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Dear Alumni...

Once again, I am happy to report to you that the Department of Chemical Engineering has had another outstanding year. In this report you will note the numerous awards, presentations, publications, etc., of the faculty and students. We received news recently that Professor Bhavik Bakshi has been selected to receive the prestigious National Science Foundation Career Award for 1998. We are proud that we now have several winners of this award in our Department which proves the status and high esteem in which our young faculty are held by their colleagues. We are also extremely proud of our undergraduate and graduate students who were recognized for their achievements this year. For example, Andrew Fisher and Michael Timko (seniors) won Honorable Mention awards in the area of Engineering at the University Undergraduate Research Forum. Phil Dahlstrom placed second in the Separations and Particle Technology Group at the Undergraduate Research Poster Contest held at the AIChE Annual Meeting in Los Angeles. During the April 1998, campus-wide Graduate Student Research Forum, Chemical Engineering graduate students Raashina Humayun placed first, and Shrinivas Chauk placed second in Engineering, and Julia Bednarck, also a ChemE, placed third in Agricultural Sciences. I am extremely proud of the hard-working, committed faculty, staff and students we have in the Department. I also want to thank all of you who have participated in many ways to aid your Department — whether by donations, service, or encouragement.

The Chemical Engineering Department is the first OSU department to have its own Sexual Harassment and Academic Misconduct policies. Manuals were recently distributed to all faculty, staff, graduate and undergraduate students. This was done so that all would clearly know the Department's policy of intolerance of academic misconduct and sexual harassment and to have clearly defined reporting procedures. The Department of Human Resources also provided a speaker on sexual harassment to explain the University policy and answer questions. This was done in order that our students would enter the workforce fully prepared to address these timely societal issues.

The 1998 William G. Lowrie Lectureship was given by Dr. James Wei, Dean of the College of Engineering and Applied Sciences and Pomeroy and Betty Perry Smith Professor of the Department of Chemical Engineering, Princeton. He gave two outstanding lectures entitled, "The Structures of Multi-Scale Uniformity in Mixtures," and "In Search of a New Compact."

Mike Kukla, our invaluable Design Engineer, whom I know many of you remember, retired at the end of August 1998. We always knew that Mike would retire some day but we were not looking forward to it. Finding someone to fill Mike's shoes is a challenge and thankfully, he has agreed to help us during the transition. Mike plans to travel while he and his wife are still enjoying good health. The Department had a special luncheon for Mike at the Faculty Club that was very well attended. If any of you have special reminiscences of Mike Kukla or amusing anecdotes, if you will send them to me they will appear in the next newsletter. The CHESS (graduate student organization) issued a special Newsletter edition in Mike's honor. The Reunion Day on September 11 will also be in his honor and the class of 1943. Glen Gifford (ChE '43) spent a lot of time and effort making plans for their special day and expects 15-20 participants from his class. Reunion Day will be held every fall in place of the former ACE Day that was held in May. The College of Engineering is having a special program "Buckeye Reunion Under the Stars" in honor of returning alumni and to present the alumni awards.

Other staff changes in the administrative offices are that we have a new Administrative Associate, Lori Rakovan, who comes to us very experienced in accounting and fiscal and personnel matters and is making a smooth transition in the Department.
Dear Alumni...

We also have had three new faculty positions approved and hope eventually to bring the number of professors in the Department to 16.

Soon you will be hearing news of a newly created OSU Society of Chemical Engineers. The details have not been worked out yet, but ChE alumni, Ron Harris (ChE BS, MS'61), is spearheading this effort and he will be contacting local alumni soon to begin the process. In May, the Class of 1948 celebrated their 50th reunion and visited the Department where they had lunch, tours, and several students and I had the pleasure of bringing them up to date on the Department and what it is like being an undergraduate/graduate student today. We truly enjoyed their company. We learned later, though, that Jack Stewart had intended to come accompanied by his son and granddaughter, but suffered heat stroke during the trip and spent the next two weeks in the hospital.

The following are some highlights of faculty activities:

**Bhavik Bakshi** spent last summer at the Wright Patterson Air Force Base, Materials Directorate, as a Faculty Summer Research Associate.

**Bob Brodkey** continues to be active in teaching fluid mechanics and continues to develop his imaging facility for his research. He also serves as Vice Chair and Treasurer of the U.S. National Committee on Theoretical and Applied Mechanics.

**Jeff Chalmers** co-organized the conference, Cell Culture Engineering VI, sponsored by the Engineering Foundation. He also received a College of Engineering Research Accomplishment Award in 1998.

**Ken Cox** is the Chairman of the AIChE Programming Group, Fundamentals and Engineering Science and on the editorial board of *Fluid Phase Equilibria*. Ken is making significant contribution to the Department through his service on the Safety Committee and student counseling.

**Jim Davis** continues an active research program although he has the additional duties as Associate Provost and Director for University Technology Services. He is also Vice President of the Board of Trustees of the CACHE Corporation, and is very active on the College Curriculum Committee.

**L.S. Fan** was co-organizer of the ninth International Fluidization Conference in Durango, Colorado, in May. His textbook, *Principles of Gas-Solid Flows* was recently published by Cambridge University Press, along with a solution manual. He is also serving on several high-visibility University and College committees and received a 1998 Engineering Lumley Award for Research in 1998.

**Marty Feinberg** joined the faculty in August 1997 as the Richard Morrow Chair Professor from the University of Rochester. He participated in the 1997 "President Gee's Road Scholar's Tour." He has established and taught a new, quite popular course on applied mathematical methods in ChE.

**Kurt Koelling** continues his very active service as adviser to the student chapter of AIChE. He is also Vice-Director of the NSF Polymer Center. He was awarded a National Science Foundation/Lucent Technologies Industrial Ecology Research Fellowship for 1997-1999 and a College of Engineering Lumley Engineering Research Award in 1998.

**Jim Lee** has been extremely busy with setting up the new NSF Industry/University Cooperative Research Center for Advanced Polymer and Composite Engineering (CAPCE) and keeping up with his active research programs. He also won the Society of Plastics Industry best paper award in the Processing Category and the Society of Plastics Engineers' Maro Future Technology Award with Dave Tomasko at their annual conference in 1998.
Dear Alumni...

Umit Ozkan, elected as the National Secretary of the American Chemical Society Petroleum Chemistry Division for 1998, had a very busy year organizing several national and international symposia and conferences, including a four-day ACS Symposium on "Catalytic NOx and SOx Reduction" in Las Vegas and a three-day symposium on "Heteroatom Removal" in Dallas. She chaired the Oxidation Symposium at the 15th North American Meeting of the Catalysis Society. She is also serving as Program Chair of the second World Congress in Catalysis, which will be held in Miami in November 1998. She continues to serve on the AIChE Catalysis and Reaction Engineering Division Board of Directors. Umit was awarded the 1998 Excellence in Catalysis Research Award by the Cleveland-Pittsburgh Catalysis Society. She also spent an extraordinary amount of time as Chair of the 1997-98 Department Faculty Search Committee.

Jim Rathman was an invited speaker at the 1997 Gordon Research Conference in August and served as a Discussion Leader on Chemical Reactions in Self-Assembled Systems. Jim is a member of The Ohio State University Academy of Teaching and is one of our most popular teachers.

Dave Tomasko continues to be a highly effective undergraduate research advisor and gives much time to undergraduate advising. He also is the advisor for all undergraduate students on academic probation, which is a time-consuming activity. He has been active representing the Department's minority interests and in recruitment and is a member of the College Minority Engineering Program Advisory Committee.

S.T. Yang is currently on sabbatical this year. He spent the first part of his leave in Taiwan and Switzerland, while at the same time maintaining an active research program and supervising eight Philippine research scholars. He has been instrumental in the design and assembling of the new distillation column, which will be ready for the unit operations course next year.

Jack Zakin continues to be of great service to the Department as Chair of the Graduate Studies, the Awards, the Space and Allocation and the Promotion and Tenure Committees, all committees that require much time and effort. He was recognized by the Mayor of Columbus, Gregory S. Lashutka, with a plaque for his service to the community in bringing to Columbus the prestigious International Society of Rheology 69th Annual Meeting, for which he and Kurt Koelling were co-Chairs of Local Arrangements. We were also recently informed that Jack will be one of the first recipients of the University Career Services Award. This new award recognizes faculty and staff who contribute much to student career advising.

The faculty are in the process of updating the graduate curriculum and the Ph.D. qualifying examination to further improve the quality of our graduate program. We also recently received news that we will receive more space (3000 ft²) in Koffolt Lab for faculty and research expansion. Research funding continues to remain high at $3.7M this year. For the past year, the Department hosted 12 Philippine graduate students who came to the Department to do the research portion of their Ph.D. program. They will receive their Ph.D. degree in the Philippines. This is an important outreach program in which the faculty is proud to participate.

I am also happy to report that alumni donations have increased and I would like to thank all those responsible for your generosity and encouragement. I hope you all had a good summer and that many of you will try to visit us so we will get a chance to meet.

Best regards,

[Signature]

Liang-Shih Fan, Chair, and
Distinguished University Professor
Each spring, two departments rise to the top and are rewarded for extraordinary teaching. This year, the University Departmental Teaching Excellence Awards will be presented to the departments of Chemical Engineering and History. Both departments will receive a $25,000 annual budget increase from the Office of Academic Affairs and a one-time $1,500 award from the Alumni Association. The Award emphasizes that which ultimately determines the quality of a student's education – collective efforts and a culture that values teaching and learning. The Departmental Teaching Excellence Awards spotlight outstanding performance by many teachers and the staff who support them.

The Department of Chemical Engineering was much honored to receive this award. “We’re very proud to be recognized by the University as a premier department in teaching,” said Liang-Shih Fan, department chair. “Chemical Engineering has a tradition of outstanding teaching.”

Tangible evidence is the loyalty and support of students long after they leave the classroom with diploma in hand. Alumni give thanks in terms of large endowments to the department, he said.

“Our faculty care about students very much, and students remember that. Alumni remember that what they have accomplished professionally came from being a student in the department.”

An important part of excellence is hiring faculty with an unlimited potential to be outstanding teachers, Fan said. The department looks for faculty who are able to interact with students.

What is one of the benchmarks a department chair uses on a day-to-day basis to measure the job being done?

“I talk to the students,” Fan said. “I always brag about my experience at Ohio State,” wrote one student nominator. “The most valuable resources are the faculty. What makes them valuable is their attitude. Faculty act like, and they make you feel like you are one of them.” Another student wrote that the department “excellently prepared me for not only my endeavors in corporate America, but also for life in general.”
Alumni Citizenship Award

Presented to Alumni who have distinguished themselves in service to humanity and who have best exemplified the University’s motto, “training for citizenship,” by having performed significant voluntary service beyond the call of business or professional duty. An evergreen located behind the alumni house was dedicated in 1977 to honor past and future recipients of the Alumni Citizenship Awards. Each year a bronze plaque engraved with names of recipients is embedded at the foot of a tree in the grove. The class of 1927, on the occasion of its 50th anniversary, presented the evergreen grove as a gift to the University.

When asked his thoughts on being chosen for this honor, Dr. Jerry Pausch writes, “I feel just like I’ve felt for the past forty nine years every time ‘The Best Damn Band In The Land’ comes out of that tunnel.

Dr. Pausch graduated from Fairfield High School in Highland County, received his bachelor of Chemical Engineering from Ohio State and his Ph.D. in Analytical Chemistry from Purdue before beginning a distinguished career as a research engineer with BF Goodrich Company.

His expertise and accomplishments include fifty publications, invited lectures, one patent and numerous national recognitions.

This Highland County native did not forget his high school, his community and those who helped him launch his career. In the late 80s, Dr. Pausch funded several OSU scholarships for Fairfield High School science students. Puzzled by the low number of applicants, he looked for an explanation. Drawing on his analytical talents, his network of engineer friends, and his deep desire to make a difference in students’ lives, Dr. Pausch did what he could.

First, he solicited gifts of high-tech equipment for schools of Highland County. Then, he initiated and supported county-wide science technology days in ‘92, ‘94, and ‘96, where 300 high school juniors and seniors experienced two dozen engineering and technical demonstrations by outstanding leaders in the science profession. Finally, he expanded the OSU science Scholarships in number and still stays involved with his scholars via campus visits and e-mail.

As one of his scholars writes, “He has truly impacted my college career by being confident in my abilities as a student and awarding me a two-year Pausch Scholarship in 1994. He deserves much gratitude from those whose lives he has touched.”

Dr. Pausch serves on The Ohio State University Wetlands Park Research Committee, among other such committees. He also developed a database to handle event and team scores for The Ohio Science Olympiad conducted by OSU’s Office of Continuing Education.

He endeavors to continue the tradition established by his parents by continuously looking for opportunities to volunteer his special skills to assist his University, the Highland County community and his profession.

One of his scholars proudly comments on Dr. Pausch’s desire to give to students by saying, “Mr. Pausch does these things not for praise or recognition, but because he has such a big heart.”
Benjamin G. Lamme, ME 1888, achieved international acclaim as a pioneering inventor and engineer for the Westinghouse Electric and Manufacturing Company at Pittsburgh. For 21 years, he served as chief engineer for Westinghouse. Among his 162 patents were new inventions on railway motors, induction motors, converters, and the developments pertaining to the first Niagara Falls power system. In his will he provided that a gold medal be presented annually to a technical graduate of his alma mater for "meritorious achievement in engineering."

Thomas J. Hanratty is the James W. Westwater professor of Chemical Engineering at the University of Illinois. He received a master's degree in chemical engineering from Ohio State in 1950. He earned a bachelor's degree from Villanova University and the Ph.D. degree from Princeton University.

For more than 40 years Hanratty has been a leading researcher worldwide in the area of fluid mechanics and, in particular, turbulence and multiphase flows. Fluid dynamics influence almost every aspect of our daily lives and the success of almost all of our industrial enterprises. The physics is defined by the Navier Stokes equations. However, the application of these equations has been elusive in analyzing turbulent and multiphase flows because of their complexity. A hallmark of Hanratty's work is the breadth of his interests, which have included turbulence, heat and mass transfer, gas absorption, multiphase flows, natural convection, flow in packed beds, reaction systems and electrochemical phenomena.

Hanratty's efforts have resulted in new experimental techniques, new physical insights, and new engineering methods of great value to industrial practice. He is known globally for his engineering research, and his impact on fluid dynamic research has been enormous. Hanratty has published 192 papers in top engineering and physics journals.

For his seminal contributions in these research areas, Hanratty has been recognized by many awards and honors at the highest level. He was elected a member of the National Academy of Engineering in 1974. From the American Institute of Chemical Engineers he received three premier awards: the 1957 Colburn Award for Excellence in Publications by a Young Member of the Institute, the 1967 Professional Progress Award for excellence in the field, and the 1964 William H. Walker Award for distinguished and continuing contributions to chemical engineering education. He also received the Ernest Thiele Award of the Chicago Section. The American Society for Engineering Education (ASEE) awarded him the Curtis W. McGraw Research Award (1963) and the General Electric Senior Research Award. (1986)

Hanratty held the Shell Distinguished Professorship at the University of Illinois from 1981-1986, and was designated University Scholar in 1987. In 1979 Villanova University awarded him an Honorary Doctorate. In 1984 the Ohio State College of Engineering designated him Distinguished Alumnus. He is a fellow of the American Physical Society and the American Academy of Mechanics.
Distinguished Alumnus Award

Distinguished Alumnus Award

The Distinguished Alumnus Awards were established by the faculty of the College of Engineering to recognize distinguished achievement on the part of alumni in the field of engineering or architecture by reason of significant inventions, important research or design, administrative leadership, or genius in production. The College Committee on Honorary Degrees and Honors judges nominations on behalf of the College faculty.

William O. Overton is president of Edison Polymer Innovation Corporation (EPIC) in Akron, Ohio. He earned his master's degree and Ph.D. from Ohio State in chemical engineering in 1952 and 1955. His bachelor's degree in chemical engineering is from Alabama Polytechnic Institute-Auburn.

As president of EPIC, a state-supported research institute, Overton has worked to include the Ohio State polymer program in its industry/university research programs. In his previous role as Technical Director for the Bailey Corporation, from 1987-1995, Overton also encouraged that company's support of Ohio State research efforts in the area of polymers. He also served the Bailey Corporation as Quality Director and Business Manager.

During a long career with Shell Chemical Company, from 1955-1987, Overton managed the Technical Department of the Martinex Chemical Plant and was Research Director-Epoxy Resins and Manager of the Union M.J. Laboratory, Product Development Manager-Industrial Chemicals, Manager-Thermoplastic Rubber/Thermoplastics, and Manager R & D Chemical. As Venture Development Manager at Shell, he was responsible for finding, evaluating and participating in negotiation of polymer-intensive, small-business diversification opportunities.

Overton was a member of the 1948 U.S. Olympic Track Team.
Awards and Recognitions

Lumley Engineering Research Awards

The Lumley Engineering Research Awards go to a select group of outstanding researchers in the College of Engineering who have shown exceptional activity and success in pursuing new knowledge of a fundamental or applied nature. The awards honor alumnus John H. Lumley, CerE ’27. The John H. and Mildred C. Lumley Engineering Endowment Fund was established with $747,000 from the Lumley estate and is intended to promote and enhance research within the College of Engineering. The 1997 recipients from the Chemical Engineering Department are:

Jeffrey Chalmers
Peijun Jiang
James Rathman

Research Accomplishment Awards

The Annual Faculty Research Accomplishment Award was established in 1996 to recognize faculty for a specific, research-related accomplishment of the previous calendar year. The recognition may be for technical, technological and scientific innovations documented by papers, patents, reports, presentations, awards, important research grants, or publication of major research monographs. A maximum number of ten $250 awards are made yearly. The 1997 awardee in Chemical Engineering is:

Shang-Tian Yang

Honor Students

In recognition of their excellent scholastic achievement, of their pace-setting leadership in promoting high standards within the College of Engineering, and in enhancing the prestige of the College, the Engineers’ Council proudly presents the following ChE students for recognition as Honor Students. This distinguished group includes seniors (June 1997-March 1998) in the top 10 percent of their respective academic programs:

Evelyn Kim
Virginia Pankratz
Nicholas Smith
Michael Timko
Michael Triplett

Robert F. Shurtz Freshman Award

The Robert F. Shurtz Freshman Award was established in 1988 with a gift from Robert F. Shurtz. Mr. Shurtz is a 1937 Mining Engineering Graduate of Ohio State. He received the Distinguished Alumnus award from the College of Engineering in 1963, and in 1987, he received the Benjamin G. Lamme Meritorious Achievement Medal. Each year, the award is given to students for outstanding academic work in the freshman year, with emphasis on mathematics.

The 1997 recipient from Chemical Engineering:

Shellie Porter
Faculty and Research Areas

Bakshi, Bhavik, Assistant Professor, Ph.D., M.I.T., 1992. Process Modeling, Operation and Control, Multiscale Methods, Process Monitoring and Diagnosis

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, Jeffrey 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, 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, 1968, Chemical Reaction Network Theory, Reactor Design w/ Complex Chemistry

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

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

Koelling, Kurt W., Assistant Professor, Ph.D., Princeton, 1992. Polymer Processing, Liquid Crystalline Polymers, Biodegradable Polymers, Polymer Rheology and Morphology

Lee, L. James, Professor, Ph.D., University of Minnesota, 1979. Polymer Processing, Composite Manufacturing, and 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., Assistant 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, Associate Professor, Ph.D., Purdue University, 1984. Biochemical Engineering and Biotechnology, Fermentation Processes, and Bioseparation


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Department Faculty and Staff

Professors
Robert S. Brodkey (Emeritus)
James F. Davis
Liang-Shih Fan
Martin Feinberg
Morton H. Friedman (Biomed Eng.)
C.J. Geankoplis (Emeritus)
Edward R. Haering (Emeritus)
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
Jeffrey J. Chalmers
Kenneth R. Cox
Karl Svanks (Emeritus)
Shang-Tian Yang

Assistant Professors
Bhavik R. Bakshi
Kurt W. Koelling
James F. Rathman
David L. Tomasko

Visiting Professor
Roberto Leyva-Ramos
Katsumi Tsuchiya
Wei Qin
Boming Yu

Visiting Scholars
Christopher Howe
Huitang Jin
Jain Ni
Guillaume Rendu

Visiting from the Department of Science and Technology of the Philippines
Michelle Almandrela
Wilheliza Baraoidan
Noel Cabigon
Alvin Capranga

Marilou Dalida
Lucita DeGuzman
Perfecto Dizon
Bonaficio Doman
Jose Gonzaga
Luis Jimenez
Antonio Mateo
Edwin Obra
Ellen San Nicolas
Geraldo Talisic
Sixto Valencia

Research Associate I
Yu Liang Huang
Peijun Jiang
Yasuo Kawaguchi

Post Doctoral Research Associates
Philipp Ellison
Sengjoo Haam
Gurkan Karakas
Yoon-Seob Lee
Suhas Mahuli
Vivek Rohatgi
Yang Zhao

Department Administrative Staff

Academic Advisor
Sherry McDonald

Asst. to the Department Chair
Kathleen Doddroe

Asst. to the Graduate Chair
Jeannie D'Aurora

Administrative Associate
Lori Rakovan *

Design Engineer
Michael Kukla

Instrument Maker
Carl Scott

Program Assistant
Lisa Brown

* Editor of annual report
PUBLICATIONS

Books and Book Chapters


Refereed Papers


Publications and Proceedings

Referred Papers con’t.


Fan, L.S., T. Hong and D.J. Lee, "Force Variations on Particle Induced by Bubble-Particle Collision", Int. J. Multiphase Flow (in press).


Publications and Proceedings

Refereed Papers con’t.


Lee, L.J., and W. Li, Shrinkage Control of Low Profile Unsaturated Polyester Resins at Low Temperature Cure”, *Polymer*, in press.


Refereed Papers con't.

Lee, L.J., L. Li, and X. Sun, "Cure of Vinylester Resins at Low Temperatures", Polymer Engineering & Science, in press.


Refereed Papers con’t.


Yang, S.T., and Q. Zhou, “Biotechnological Control of Air Pollution”, *Shanghai Environmental Sciences*, 16 (12), 6-10 (1997).


Refereed Papers con't.


Proceeding Publications


Publications and Proceedings

Proceeding Publications con’t.


Technical Reports


Publications and Proceedings

Technical Reports con’t.

Cox, K., J.J. Chalmers and J. Rathman. “Improved Surfactants for Cell Culture”, Funded as subcontractor to Anatrace through SBIR program.


Patents


Invited Lectures, Seminars, and Short Courses


Cox, K., "Introducing Molecular Techniques to a Macroscopic World", Seminar at New Mexico State University, Department of Chemical Engineering, Las Cruces, New Mexico, October 24, 1997.

Invited Lectures, Seminars, and Short Courses con’t.


Feinberg, M., Department of Chemical Engineering, University of Wisconsin, January, 1997.

Feinberg, M., Department of Chemical Engineering, Ohio State University, February, 1997.

Feinberg, M., Department of Chemical Engineering, McMaster University, March, 1997.


Publications and Proceedings

Invited Lectures, Seminars, and Short Courses con't.


Tomasko, D.L., "Environmentally Benign Crystallization: Compressed Fluids as Separable and Recoverable Antisolvents", Eli Lilly, Indianapolis, IN (December, 1997). Joint presentation with Barbara Knutson, Univ. of Kentucky.

Tomasko, D.L., "Applications of Supercritical Fluids to Materials Processing", Xerox Research Centre of Canada, Mississauga, Ontario (October, 1997).

Tomasko, D.L., "Materials Processing with Supercritical Fluids I: Processing in the Solid Phase", Tri-State Supercritical Fluids Discussion Group, Cincinnati, OH (October, 1997).


Yang, S.T., "Biodegradation of BTEX and TCE in a Fibrous Bed Bioreactor", Institute of Environmental Engineering, National Central University, Chung-Li, Taiwan, October 13, 1997.

Yang, S.T., "Fibrous-Bed Bioreactor for Fermentations and Animal Cell Cultures", Food Industry Research and Development Institute, Hsin-Chu, Taiwan, October 27, 1997.

Yang, S.T., "Advances in Biotechnology and Bioprocess Engineering for Production of Biopharmaceuticals and Biochemicals", one-day short course sponsored by the Department of Industry, Ministry of Economic Affairs, ROC, Taipei, Taiwan, November 27, 1997.

Yang, S.T., "Metabolic Engineering and Extractive Fermentation for Enhanced Propionic Acid Production from Biomass", Department of Agricultural Chemistry, National Taiwan University, Taipei, Taiwan, December 8, 1997.

Yang, S.T., "Fibrous-Bed Bioreactor for Fermentations and Animal Cell Cultures", Department of Chemical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan, December 11, 1997.
Invited Lectures, Seminars, and Short Courses con’t.


Additional Paper Presentations


Additional Paper Presentations con’t.


Elkovitch, M., L.J. Lee and D.L. Tomasko, "Polymer Blending with the Addition of Supercritical Carbon Dioxide", paper presented at AIChE Annual Meeting, Los Angeles, CA (November, 1997).


Additional Paper Presentations con’t.


Additional Paper Presentations con’t.


Publications and Proceedings

Additional Paper Presentations con’t.


Organizers and Session Chairs of National and International Meetings


Brodkey, R.S., MUFMECH, Midwestern Universities Fluid Mechanics Retreat, chair morning session on general fluids, Rochester, IN., April 11-12, 1997.
Organizers and Session Chairs of National and International Meetings con't.


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; PTF Award Committee 1995-97.

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., Chair, Search Committee for the Dean of the College of Engineering, The Ohio State University, 1996-97.

Koelling, K.W., Co-Chair of Local Arrangements Committee: Fall 1997 Annual Meeting of Society of Rheology held in Columbus, Ohio, October 18-23, 1997. (Attended by 315 people from 15 countries.)

Koelling, K.W., Session Co-Chair - American Institute of Chemical Engineering Annual Meeting, “Polymer Processing and Rheology”, Los Angeles, CA, November 1997.

Lee, L.J., Session Co-Chair, AIChE Annual Meeting.

Lee, L.J., Technical Program Chair of AIChE Group 8f.


Ozkan, U.S., Second World Congress on Environmental Catalysis, Miami Beach, FL, November 1998 (Program Chair and Executive Committee). (International)


Ozkan, U.S., Recent Developments in NOx and SOx Removal, 213th National Meeting of the American Chemical Society, Las Vegas, Nevada, September 1997 (Chair and Organizer).

Ozkan, U.S., Fundamentals of Oxide Catalysis, Annual Meeting of the American Institute of Chemical Engineers, Los Angeles, CA, November 1997 (Chair and Organizer).
Publications and Proceedings

Organizers and Session Chairs of National and International Meetings con’t.

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

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

Tomasko, D.L., Co-Chairman, AIChE Area 1f (High Pressure) Programming for 1997 Annual Meeting (Los Angeles, CA).

Zakin, J.L., Chair, Local Arrangements, 69th Annual Meeting Society of Rheology, Columbus, October 19-23, 1997 (attended by 315 people from 15 countries).

Zakin, J.L., Chair, Session on Polymer Solutions, 2nd Pacific Rim Conference on Rheology, Melbourne, Australia, July 27-31, 1997.

Editorial Boards, National Committees, and Other Professional Activities


Brodkey, R.S., Vice Chair and Treasure of the US National Committee-Theoretical and Applied Mechanics.

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


Davis, J.F., CACHE Corporation, Board of Trustees, Vice President.

Davis, J.F., Honeywell Abnormal Situation Management Consortium, invited academic participation.


Lee, L.J., Director of NSF Industry/University Cooperative Research Center for Advanced Polymer and Composite Engineering (CAPCE).

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

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


Lee, L.J., Paper Reviewer for many Technical Journals in the Field of Polymer and Chemical Engineering.


Ozkan, U.S., American Chemical Society Petroleum Chemistry Division Secretary (National) (1997-present).


Publications and Proceedings

Editorial Boards, National Committees, and Other Professional Activities con’t.

Ozkan, U.S., Registered Professional Engineer (Ohio).

Ozkan, U.S., AIChe, Catalysis and Reaction Engineering Division, Board of Directors.

Rathman, J.F., Associate Editor, Journal of the American Oil Chemists’ Society (JAOCs).

Tomasko, D.L., Vice-Chairman, AIChe Area 11f (High Pressure), Elected 1997.

Tomasko, D.L., Member, American Chemical Society.

Tomasko, D.L., Member, AIChe.

Tomasko, D.L., Member, 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).


Davis, J.F., Hold the position of Associate Provost and Director of University Technology Services.

Fan, L.S., Honoree at the Alpha Chi Sigma Award Symposium on Fluidization and Fluid-Particle Systems, AIChe Annual Meeting, Nov. 17, 1997.


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


Yang, S.T., Research Accomplishment Award, College of Engineering, Ohio State University (1997).

Honors and Awards

Bakshi, B.R., University Department Teaching Award. Awarded by the Ohio State University, 1997.

Bakshi, B.R., Faculty Summer Research Associate, Wright-Patterson Air Force Base, Materials Directorate, OH, Summer 1997.
Publications and Proceedings

Honors and Awards con’t.

Yang, S.T., Visiting professor, Department of Chemical Engineering, National Taiwan University (10/97 to 2/98).


OSU President E. Gordon Gee, and Provost, Richard Sisson, visited the ChE Department to present the 1997 Distinguished Teaching Award to our Faculty on ACE Day 1997.
# Sponsored Research

## Sponsored Research Distribution 1992 - 1996

- **(42.0%) Federal**
- **(16.6%) Industrial**
- **(10.9%) Ohio**
- **(30.4%) *Other**

*Includes state and local agencies, and foundations*

## Current Sponsored Research Projects:

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<th>Budget</th>
<th>PI/Title/Sponsor</th>
<th>Project Period</th>
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| $10,000 | **Bakshi, B. R.**
Improving the Efficiency of Empirical Modeling by Nonlinear Continuum
Technical Management Concepts | 10/01/97 – 12/31/98            |
| $20,000 | **Bakshi, B. R.**
Novel and Integrated Techniques for Data Rectification, Compression, and Multivariate Statistical Process Monitoring
American Chemical Society, Petroleum Res. Fund | 01/10/96 – 08/31/98            |
| $5,000  | **Brodkey, R. S.**
Travel Support for US Contributors to ICTAM, Japan Army Research Office | 07/01/96 – 06/30/97            |
| $80,000 | **Brodkey, R. S.**
Flow visualization of Forced and Manual Convection in Internal Cavities
University of Idaho | 09/15/97 – 09/14/00            |
| $89,920 | **Brodkey, R. S.**
Using Mixing to Minimize Waste in Reactive Systems
Rutgers University | 09/01/04 – 08/31/97            |
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<td>Chalmers, J. J.</td>
<td>Development of a Continuous Magnetic Cell Separator</td>
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<td>$159,759</td>
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<td>Functional and Diagrammatic Representation for Device Libraries</td>
<td>05/01/96 - 04/30/99</td>
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<td>Advanced Dry Technologies for Acid Gas and Trace Toxics Characterization and Emission Control for Ohio Coal</td>
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<td>Kinetics and Mechanisms of H₂S/Sorbent Interactions at High Temperature and Pressure</td>
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<td>Slurry Bubble Column Hydodynamics: Quantification and Scale-Up</td>
<td>07/14/95 - 07/13/98</td>
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<td>Intrinsic Flow Behavior in a Slurry Bubble Column at High Pressure and High Temperature Conditions</td>
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<td>Air Products &amp; Chemicals/U.S. Department of Energy</td>
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<td>Optimal Reactor Design from a Geometric Viewpoint</td>
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<td>Gas-Assisted Injection of Molding of Long Glass Fiber Filled Thermoplastics</td>
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<td>Mat. Engineering &amp; Tech Support</td>
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<td>$5,000</td>
<td>Research Initiation Award: Rates and Equilibria in Supercritical Extraction from Sold Matrices</td>
<td>Tomasko, D. L.</td>
<td>07/01/96 - 06/30/98</td>
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<td></td>
<td>National Science Foundation</td>
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<td>$35,513</td>
<td>Environmentally Benign Crystallization: Supercritical Fluids as Separable and Recoverable Antisolvents</td>
<td>Tomasko, D. L.</td>
<td>01/01/97 - 06/30/98</td>
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<td>Emission Red Res Center/NJIT</td>
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<td>$90,000</td>
<td>Rates and Equilibria in Supercritical Extraction from Solid Matrices</td>
<td>Tomasko, D. L.</td>
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<tr>
<td>Amount</td>
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<td>Project Title</td>
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<td>$70,000</td>
<td>Yang, S.-T.</td>
<td>Novel Metabolic and Process Engineering Approaches for Enhanced Propionic Acid Production from Plant Biomass</td>
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<td>$50,000</td>
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<td>Development and Scale-Up of an Extractive Fermentation Process for Carboxylic Acids Production from Food Processing</td>
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<td>$110,000</td>
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<td>Calcium Magnesium Acetate (CMA) at Lower-Production Cost/Production of CMA Deicer from Cheese Whey, Phase II</td>
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<td>$114,878</td>
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<td>Sodium Lactate Production from Acid Whey Kraft General Foods</td>
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<td>Calcium Magnesium Acetate at Lower-Production Cost/Production of CMA Deicer from Cheese Whey Department of Transportation - Fed Highway Admin</td>
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<tr>
<td>$1,000</td>
<td>Zakin, J. L.,</td>
<td>Travel Grant to Attend IUTAM Symposium (Sydney) and 2nd Pacific Rim Conference on Rheology (Melbourne) NSF</td>
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<td>$15,000</td>
<td>Zakin, J. L.</td>
<td>Philippine Overseas Sandwich Program of Engineering and Science Education Project (ESEP) Philippine Government</td>
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<td>Zakin, J. L.</td>
<td>Mechanical Engineering Lab Grant for Consumeable Chemicals and Software MITI Japan</td>
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</table>
Sponsored Research

$41,750

Zakin, J. L., and Christensen, R. N.
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 Microstructure with Drag Reducing Ability
Office of Vice President for Research

10/01/97 – 12/31/98

$150,000

Zakin, J. L.
Reducing Energy Costs in District Heating System
Agency Intl. Development

08/16/91 - 12/31/98

$400,000

Zakin, J. L., Rathman, J. and Swartz, F.
Interdisciplinary Research Seed Grant
The Ohio State University

01/01/97 - 06/30/98

Bill Lowrie, Fisher College of Business Dean Joseph A. Alutto, Ernestine Lowrie, Alex Shumate, L.S. Fan, professor of Chemical Engineering, and Ted Beattie attended a reception and dinner celebrating “Affirm Thy Friendship” at the Shedd Aquarium in October for over 300 Chicago area alumni and friends.
Bachelor of Science

August 1996
Jacqueline L. Thatcher

December 1996
Sarah C. Bruckelmeyer
Mark E. Buzek
Jakub M. Cech
Michael D. Hill
Timothy R. Johnson

March 1997
Michael D. Chiang (magna cum laude)
Kane N. Doerfler
Joel D. Duvall
Theresa A. Dziewatkowski
Samir I. Parikh (cum laude)
Rae L. Roby
David E. Schwartz
Robert L. Struck
Amy L. Smith

June 1997
Matthew W. Aken
Joseph G. Chavez
April K. Clark
Paul D. Cowan
David B. DiGiulio
Abraham C. George
Christiana Hambadi
David R. Heine, Jr.
Mohammad M.A. Hossain
Francis Hui
Chad A. Johnson
Tina M. Killebrew
Evelyn B. Kim
W.M. Raymond Lau
Anthony Q.D. Lee
Shannon M. Lenze
S.C. John Lok
Lei M. Low
Erik R. Lowe

Marc D. Luker
Michael W. McGraw
Nanette L. Nardi
Dennis M. O'Brien
Virginia E. Pankratz
Dana E. Pasquali
Robert T. Scheehle, Jr.
Ping Shen
Nicholas A. Smith
Nany Sukarto
Srinivasan Surendranath
Jisca S. Susanto
Andrew R. Tadd
Michael D. Triplett II
Joshua S. Vermillion

Dr. L.S. Fan, Mike Timko and his parents enjoyed the Commencement party at the Department.
Chemical Engineering Graduates (1996-97)

M.S. Degrees

James Ackerman
Advisor: K.W. Koelling
Thesis: Effect of Geometry and Heat Transfer on Gas Bubble Penetration Through Viscoelastic Fluids

Patricia Bauer
Advisor: Chalmers, Rathman
Thesis: Surfactants and Cells

Huo-Hua Chen
Advisor: J.J. Chalmers
Thesis: Magnetic Cell Separation

Michael Elsass
Advisor: J.F. Davis
Thesis: Functional Representation as a Framework for a Multipurpose Sharable Engineering Knowledge Database

Al Jwayyed
Advisor: D.L. Tomasko
Thesis: Gravimetric Desorption Measurements in Supercritical Fluids

Randy Lytle
Advisor: J.F. Davis
Thesis: Intelligent Interfaces for Tuning of Model Parameters

Xun Ma
Advisor: D.L. Tomasko
Thesis: Coating and Impregnation of Nonwoven Fibrous Materials with a Nonionic Surfactant Using a Supercritical Fluid

Derek Rosa
Advisor: L.J. Lee
Thesis: Adhesive Bonding of Sheet Molding Compounds

Brian Schilf
Advisor: U.S. Ozkan
Thesis: Partial Oxidation of Pentane and Pentene Over Suboxides of Vanadium

Cinein Siswanto
Advisor: J.F. Rathman
Thesis: Miscellar Phase Transfer Catalysis as a Replacement for Organic Solvents in Synthesis Reactions in the Pharmaceutical Industry

Dede Surjadi
Advisor: J.F. Rathman
Thesis: Effects of Aluminosilicate Counterions on the Structure of Surfactant Aggregates Used in the Synthesis of Mesoporous Molecular Sieves

Jianping Zhang
Advisor: L.S. Fan
Thesis: Bubble Rising Characteristics
Chemical Engineering Graduates (1996-97)

Ph.D. Degrees

Seungjoo Haam  
Advisor: R.S. Brodkey  
Thesis: Two-Phase Solid-Liquid Dispersion in a Cylindrical Column

Mahesh Kumthekar  
Advisor: U.S. Ozkan  
Thesis: Catalytic Reduction of Nitric Oxide Using Ammonia and Methane Over Vanadia Based Catalysts

Paul Kust  
Advisor: J.F. Rathman  
Thesis: Study and Application of Micellar Autocatalysis in Surfactant Synthesis

Bin Lu  
Advisor: J.L. Zakin  
Thesis: Rheology and Drag Reduction of Dilute Surfactant Solutions

Tsao-Jen Lin  
Advisor: L.S. Fan  
Thesis: Pressure and Temperature Effects on Bubble Column and Liquid-Solid Fluidized Bed

Chih-Hsin Shih  
Advisor: L.J. Lee  
Thesis: Micro-Flow Mechanics in Liquid Composite Molding

Ellen Silva  
Advisor: S.T. Yang  

Liping Zhang  
Advisor: U.S. Ozkan  
Thesis: Simultaneous Indole HDN and Benzothiophene HDS over Sulfided Ni-Mo Catalysts
Chemical Engineering Graduates (1996-97)

Row 1: Nanette Nardi, Rob Schechle, Mohammad Hossain, Henry Thenoch, Shri Surendranath, Jaideep Vaidya, David Semersky
Row 2: Nicholas Smith, Dana Pasquali, Dr. Brodkey, Virginia Pankratz, Eim Glaser, April Clark
Row 3: Mike Triplett, Nany Sukarto, Ping Shen, Paula Garcia, Dawn Denko, Bryan Wisecup
Row 4: Dennis O’ Brien, Jisca Susanto, Devvie Low, Che Chit Wang, Tina Killebrew, Jay Bickett, Mitesh Kadakia
Row 5: Shannon Lenie, Michael Tinko, John Sze-Chung Lok, Mike McGraw, Matthew Aken, Novin Tegult
Row 6: Raymond Lau, Prasad Gupte, Wayne A. Pettay III, Marc Luker, Kevin Turco, Dr. Tomasko, Dr. Fan
Row 7: Aravind Asthagiri, Dr. Zakin, Abraham George, Nathan Albert, Sam Ang, Bin Lu, Dr. Cox, John Clay
Row 8: Michael Wirtz, Dr. Koelling, Brian Hawkins, Dr. Rathman
<table>
<thead>
<tr>
<th>Graduate Students (By Advisor)</th>
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<tbody>
<tr>
<td><strong>Bhavik Bakshi</strong></td>
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<tr>
<td>Mohammed Nounou M</td>
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<tr>
<td>Selman Torlak M</td>
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<tr>
<td>Shermin Top M</td>
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<tr>
<td>Raja Chatterjee M</td>
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<tr>
<td>Himanshu Gupta P</td>
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<tr>
<td>Raja Jadhav P</td>
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<tr>
<td>DJ Lee P</td>
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<tr>
<td>Xukun Luo P</td>
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<tr>
<td>Guoqiang Yang M</td>
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<tr>
<td>Tsao-Jen Lin P</td>
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<tr>
<td>Jiang-Ping Zhang P</td>
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<tr>
<td><strong>James Rathman</strong></td>
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<tr>
<td>Yani Angasani M</td>
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<tr>
<td>Turgut Battal P</td>
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<tr>
<td>Paul Kust P</td>
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<tr>
<td>Zhifeng Wang P</td>
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<tr>
<td>Angela Younger M</td>
</tr>
<tr>
<td><strong>Robert Brodkey</strong></td>
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<tr>
<td>Leander Richards M</td>
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<tr>
<td>Kristina Bailey M</td>
</tr>
<tr>
<td><strong>Kurt Koelling</strong></td>
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<tr>
<td>John Clay P</td>
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<tr>
<td>Kristin Cutright M</td>
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<tr>
<td>Jose Garcia M</td>
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<tr>
<td>Vishual Gauri P</td>
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<tr>
<td>Amit Jain M</td>
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<tr>
<td>Minesh Tendulkar M</td>
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<tr>
<td>Ali Scott M</td>
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<td>Hung Nguyen M</td>
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<tr>
<td><strong>David Tomasko</strong></td>
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<td>Young-Ho Chou P</td>
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<td>Raashina Humayan P</td>
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<td>Yiquing Wang M</td>
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<tr>
<td><strong>Jeff Chalmers</strong></td>
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<tr>
<td>Nikki Gregoriades M</td>
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<tr>
<td>Cesar Mauras M</td>
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<tr>
<td>Kara McCloskey M</td>
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<tr>
<td>Liping Sun P</td>
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<tr>
<td>Nikhil Gauri P</td>
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<tr>
<td>Alok Sood P</td>
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<tr>
<td><strong>S.T. Yang</strong></td>
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<tr>
<td>Julia Bednarcik M</td>
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<tr>
<td>Chunnuan Chen M</td>
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<tr>
<td>Amy Kneidel M</td>
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<tr>
<td>Teng Ma P</td>
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<td>Yan Huang M</td>
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<td>Likun Zhang M</td>
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<td>Ellen Silva P</td>
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<td>Matthew Seikel M</td>
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<tr>
<td><strong>L. James Lee</strong></td>
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<td>Tracy Chiu P</td>
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<td>Mark Elkovitch M</td>
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<td>Yi-Je Juang M</td>
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<td>Ling Li P</td>
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<td><strong>Jack Zakin</strong></td>
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<td>Zhiqing Lin P</td>
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<td><strong>James Davis</strong></td>
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<td>Zafar Ali M</td>
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<td><strong>L.S. Fan</strong></td>
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<td>R. Agnihotri P</td>
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<td>Shri Chauk P</td>
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<td>W.-S. Chen M</td>
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<tr>
<td>Umit Ozkan M</td>
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<tr>
<td>Abdu Bunch M</td>
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<td>Rick Watson M</td>
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</table>

M=Master Program
P=Ph.D. Program
B.S. Placement Information

Employers That Hired B.S. Graduates

<table>
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<tr>
<th>Employer</th>
<th>Location</th>
<th>Employer</th>
<th>Location</th>
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<tbody>
<tr>
<td>Amoco</td>
<td>1-IL</td>
<td>International Paper</td>
<td>1-AL</td>
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<tr>
<td>Andersen Consulting</td>
<td>2-OH</td>
<td>Kemper National Insurance</td>
<td>1-IN</td>
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<td>Arizona Chemical</td>
<td>1-LA</td>
<td>Libbey Owens Ford</td>
<td>1-OH</td>
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<tr>
<td>Ashland Chemical</td>
<td>1-OH</td>
<td>MG Industries</td>
<td>1-OH</td>
</tr>
<tr>
<td>Battelle Memorial Institute</td>
<td>1-OH</td>
<td>MG Industries</td>
<td>1-PA</td>
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<td>BP America</td>
<td>1-OH</td>
<td>Montell Polyolefins</td>
<td>1-DE</td>
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<td>Cargill</td>
<td>3-OH</td>
<td>Morton International</td>
<td>1-MI</td>
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<td>Cooper Tire and Rubber</td>
<td>1-OH</td>
<td>Occidental Chemical</td>
<td>1-TX</td>
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<td>DNV USA Inc.</td>
<td>1-TX</td>
<td>Procter &amp; Gamble</td>
<td>5-OH</td>
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<td>Dow Chemical</td>
<td>1-MI</td>
<td>SLS</td>
<td>1-OH</td>
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<td>Gilson Engineering Sales</td>
<td>1-OH</td>
<td>Stone &amp; Webster</td>
<td>1-GA</td>
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<td>Guardian Industries</td>
<td>1-PA</td>
<td>Worthington Steel</td>
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<td>Harris Corp.</td>
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Status of B.S. Graduates (SU96 - SP97)

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<tr>
<th>No. B.S. Grads</th>
<th>% Reg'd W/ECS*</th>
<th>% Report Employ.</th>
<th>% to Grad School</th>
<th>% to Military</th>
<th>% Other Plans*</th>
<th>% Seek Employ.</th>
<th>% No Information</th>
<th>Avg. Ann. Salary Acc.</th>
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<td>50</td>
<td>90</td>
<td>62</td>
<td>14</td>
<td>0</td>
<td>4</td>
<td>12</td>
<td>8</td>
<td>$41,586</td>
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* Registered with Engineering Career Services
+ Includes Returned Overseas

Summary of Recruiting Activities

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<th>1995-96</th>
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<td>No. of Employer Divs. Conducting Interviews</td>
<td>68</td>
<td>62</td>
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<td>No. of Interviews</td>
<td>524</td>
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<td>No. of resume Requests</td>
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Yearly Starting Salaries

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<th>Average</th>
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<th>Low</th>
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<td>1996-97</td>
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<td>1995-96</td>
<td>$38,356 (28)</td>
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( ) Number of reported acceptances

Placement data from Engineering Career Services 1997 Annual Report
## Course Enrollments

### Summer Quarter 1996

<table>
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<th>Course</th>
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<td>ChE 630 Unit Operations</td>
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<td>ChE 717 Colloids and Surfaces</td>
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<tr>
<td>ChE 489 Professional Practice in Industry</td>
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<td>ChE 693 Individual Studies</td>
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<td>ChE 881 Seminar in ChE</td>
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<tr>
<td>ChE 999 Graduate research</td>
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<table>
<thead>
<tr>
<th>Course</th>
<th>Enrollment</th>
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<tbody>
<tr>
<td>ChE 200 ChE &amp; Process Calculations</td>
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</tr>
<tr>
<td>ChE 201 ChE &amp; Process Calculation</td>
<td>26</td>
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<tr>
<td>ChE 489 Professional Practice in Industry</td>
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<td>ChE 509 ChE Thermodynamics</td>
<td>52</td>
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<tr>
<td>ChE 522 Transport Phenomena II</td>
<td>60</td>
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<tr>
<td>ChE 626 Digital Control</td>
<td>55</td>
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<tr>
<td>ChE 666 Principals of Biochemical Eng.</td>
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<td>ChE 693 Individual Studies</td>
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<td>ChE 712</td>
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<td>ChE 762 ChE Process Development</td>
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<td>ChE 773</td>
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<td>ChE 808 Advanced Thermodynamics I</td>
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<td>ChE 815.01 Advanced Mass Transfer I</td>
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<td>ChE 999 Graduate Research</td>
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<td>ChE 999F Graduate Research</td>
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### Winter Quarter 1997

<table>
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</tr>
<tr>
<td>ChE 201 ChE &amp; Process Calculation</td>
<td>26</td>
</tr>
<tr>
<td>ChE 489 Professional Practice in Industry</td>
<td>4</td>
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<tr>
<td>ChE 509 ChE Thermodynamics</td>
<td>52</td>
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<td>ChE 522 Transport Phenomena II</td>
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<tr>
<td>ChE 626 Digital Control</td>
<td>55</td>
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<tr>
<td>ChE 666 Principals of Biochemical Eng.</td>
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<td>ChE 693 Individual Studies</td>
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<td>ChE 762 ChE Process Development</td>
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<td>ChE 773</td>
<td>33</td>
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<tr>
<td>ChE 808 Advanced Thermodynamics I</td>
<td>23</td>
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<tr>
<td>ChE 815.01 Advanced Mass Transfer I</td>
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<tr>
<td>ChE 981 Research Seminar</td>
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<td>ChE 999 Graduate Research</td>
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<td>ChE 999F Graduate Research</td>
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### Autumn Quarter 1996

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<th>Course</th>
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<tr>
<td>ChE 200M ChE &amp; Process Calculations</td>
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<td>ChE 489 Professional Practice in Industry</td>
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<td>ChE 508 ChE Thermodynamics</td>
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<td>ChE 521 Transport Phenomena II</td>
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<td>ChE 624 Chemical Process Dynamics and Control</td>
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<td>ChE 693 Individual Studies</td>
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<td>ChE 750 Profession of ChE</td>
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<td>ChE 760 ChE Economy and Strategy</td>
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<td>ChE 761 ChE Processes</td>
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<td>ChE 775 Intro. To High Polymer Engineering</td>
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### Spring Quarter 1997

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## Current Academic Status and Capsule History

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### ChE Starting Salary Offers for 1996-97 graduates:

- **B.S.:** $45,008
- **M.S.:** $49,616
- **Ph.D.:** $63,93
1997 Department Seminar Speakers

January 8  Dong-Zhi Wei, Director and Professor, Research Institute of Biochemistry, East China University of Science & Technology
            "Enzymatic Reactions in Non-aqueous Systems"

January 15  Michael L. Mavrovouniotis, Associate Professor of Chemical Engineering, Northwestern University
            "Systems Engineering for Chemical Structures"

January 22  Eric W. Kaler, Chair and Professor of Chemical Engineering, University of Delaware
            "Phase Behavior and Microstructure of Surfactant Mixtures"

February 5  Jonathan Dordick, Chair and Professor of Chemical Engineering, University of Iowa
            "Enzyme Engineering for Biotransformations and Drug Discovery"

February 12 Martin Feinberg, Professor of Chemical Engineering, University of Rochester
            "An Introduction to Chemical Reaction Network Theory"

February 19  Lu-Kwang Ju, Associate Professor of Chemical Engineering, University of Akron
            "On-line Fluorometric Study of Biological Wastewater treatment Processes"

February 26  Sudhir Sastry, Professor of Food, Agricultural, and Biological Engineering, Ohio State University
            "Continuous Sterilization of Solid-liquid Mixtures"

March 5  Douglas C. Cameron, Associate Professor of Chemical Engineering, University Of Wisconsin – Madison
            "Metabolic Engineering of Propandiol Pathways"

March 12  Morten Denn, Professor of Chemical Engineering, University of California – Berkeley
            "Polymer/Wall Interactions in Melt Processing"

April 3  Dr. Madan Bhasin, Corporate Fellow, Union Carbide
            "Alkali Promoter Synergism in Selective Oxidation"

April 10  Pablo G. Dehenedetti, Chair and Professor of Chemical Engineering, Princeton University
            "Thermodynamics of Supercooled and Glassy Water"

April 24  W.R. Schowalter, Professor of Chemical Engineering and Dean, University of Illinois at Urbana – Champaign
            Bill Lowrie Lectureship: "Some Devils in the Details of Stokesian Dynamics Applied to Colloidal Dispersions"

May 1  Jerry Lin, Associate Professor of Chemical Engineering, University of Cincinnati
            "Mixed- Conducting Ceramics: Oxygen Permeation and Surface Catalytic Properties"

May 8  Murray Moo-Young, Professor of NSERC Industrial Biotechnology Chair, University of Waterloo
            "Bioprocessing Innovation in Biotechnology"

May 15  Theodore Randolph, Associate Professor of Chemical Engineering, University of Colorado
            "Interactions of Surfactants with Pharmaceutical Proteins"

May 22  GRIP – Graduate Research Initiative Program Seminars

May 29  Linda Broadbelt, Assistant Professor of Chemical Engineering, Northwestern University
            "Polymer Resource Recovery through Coprocessing"
1997 Department Seminar Speakers

June 5       Albert Venosa, US EPA, Cincinnati
             "Engineering Aspects of Oil Spill Bioremediation in Coastal Environments"

September 25 L.S. Fan, J. Zakin, and CHESS, The Ohio State University
             "An Introduction of New Graduate Students"

October 9    Ishi Talmon, Professor of Chemical Engineering, Technion-Israel Institute Technology
             "Cryogenic Transmission Electron Microscopy of Complex Fluids"

October 16   Dr. Movath Unni, Department Manager, CAS
             "OnLine Searching at Chemical Abstract Service"

October 23   Dr. David Boger, Department of Chemical Engineering, University of Melbourne

October 30   Peter Cummings, Department of Chemical Engineering, University of Tennessee
             "Molecular Modeling and Simulation: Present and Future Tools for Physical Properties Prediction"

November 6   Dr. S. Sundaresan, Department of Chemical Engineering, Princeton University
             "Origin of Some Meso and Macroscale Phenomena in TwoPhase Flows"

November 20  AIChE Conference

November 27  Thanksgiving

December 4   Derek Rollins, Professor of Chemical Engineering, Iowa State University

December 11  Finals Week
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Willis Everett Jackson 1948
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1955
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1956
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1958
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Orville William Gruebemeyer Jr
1962
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1963
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Robert Peter Kasper
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1965
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William G. Lowrie
1967
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1968
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James William Serbert
1969
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John William Toussant
1970
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Dr. Harry Heh Nien Yieh
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Jeffrey Louis Kosch
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1975
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Fred David Ehrman
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Daniel Robert
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Harry Charles Wolf Jr
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Joyce Wagner Mondak
1983
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Affieri
Michael Brian Begland
Tracy Flora Begland
Mark Douglas Dieringer
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Kay Herouvis -
Metropolous
Ronald Alan Howdyshell
James Arthur Leonard
Robert Philip Lewis
Clark Brian Wade
1984
Robert Harold Kelch
Capt. George W. Miller
Teresa Datz Siegel
1985
Roger Glen Facier
Timothy Allen Johnson
David Jordan Mooney
Sharyn Stevenson Veley
1986
Norman Merrill Powell
Dr. Sik Kwan Shum
1987
Karan Graham Johnson
Mr. Martin David Legg
Dallas Brian Noe
Scott Allen White
1988
Eric Scott Deligatti
Amy Schmitt Doty
Joseph Francis Ennis
William Madison Irvin IV
John Wesley Oren
Dr. Keith Mitchell Russ
1989
Stuart Franklin Doty
1990
Craig Michael Kehres
Darrin Leonard Lacheta
Kara Blachowski Long
Alex Charles Woravka
1992
Julie Vander Meer Joehlin
Scott Arthur Joehlin
1993
James Gregory Skipworth
1994
Christopher William
Voight
1995
Jason Lee Chamberlain
1997
Robert Thomas Scheehle
Paulette F. Kay
Ruth S. Kay
John R. Kearns
Dr. Kurt Koelling
Ernestine R. Lowrie
Betty L. Mahman
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Dr. Umit S. Ozkan
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Bruce W. Kay
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Ashland Incorporated
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Mitsubishi Chemical Corp.
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USW Corporation Foundation
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Members of our esteemed faculty
## Anniversary Classes

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<tr>
<th>Year</th>
<th>Names</th>
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| 1923 | Ernest A. Remesch  
Angel F. Acosta  
Durain C. Butts  
Harry G. Carroll  
Dean M. Cleaveland  
Harold M. Davies  
Elmer J. Fisher  
Joseph F. Gorman  
Elmer H. Haux  
Edgar C. Hendrickson  
William L. Lonsway  
Clare S. Martin  
Edward G. Meiter  
Wesley H. Miller  
Harold L. Moon  
Gordon H. Mutersbaugh  
Wayne C. Norris  
Gerald G. Osterhof  
Gordon D. Patterson  
Alvin H. Peters  
Ying Lam Pun  
Albert Schwensen  
Lawrence E. Stout  
Edward D. Turnbull  
George H. Wilkinson |
| 1938 | Robert S. Armstrong  
Gerald L. Benson  
Thomas A. Boyd  
Carl S. Casto  
Norman C. Cammerer  
Jefferson C. Cole  
Maynard E. Coller  
Robert W. Conaway  
Frank J. Cserenyak  
Paul F. Cunningham  
Dana D. Davis  
Daniel W. Duncan  
Frederick Eastman  
Howard D. Evans, Jr.  
Charles W. Gaylord  
Harvey H. Grice  
John R. Grist  
Louis F. Guentert  
Elton B. Gunyou  
David C. Hale  
Victor J. Harris  
Edward J. Haven  
Charles H. Hiser  
George H. Hughey  
John S. King  
Paul H. Lenz  
Leland W. Love  
Chester A. McCall  
Keator McCubbin  
John W. McKinney  
Adolph S. Miller  
Daniel M. Miller  
Frederick E. Miller  
Frederick C. Neuhart  
Wayne L. Oberlin  
James R. O'Roark  
Woodrow W. Portz  
Donald E. Powell  
Robert S. Radow  
Prentice W. Reeves  
Louis E. Reidisch  
Robert L. Savage  
Randal E. Smith  
Robert F. Snider  
Charles E. Spencer  
John E. Teagarden  
George S. Tobias  
Garrett L. Wander  
Harry B. Warner  
Merle E. Wendt  
John T. Wilson  
Harold F. Wise  
Burton M. Wolf  
Gaylord Woodward  
Tse Kao Wu |
| 1943 | C. Dixon Arrich  
Nicolaë N. Bacaintan  
Richard Bengston  
Thomas E. Bieterman  
Charles E. Boyd  
Robert L. Brehmer, Jr.  
Chester J. Brown, Jr.  
Melvin Browning  
Lloyd J. Bridenbach  
Edgar E. Buxton  
James R. Cameron  
William H. Cameron  
Robert W. Cassinan  
Constantine L. Chase  
Halver S. Christianson  
Walter E. Craw  
Howard S. Dannemiller  
Dalton F. Drake  
Robert E. Farison  
Richard M. Garrett  
Paul K. Gaulke  
Glenn L. Gifford  
Dean C. Glass  
Hart F. Graff  
Max F. Grandey  
Harry J. Green, Jr.  
Gabriel Grushcow  
Dean F. Haberkost  
Ernest Handley  
Leonard Harris  
Bryce D. Inman  
Gordon C. Inskipe  
John Kekich  
Robert Lange  
Thomas Lavery  
Alexis W. Lemmon  
Walter S. Lodge  
Richard E. Loftfield  
Roger Long  
William C. Louis, Jr.  
Walter Luce  
William C. Martin  
William C. McDonnell  
Richard L. McMillan  
Kenneth Mercer  
Daniel A. Meyer  
Charles W. Miller  
Myrl E. Miller  
Donald E. Morgan  
Jack R. Oldenburg  
Harold J. Pierce, Jr.  
James R. Randall  
Raymond K. Ritzert  
Charles J. Schmidt  
Roy E. Schneider  
Elmer F. Schroeder  
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Carlyle E. Shoemaker  
John K. Siddle  
Leonard Skolnik  
William D. Thomas  
Ralph O. Tribolet  
Augustus R. Van Kleek  
William J. Verross  
Richard A. Walther  
Thomas A. Weisz  
Edward E. White  
Wade Wolfe, Jr.  
Paul T. Whitmire  
Gerald V. Wootton  
James C. Wynd  
Hong Ton Yee |
| 1928 | William C. Barnett  
Harry E. Chambers  
Yun-Hao Feng  
Chieh Ma  
Arnold H. Nieman  
Kenneth E. Steeie  
Edwarado A. Urueta  
Wei Yang |
| 1933 | Ralph E. Cramer  
Henry S. Curtis  
John S. Eckert  
Robert E. Elliott  
Elmore A. Faine  
Albert L. Fishback  
Kermith K. Fligor  
George E. Fromm  
Edward H. Fournier  
Donald H. Gardner  
Elden K. Haller  
Theodore F. Kuntz  
Harry M. Louden  
Herbert E. Miles  
George L. Meyer  
Joseph D. Parent  
Nathan C. Price  
John A. Purinton  
Kenneth Brandsetter  
John A. Burgbacher  
John E. Buskirk, Jr.  
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David Grove
Hanford L. Gunnerson
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Richard C. Harshman
Abdul M. Hassan
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Hugo C. Johnson
Jeanne H. Johnson
Newton H. Johnson, Jr.
Lewis Jones
William Jurevic
Robert M. Kell
Charles M. Kincaid
Lucille D. King
Harlen W. Kline
William A. Klink, Jr.
Jack Kolins
Robert E. Kraus
Henry B. Lange
William L. Larcamp
George R. Lewis
Ju Luan Ma
John C. Marting
F. Robert Mayforth
Robert G. McCammon
Louis V. McIntire
Clement McLain
Thomas J. MacLean
William J. Mead
William R. Meredith
Chester Milewski
Myrl E. Miller
Robert H. Miller
Robert N. Miller
Enze T. Min

Ralph Montello
Harry L. Moore
Milton E. Nathan
Leonard H. Ogan
Douglas Ordahl
Dorothy E. Pettenski
Robert E. Petty
Howard H. Pickrel
Frank C. Prisc
John Purdon
Joseph Quattlebaum
Manuel Ramos
Cloyd Reeg
Harry F. Reid
Douglas O. Robinette
Harold Robinson
Robert T. Scharenberg
Karl Scheller
Arthur C. Secrest
George Secrist
Carl Setzer
Dale B. Shull
Allan L. Sluizer
Alexander Stern
Jack C. Stewart
Paul J. Stubler
Richard O. Stuckler
Aaron J. Supowit
Robert Tarr
David G. Thomas
Ohn Tin
William Tomlinson
Donald E. Walker
Leroy Wallace
John M. Wallen
Lan-Ching Wang
Richard E. Warner
Fred Warzel
Adm. Arnold Watts
Earl L. White
Robert G. Wilkinson
Myron Wilson
Jack Wunderle

Walter E. Donham
Chris C. Elenias
Louis Elsasser
Donald E. Findlay
John A. Fisher
Robert T. Hewitt, Jr.
Richard L. Huntington
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Herbert G. Krane
Paul R. Kumler
Wilfred Ling
William L. Maag
Donald A. MacDougall
John G. Mahoney
Leo C. Peoples
Willard H. Potter, Jr.
Ernest Reinmuller
Manojkumar Sangvi
Thomas F. Sashihara
Geoffrey R. Snelling
Harold L. Steltzer, Jr.
Michael A. Tallarico
David G. Thomas
John Van Sise
Y.F. Venkatesham
Kenneth E. Whitehead
Alfred E. Williams
James L. Wilson
Robert Wiseman
William H. Wiseman

1958
Anthony F. Altamira
William J. Asher
Donald D. Baker
Edward H. Bollinger
Charles N. Carpenter
Sheldon Chapman
John J. Connelly
Clifton W. Cooke, Jr.
Victor A. Crainich
Kenneth E. Davis
George W. Dietrich
James R. Facer
Thomas E. Ferris
Edward J. Freeh
Phillip H. Gifford, II
Mahmoud H. Hamdy
Barry C. Hartley
Dan M. Hayes, Jr.
Thomas E. Hedge
David W. Jones
Donald S. Kerrigan
Richard P. Kistler
Albert W. Krock

Phasook Kullavanijaya
Jon H. Lee
James C. Leslie
William T. Leslie
Glen F. Leverett
Werner S. Lichtenstein
Tommy R. Loy
Michael J. Lucas
James McCaffery, III
Frank J. Nagy
Valdis E. Petrits
Charles D. Ruff
Robert G. Savageau
Marcus D. Scharf
William H. Saeton
Richard J. Shafer
Steve Simecek
James M. Skates
Richard M. Smith
Mitchell J. Somers
Harold A. Sorgenti
James W. Stark
Lawrence R. Steele
Mark D. Tawney
John D. Turner
John M. Uncapher
Wolf R. Vieth
Richard Y. Walter
Bruce W. Wilkinson
Donald J. Wilhelm
Robert M. Yarrington

1963
Jawad N. Al-Sheik
Nelson W. Barnhill
Keith E. Bazaire
Gary L. Becler
John D. Birle
James Chin
William C. Corder
Jon E. Fletcher
Donald L. Furry
Scott C. Gordon
Myers G. Hammond
Jonh P. Henry, Jr.
Robert P. Kasper
Alan L. Keller
Heung T. Kim
Isabel K. Logan
James C. Meek
Ajitkumar V. Mehta
Stanley A. Metelko
James F. Nester
James S. Outland
Phillip F. Pfauuner
Anniversary Classes

Joseph H. Reitberger
Fred A. Shaffistall
Wilbur H. Sidner
William D. Staten
Bruce G. Strickland
Elwood D. Traylor

1968
Jerry R. Barber
Arthur D. Bare
Sushil K. Bhalla
William E. Ferguson
James M. Flerchinger
Raymond A. Foisset
Neil K. Goldwein
Lawrence H. Green
Richard D. Haberkost
Edward M. Halko
Richard F. Havlice
Douglas W. Hissong
Roy R. Huddleston
Eugene L. Jarrett
Lloyd G. Jones
Modupeola O. Kasim
Frederick C. Kerscher
Ronald M. Kovach
Ahmet Z. Kutlu
Gerald M. Lehman
William E. Lewis
Richard T. Linak
Geoffrey A. Lindsay
David L. Lull
Arun V. Mandlekar
Kenneth N. McKelvey
Paul R. Michl
Merrill L. Minges
Faramarz Nazem
Herbert A. Newhouse
Sung C. Pak
William C. Pontius
Dean H. Reber
Dudley K. Reese
Ronald R. Remick
Michael C. Rominger
John M. Salladay
James W. Schert
Gerald A. Wilcox
James W. Sebert
Douglas E. Smith
Allan W. Strong
Joseph E. Suhrie
Joseph L. Taraba
Arthur W. Thornton
David J. Walters
James E. Williamson
Larry E. Wing
John M. Yacher
Hugh J. Zeller

1973
Mazen Y. Anastas
Steve M. Benner
Patrick L. Berry
John S. Biersteker
Richard E. Blake
Vernon G. Bolender, Jr.
John C. Bost
Sidney E. Bowers
John R. Cameron
Charles N. Carpenter
John D. Chmielewski
Sun-I Chen
William B. Clark
Thomas E. Clausg
Terry L. Collett
David A. Dagan
John A. Douglas
Raoul E. Fajardo
William M. Fugel
Arthur E. Garavaglia
Clyde R. Garrett, Jr.
John C. Groves
Jorge A. Guzman
Gary L. Hahn
Craig A. Heselton
Carl A. Hofmann
Michael J. Katila
Edward K. King
Philip G. Knowles
William C. Kraft
John P. Kuch
Jeffrey T.-H. Kuo
Richard K.-K. Law
Alan P. Lawrence
Eric J. Linak
Donald G. Lorentz
Norman F. Lucas, Jr.
Bobby J. Lumpkins
Arthur N. Maupin
Luther J. Mills, III
Paul B. Mount, II
Larry S. Moyer
John A. Osterhage
Seong Ho Rhee
Harvey S. Rozenberg
Bruce A. Stamoffs
Richard T. Schwarz
Dale G. Serian
David M. Silva
Thomas E. Spriggs
Paul W. Springer
Gary R. Strickler
Allan W. Strong
Samuel S.J. Tam
Larry D. Tanner
Dennis D. Terry
Timothy J. Thomas
Sutrisno B. Tirtawidjaja
David P. Turtle
Donald L. Weaver
Mark D. Westbrook
Johnny O. Wright
Paul J. Zarella

1978
John A. Albers, Jr.
Joseph Arar
Brian W. Baird
Robert M. Andes
David M. Bantz
Debra L. Beran
Douglas T. Brown
Jay W. Bruggeman
Timothy L. Burns
James R. Cominsky
Daniel M. Coombs
Christopher Cunningham
James H. Etherton
Leslie S. Fisher
Dale W. Folsom
James W. Hartings
Kurt R. Hansheke
Janet L. Inkrott
Mannsik Kang
Chinkoo M. Kim
Donna R. Kniss
Edward J. Levine
Jeffrey T. Lowry
John C. Loy
Gerald E. Markley
Donald L. McDowell
Bronko P. Mitevski
Michael P. Moore
Ronald J. Morin
David J. Murphy
Marc P. Papai
Elbano J. Parades
Ronald E. Perez
Daniel Rusyniak, Jr.
David V. Sass
Joe W. Sayre
Randall S. Scott
Pete A. Singer
Jack A. Sigan
David P. Steinmetz

1983
Hashim B. Ahmad
Robert M. Andes
Joanne K. Appoy
Yousef G. Aouad
Barbara M. Backs
Lamont E. Beaver
Michael B. Beglade
Joseph H. Bishel
James V. Blackwell
Charles D. Bond
Richard H. Brandon
Thomas E. Burns
Lee S. Burroughs
Stephen R. Cammarn
D. Scott Carter
Li Kow Chang
Rex-Chein Chang
Chi-Yu Chen
Diana M. Chen
Richard G. Cicciotti
James H. Cordray
Donald J. Davis
Mark Deringer
Craig B. Dotson
Linda S. Evans
James C. Ferguson, Jr.
Samuel D. Fink
Tracy L. Flora
Harold E. Flinn
Roger L. Frye
Mark H. Gaston
Robert F. Gause, Jr.
Albert M. Gesenhuber
Stephen M. Graf
David J. Grigg
Clarice J. Hanusz
Thomas G. Heeb
David B. Henninger
Kay J. Herouvis
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<td>Mohammed S. Alhindal</td>
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<td>Lofti Ben-Said</td>
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<td>Maleh T. Karadshah</td>
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</table>
Chair: Mr. Jack A. Hammond
Senior Vice President
Westvaco
Westvaco Building
299 Park Avenue
New York, NY 10171

Dr. J.A. Brothers
Senior Vice President
Ashland Oil, Inc.
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Dr. E. R. Corino
Exxon Research and Engineering Company
P.O. Box 101
Florham Park, NJ 07932-0101

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The Procter and Gamble Company
Winton Hill Technical Company
6210 Center Hill Road
Cincinnati, OH 45224

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Director of Devlp. Engineering and Tech. Svcs.
Eli Lilly and Company
Tippecanoe Laboratories
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Lafayette, IN 47902

Mr. Ronald D. Harris
Director of Exec. Educ. Development
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Mr. E. L. Jarrett
Vice President
OSI Specialties, Inc.
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Tarrytown, NY 10591

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President
AMOCO Corporation
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