deist
Michael J. Wirtz
Bryan C. Wisecup

March 1998

Jonathan S. Piazza
David J. Semersky
Gary O. Spitznogle
Matthew J. Tessman

June 1998

Aravind R. Asthagiri (cum laude)
Matthew G. Aubert (magna cum laude)
Dora Babai
Gregory B. Bass (summa cum laude)
Erin C. Bennett
Kang Chen
Brian R. Collett
Erin S. Conner (cum laude)
Jeffrey B. Craig
Philip R. Dahlstrom
Michael F. Davis
Jason T. Ebin
Brian E. Hawkins (cum laude with distinction)
Ronald M. Howard, Jr.
Shawn W. Hull
Nicole Johnson
Douglas T. Krysiak
Edward J. Legenza
Raed M. Mohamed
Robert B. Nack
Gim Yang Pee
Stephen A. Pitrone
Sue A. Purvis
Sultane R. Salim
Stephen F.S. Sarmiento
Jesse M. Sawyer
Matthew B. Schmidt
Amy M. Skolmowski
Kevin A. Snyder
Steven J. Solomon
Michael T. Timko (summa cum laude with distinction)
Tavip Tobing
Kevin R. Turco
Shannon L. Wallace
William M. Werner
Nicole D. Williams
Wailok Yee
Fadhel Zammouri

Master of Science

Zafar Ali J.F. Davis
"On-Line State Estimation in Intelligent Diagnostic Decision Support Systems for Large Scale Process Operations"

Yani Angsani J.F. Rathman
"Design of Silica Mesostructures Using Simple Organic Additives and the Synthesis of Mesoporous Film at Liquid/Liquid Interfaces"

Abdu Y. Bunch U.S. Ozkan
"An Investigation of the Indole Hydrodenitrogenation Network over Nickel-Molybdenum and Molybdenum Sulfide Catalysts"

Kristin R. Cutright K.W. Koelling
"Experimental Verification of C-Mold and Effects of Complex Gas Channels on Mold Filling and Mechanical Properties for Gas-Assisted Injection Molded Parts"

Mark D. Elkovitch L.J. Lee and D.L. Tomasko
"Supercritical Fluid Assisted Polymer Blending"

Elpiniki Gregoriades J.J. Chalmers
"Cell Damage in Microcarrier and Suspended Cultures of Chinese Hamster Ovary Cells in an Extensional Flow as a Function of Local Energy Dissipation"

Amit Jain

Yi-Je Juang L.J. Lee
"Analysis of De-Airing Process in Windshield Manufacturing"

Amy L. Kneidel S.-T. Yang
"Biodegradation of Trichoroethylene by Methylosinus trichosporium OB3b Immobilized in a Fibrous Bed Bioreactor"

Cesar J. Mauras J.J. Chalmers
"Quantification of Biofilms Using Confocal Microscopy and Image Analysis"

Mohamed N. Nounou B.R. Bakshi
"On-Line Multiscale Rectification of Process Data with Gaussian and Non-Gaussian Errors without Process Model"

Minesh R. Tendulkar K.W. Koelling
"Gass Bubble Dynamics in Viscous Newtonian Fluids under Non-Isothermal Conditions"

Zhifeng Wang J.F. Rathman
"Application of Lecithin to the Biotransformation of Cholesterol to ADD/AD"

Hong Wu J.F. Davis

Doctor of Philosophy

Rajeev Agnihotri L.-S. Fan
"High Reactivity Ca-Based Sorbents for SO_2 and As_2O_3 Removal at Elevated Temperatures: Experimental & Modeling"

Hung-Tzu Chiu L.J. Lee
"CV/FEM Simulation of Composite and Polymer Processing"

John D. Clay K.W. Koelling
"Molecular Degradation of Polymer Solutions in a Fast Transient Extensional Flow"

Zuwei Jin S.-T. Yang
"Continuous Extractive Fermentation Using Hollow Fiber Membrane Extractors for Enhanced Propionate Production"

Wen Li L.J. Lee
"Integrated Analysis of Low Profile Unsaturated Polyester Resin Cured at Low Temperatures"

Xukun Luo L.-S. Fan
"High Pressure Three-Phase Fluidization: Hydrodynamics and Transport Phenomena"

Liping Sun J.J. Chalmers
"Immunomagnetic Cell Separation"

Xiudong Sun L.J. Lee
"Analysis of Vacuum Assisted Resin Transfer Molding"

American Institute of Chemists
Outstanding Senior
James W. Holder

Outstanding Graduate Student
Rick B. Watson

Outstanding Postdoctor
Yang Zhao

ChE Department Awards
Oustanding Sophomore Award for Academic Excellence
Shawn Bruggemeier

Outstanding Senior Award for Academic Excellence
Shannon M. Novosad
Andrew T. Fisher
Samir Verma

Outstanding Senior Award for Research
Gregory B. Bass

Outstanding Graduate Award for Academic Achievement
Xiudong Sun

Outstanding Postdoctoral Award for Research Excellence
Gurkan Karakas
Yasuo Kawaguchi
Suhas Mahuli

Fellowship and Scholarship Students

Alcoa
Michael Koob

Harold Almen Scholarship
Jonathan Kiel

Amoco Scolarship
Ricky Gray
Daniel Schneider
Phillip Smith

Aristech Scholarship
James Holder
Lorie Burgess

Ashland Oil Scholarship
Marcin Telko
Erin Wehlage

Paul Bates Scholarship
Anita Nuckols
Dameon Medley

Class of 1941 Fund
Jason McComas
Michelle Gunyula
Molly Simenz

Dow Chemical Scholarship
Christopher Gygax

Dow Outstanding Junior Award
Brian McLain

Dorothy J. & Herbert L. Fenburr Scholarship
Peter Kern
Heather King
Alison Mahood

David H. George Scholarship
Kevin Good
Mohamadou Sarr
Clayt Robinson
Evan Wagner
Benjamin Wakefield

Allan I. Gordon Scholarship
Timothy Denison
Jennifer Drignat

Raymond D. Hammond Scholarship
Shawn Brueggemeier
Elaina Carpino
Carrie Chambers
Kevin Dalley
Matthew Ehlerding
Paul Matter
Shannon Novosad
Lisa Ringler
Samir Verma

Todd Harris Memorial Scholarship
Stacy Reinhart

William R. & Doris M. Harris Scholarship
Stanley Caldwell
Christine Dannemiller
Tania Espinas
John Gilbert
Gunartiria Karim
Jennifer Sellman

John Hoge Scholarship
Bryan Kosters
David Luchtenberg
Austin Partee

The Smith Howland and Aristech Chemical Corp. Scholarship
Rebecca Morbitzer
Tedilea Watts

Webster B. Kay Scholarship
Abraham Middleton
Vanessa Guscoff

Lubrizol Foundation Scholarship
Kevin Woleab

Proctor & Gamble Scholarship
Jeremy Merling

Aldrich Syverson Scholarship
Debra Jakielski
Christopher Legge

Union Carbide Scholarship
Benjamin Buss
Shannon Ryan

Harry B. Warner Scholarship
Stephen Cummings
Craig Lytle
Shellie Porter
Jason Vititoe

William H. Whirl Scholarship
Leslie Crook

James R. Withrow Memorial Scholarship
Tricia Brewer
Vivi Dana

Bhavik Bakshi

Wen-Shian Chen (w/Fan)	PhD
Travis Horstman	MS
Oscar Lara (w/Chalmers)	PhD
Mohamed Nounou	PhD
Ramon Strauss	MS

Jeffrey Chalmers

Kristen Comella	MS
Oscar Lara (w/Bakshi)	PhD
Ningning Ma	PhD
Kara McCloskey	PhD

Ken Cox

Patricia Frink	PhD
Regis Geisler	MS
Sumant Kulkarni	MS
Tao Zheng	MS

Jim Davis

Hrishikesh Aradhye	PhD
Magaly Barroeta	MS
Tsz Yan Iky Chan	MS
Michael Elsass	PhD

Liang-Shih Fan

James Bach	MS
Wen-Shian Chen (w/Bakshi)	PhD
Himanshu Gupta	PhD
Raja Jadhav	PhD
Wai Man Lau	MS
Eung Lee	PhD
Santhosh Misro	MS
Guoqiang Yang	PhD

Kurt Koelling

Denitra Bruer	MS
Jose Garcia	PhD
Vishal Gauri	PhD
Xiangmin Han (w/Lee & Tomasko)	PhD
Kai Kang	PhD
Hung Nguyen	MS
Guojun Xu	MS
Hua Wang (w/Lee)	PhD
Yijie Wang	MS
Liyong Yu	PhD

L. James Lee

Xia Cao	PhD
Mark Elkovitch	PhD
Xiangmin Han (w/Koelling & Tomasko)	PhD
Travis Horstman (w/Bakshi)	MS
Yi-Je Juang	PhD
Siyi Lai	PhD
Ling Li	PhD
Ming Li	MS
Chih-Hsin Shih	PhD
Hua Wang (w/Koelling)	PhD
Huan Yang	PhD
Changchun Zeng	MS

Umit Ozkan

Enrique Aceves	MS
Abdu Bunch	PhD
Junko Mitome	PhD
Ramasamy Venkatachalam	MS
Rick Watson	PhD

James Rathman

Yani Angsani	MS
Turgut Battal	PhD
Jeff Clogston (w/Tomasko)	MS
Janine Lawrence	MS
Gim Yang Pee (w/Weavers)	MS
Haiying Zhou	MS

David Tomasko

Jeff Clogston (w/Tomasko)	MS
Xiangmin Han (w/Koelling & Tomasko)	PhD
Raashina Humayan	PhD
Jangwon Kim	MS
Yijie Wang	PhD

Shang-Tian Yang

Chunnuan Chen	PhD
Yan Li	PhD
Jun Luo	PhD
Ying Zhu	PhD

Jacques Zakin

Zhiqing Lin	PhD
Yunying Qi	PhD

Placement Information

Employers that Hired B.S Graduates

Abbot Laboratories	1-IL	Exxon	1-TX
Adsorption Research	1-OH	Foseco, Inc.	1-OH
American Electric Power	1-OH	Goodyear Tire & Rubber	3-OH
Amko Service Co.	1-OH	Guardian Industries	1-NY
Andersen Consulting	1-IL	International Paper	1-SC
Archer Daniels Midland	1-IA	Lincoln Electric Co.	1-OH
Archer Daniels Midland	1-IL	Merck	2-PA
Ashland Chemical	1-CO	Modular Process Systems	1-NJ
Ashland Chemical	1-OH	Montell	1-TX
Ashland Chemical	1-TX	Montell Polyolefins	1-OH
Battelle Memorial Institute	1-OH	Roxane Labs	1-OH
Bechtel Savanah River Co.	1-SC	RWD Technologies	1-OH
BP Oil	1-LA	Superior Graphite	1-IL
Dow Corning Corp.	2-MI	U.S. Patent & Trademark Office	1-DC
Eli Lilly	1-IN	Westinghouse	1-SC

Status of B.S. Graduates (SU 97 - SP 98)

No. B.S. Grads	% Reg'd w/ECS*	% Report Employ.	% to Grad Sch.	% to Military	% Other Plans+	% Seek Employ.	% No Inform.	Avg. An. Salary
57	87.7	64.9	14.0	0.0	7.8	7.0	5.3	$44,229

* Registered with Engineering Career Services
\+ Includes Returned Overseas

Summary of Recruiting Activities

	1997-98	1996-97	1995-96
No. of Employer Divs. Conducting Interviews	92	68	62
No. of Interviews	521	524	373
No. of Resume Requests	79	51	75

Yearly Starting Salaries

	Average	High	Low
1997-98	$44,229	$52,000	$31,500
1996-97	$41,586	$48,000	$27,000
1995-96	$38,356	$46,700	$29,500

Placement data from Engineering Career Services 1998 Annual Report

Summer Quarter 1997

First Term		Enrollment
ChE 630	Unit Operations	44
Second Term		
ChE 694	Group Studies	9
Full Term		
ChE 693	Individual Studies	5
ChE 733	Novel Separations	19
ChE 801	Advanced Special Problems in ChE	5
ChE 881	Seminar in ChE	18
ChE 981	Research Seminar	1
ChE 999	Graduate Research	65

Autumn Quarter 1997

ChE 200	ChE & Process Calculations	52
ChE 489	Professional Practices in Industry	1
ChE 508	ChE Thermodynamics	58
ChE 521	Transport Phenomena II	50
ChE 624	Chemical Process Dynamics & Control	58
ChE 693	Individual Studies	7
ChE 712	Catalysis & Catalytic Processes	19
ChE 760	ChE Economy and Strategy	56
ChE 761	ChE Processes	24
ChE 773	Intro to High Polymer Engineering	39
ChE 812	Advanced ChE Kinetics I	21
ChE 815.01	Advanced Mass Transfer I	22
ChE 981	Research Seminar	1
ChE 999	Graduate Research	63
ChE 999F	Graduate Research	10

Winter Quarter 1998

ChE 200	ChE & Process Calculations	53
ChE 201	ChE & Process Calculations	43
ChE 489	Professional Practices in Industry	1
ChE 509	ChE Thermodynamics	69
ChE 522	Transport Phenomena II	75
ChE 693	Individual Studies	18
ChE 712	Catalysis & Catalytic Processes	7
ChE 717	Colloids & Surfaces	58
ChE 764	ChE Process Design	58
ChE 766	Biotechnology & Bioprocess Engr.	9
ChE 776	Principles of Polymer Conversion Ops.	17
ChE 815.01	Advanced Mass Transfer I	18
ChE 815.08	Advanced Momentum Transfer I	13
ChE 981	Research Seminar	5
ChE 999	Graduate Research	58
ChE 999F	Graduate Research	15

Spring Quarter 1998

ChE 201	ChE & Process Calculations	45
ChE 420	Elements of ChE Transport Phenomena I	88
ChE 520	Transport Phenomena	3
ChE 523	ChE Operations	67
ChE 610	ChE Kinetics	66
ChE 626	Digital Control	54
ChE 693	Individual Studies	8
ChE 733	Novel Separation Processes	9
ChE 750	Profession of Chemical Engineering	56
ChE 762	ChE Process Development	59
ChE 771	Air Pollution	19
ChE 775	Rheology of Fluid	24
ChE 808	Advanced ChE Thermodynamics I	16
ChE 815.05	Advanced Heat Transfer I	11
ChE 881	Seminar in Chemical Engineering	8
ChE 999	Graduate Research	60
ChE 999F	Graduate Research	9

Summer Quarter 1998

First Term		
ChE 630	Unit Operations	50
Second Term		
ChE 694	Group Studies	16
Full Term		
ChE 693	Individual Studies	3
ChE 801	Advanced Special Problems in ChE	1
ChE 881	Seminar in ChE	21
ChE 981	Research Seminar	1
ChE 999	Graduate Research	62

Autumn Quarter 1998

ChE 200	ChE & Process Calculations	53
ChE 489	Professional Practices in Industry	1
ChE 508	ChE Thermodynamics	71
ChE 521	Transport Phenomena II	74
ChE 624	Chemical Process Dynamics & Control	56
ChE 666	Principles of Biochemical Engr.	18
ChE 693	Individual Studies	6
ChE 760	ChE Economy and Strategy	59
ChE 761	ChE Processes	32
ChE 773	Intro. to High Polymer Engineering	33
ChE 801	Advanced Special Problems in ChE	14
ChE 812	Advanced ChE Kinetics I	15
ChE 981	Research Seminar	1
ChE 999	Graduate Research	58
ChE 999F	Graduate Research	9

Course Enrollment

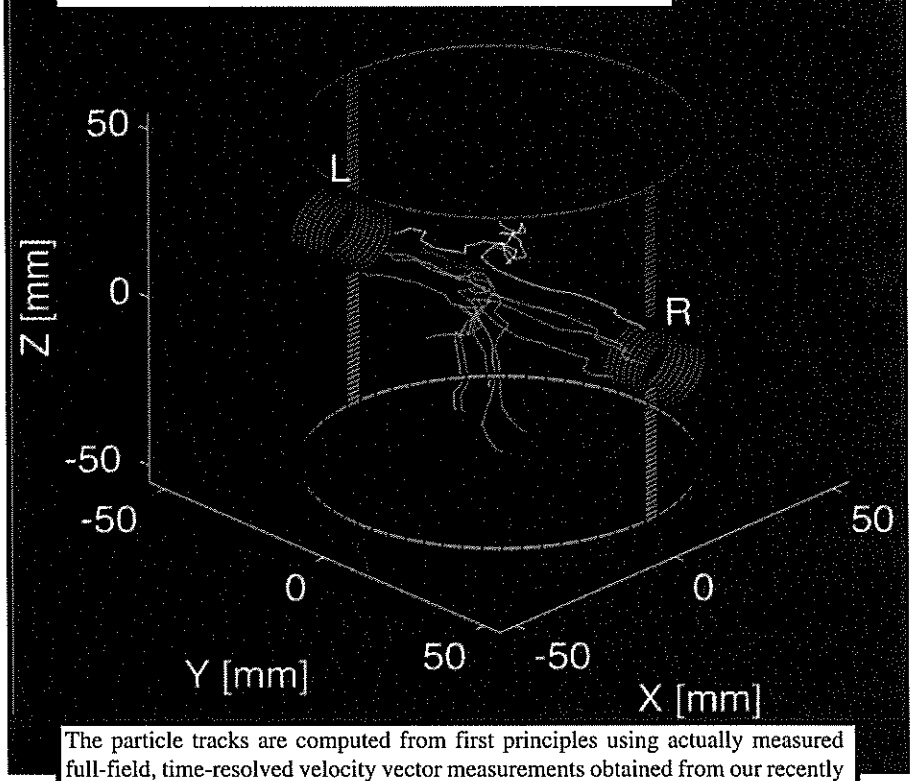
Winter Quarter 1999

ChE 200	ChE & Process Calculations	52
ChE 201	ChE & Process Calculations	44
ChE 489	Professional Practices in Industry	1
ChE 509	ChE Thermodynamics	59
ChE 522	Transport Phenomena II	52
ChE 666	Principles of Biochemical Engr.	42
ChE 693	Individual Studies	14
ChE 764	ChE Process Design	55
ChE 775	Rheology of Fluids	31
ChE 801	Advanced Special Problems in ChE	26
ChE 808	Advanced ChE Thermodynamics I	22
ChE 815.08	Advanced Momentum Transfer I	23
ChE 981	Research Seminar	2
ChE 999	Graduate Research	55
ChE 999F	Graduate Research	17

Spring Quarter 1999

ChE 201	ChE & Process Calculations	41
ChE 420	Elements of ChE Transport Phenomena I	82
ChE 520	Transport Phenomena	1
ChE 523	ChE Operations	56
ChE 610	ChE Kinetics	57
ChE 626	Digital Control	58
ChE 693	Individual Studies	8
ChE 750	Profession of Chemical Engineering	58
ChE 762	ChE Process Development	52
ChE 766	Biotechnology & Bioprocess Engr.	13
ChE 771	Air Pollution	19
ChE 776	Principles of Polymer Conversion Ops.	16
ChE 801	Advanced Special Problems in ChE	2
ChE 815.05	Advanced Heat Transfer I	19
ChE 981	Research Seminar	2
ChE 999	Graduate Research	60
ChE 999F	Graduate Research	9

R.S. Brodkey: Three-dimensional particle tracks in an opposed-jet mixer configuration



The particle tracks are computed from first principles using actually measured full-field, time-resolved velocity vector measurements obtained from our recently developed particle tracking velocimetry system.

1998-99 Department Seminar Speakers

Autumn 1998

September 24	Introduction to New Graduate Students
October 1	Prof. Zhongyao Shen, Tsinghua University, Beijing, China. "Overexpression of Lambda Phage Lysis Genes in E. Coli for Disruption Cell and Recovery Intracellular Products."
October 15	Prof. Robert Simha, Case Western Reserve University, Cleveland, Ohio. "Free Volume Theory: Equation of State of Polymer Melts, Gas Solubility and Transport Properties."
October 22	Prof. John Kardos, University of Washington, St. Louis, Missouri.
October 29	Dr. Robert G. Laughlin, The Procter & Gamble Co., Cincinnati, Ohio. "Thermodynamics of Phase Transition in Aqueous Surfactant Systems."
November 5	Dr. Isamu Kusaka, University of Chicago, Chicago, Illinois. "Molecular Theory of Vapor Phase Nucleation."
November 12	GRIP.
November 19	AIChE (No Seminar).
November 26	Thanksgiving (No Seminar).
December 3	Prof. Alan Hatton, Massachusetts Institute of Technology, Cambridge, Massachusetts. "The Dynamics of Micelle-to-Vesicle Transitions in Mixed Anionic/Cationic Surfactant Systems."

Winter 1999

January 7	Maria Papadki, Massachusetts Institute of Technology. "Towards a Functional Tissue Engineered Cardiac Muscle."
January 14	L.E. Scriven, University of Minnesota. "Liquid is Readily Coated, but Coating Cannot be Liquid."
January 28	Lee Magid, University of Tennessee.
February 4	Talid Sinno, Massachusetts Institute of Technology. "Modeling Microdefect Formation in Crystalline Silicon Growth from the Melt."
February 11	Dan Klingenberg, University of Wisconsin. "Flowing Flexible Fiber Suspensions."
February 18	Steve Foster, EHS, The Ohio State University. "General Hazardous Materials Communication Policy of the Ohio State University."
February 25	Jeff Varner, ETH-Zurich. "The Role of Self-Optimizing Adaptive Cybernetic Models in Metabolic Engineering."
March 2	Christopher Rao, University of Wisconsin. "Moving Horizon Strategies of Constrained State Estimation."

1998-99 Department Seminar Speakers

March 4	Chris MaCosko, University of Minnesota. "Morphology Development During Polymer-Polymer Blending."
March 11	William Miller, Northwestern University. "Effects of Carbon Dioxide and Ammonia on Cell Growth, Metabolism, Protein Production, and Glycosylation."

Spring 1999

April 1	Richard A. Vaia, Air Force Research Laboratory, Polymer Branch, Wright Patersen AFB. "Impact of Mesoscopic Structure on the Behavior of Polymer-Inorganic Nanocomposites."
April 8	H. Henning Winter, University of Massachusetts at Amherst. "Shear Induced Rotation of Liquid Crystal Molecules."
April 15	Ica Manas-Zloczower, Dept. of Macromolecular Science, Case Western Reserve Univ. "Influence of Design on Mixing Performance in Polymer Processing Equipment."
April 22	C. Judson King, University of California at Berkeley. Bill Lowrie's Lecture.
May 6	Howard Brener, Massachusetts Institute of Technology.
May 13	Reg Davis, Particle Technology.
May 20	Jeff Siirola, Eastern Chemical Company. "Industrial Examples of Process Synthesis and Integration."
May 27	Keith Johnston, University of Texas at Austin. "Environmentally Benign CO_2: Colloid and Interface Science."

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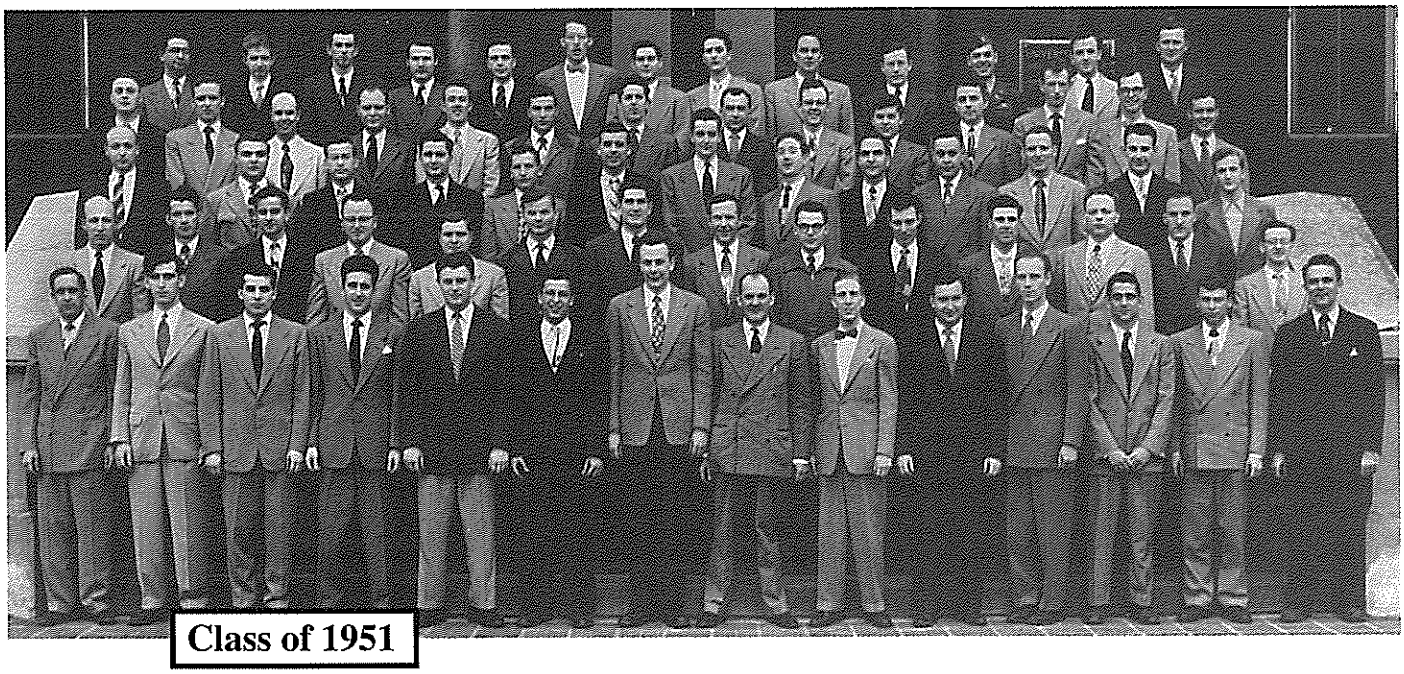

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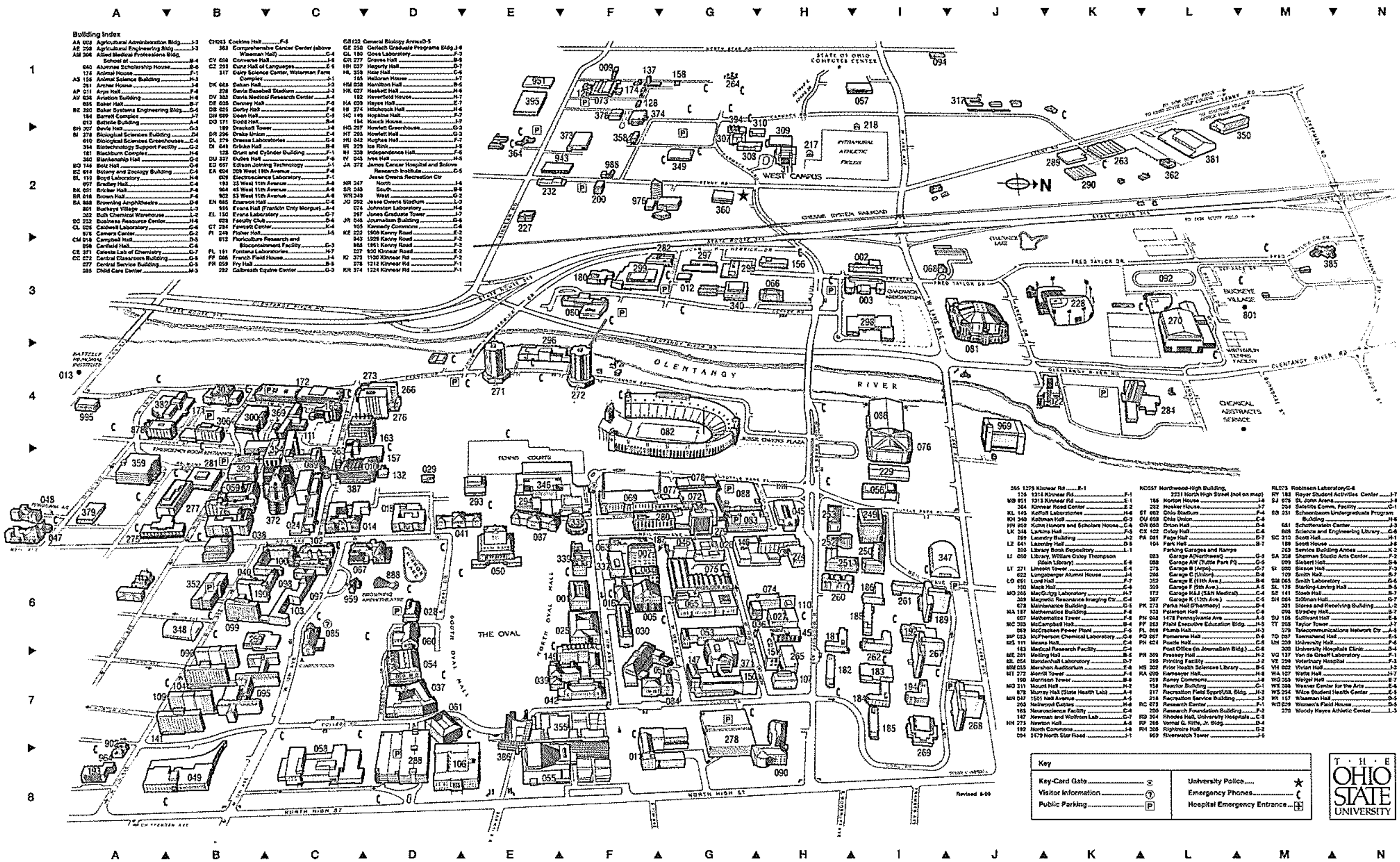

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