CHEMICAL & BIOMOLECULAR
ENGINEERING

UNIVERSITY of HOUSTON

A LETTER FROM THE CHAIR

The Department of Chemical and Biomolecular Engineering at the University of Houston takes pride in its graduate research program.

We have an outstanding faculty, supported by excellent doctoral and post-doctoral researchers, who carry out research in four principal areas: energy engineering, environmental and sustainable engineering, advanced materials engineering and biomolecular engineering. Energy research in the department currently focuses on optimizing hydrocarbon production, enabling the production of tight gas and shale oil, the generation of biofuels, generation of hydrogen and fuel cells, and novel designs for optimizing wind and solar energy production. Research in environmental aspects addresses reduction in NOx, SOx and soot production in diesel engines and is exemplified by the diesel testing center that is housed in the department. The research in materials engineering across the department spans polymer nanocomposites and thin films, bio-based materials, colloids and inorganic materials, and electronic materials. In the emerging field of biomolecular engineering, members of our faculty are researching novel methods of biohazard detection, high-throughput assays, drug delivery, biomolecular crystallization and development of therapeutic interventions to target autoimmune diseases.

The department is relatively young, having established an undergraduate program in 1949 and doctoral program in 1958. The department grew rapidly in the 1960s and established an international reputation by the late 1970s. Since 2000, our faculty has more than doubled in size. The newest members of our faculty are carrying on the department's tradition of excellence in cutting-edge research and scholarship.

The department has close ties with strong programs in chemistry, biology and biochemistry, and physics, with several faculty members from those departments holding affiliated positions in chemical and biomolecular engineering. Our faculty members are active participants in several multidisciplinary research centers on campus and across the country. The wind energy center and the diesel engine testing center are led by faculty from the department. Our faculty members also hold leading positions in the Alliance for NanoHealth and the NIH Western Regional Center of Excellence for Biodefense and Emerging Infectious Diseases Research. The majority of our faculty members have ongoing collaborations with leading multinational or start-up companies — varying in size, location and focus — reflecting the diversity of research in the department.

I invite you to read this brochure and to visit us on-line at www.chee.uh.edu, for additional information. Should you have questions, please contact me or other members of the department.

Ramanan Krishnamoorti
Dow Chair Professor & Department Chair

CONTENTS

Prepared by Professor Richard Willson and Linda Keng, University of Houston Department of Chemical & Biomolecular Engineering.

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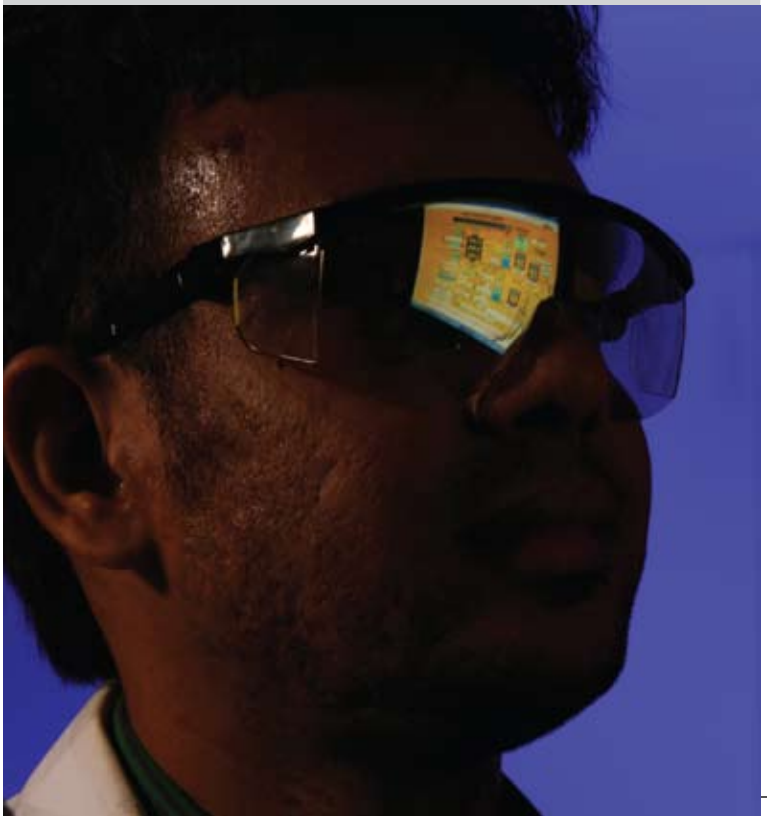
GRADUATE DEGREE PROGRAMS

The UH Department of Chemical and Biomolecular Engineering is dedicated to producing graduates of the highest scholarship, with skills that will enable them to prosper in their career endeavors and adapt to a changing landscape. While most of our graduate students pursue a Ph.D. in chemical engineering, we also offer thesis-based M.S. and non-thesis M.ChE degrees. The department occupies more than 50,000 square feet in one of the two buildings that house the Cullen College of Engineering. All full-time graduate students are provided office and laboratory space to carry out their studies and research. Most of our Ph.D. graduate students are provided financial aid in the form of teaching or research assistantships and receive a full tuition waiver and benefits plan. Competitive graduate scholarships are also available. The college has many student organizations, including a very active graduate student group — the Organization of Chemical Engineering Graduate Students.



M.S. WITH THESIS

Eighteen semester hours of coursework are needed for completion of the M.S. degree, 12 of which are required core courses. In addition, a research project and master's thesis must be completed, providing an additional 12 credit hours. Candidates with a Bachelor of Science in chemical engineering can complete all requirements in 15 to 21 months. Students with degrees in related fields, such as chemistry, physics, mechanical engineering or materials science may need nine to 18 hours of preparatory coursework.

PART-TIME M.S.

The M.S. degree may be obtained through course work only. This program is intended for part-time students with a B.S. in chemical engineering who are currently working in the industry. Thirty semester hours of coursework are required, consisting of four core courses plus six elective courses.

DOCTOR OF PHILOSOPHY

In addition to continued study of a broad range of engineering fundamentals, candidates for the doctoral degree program enjoy intensive exposure to a specific field of engineering research. Individual research is the major focal point for these students, who are expected to expand the frontiers of knowledge in their area of endeavor. Moreover,

candidates learn and experience the general philosophy, methods and concepts of research and scholarly inquiry so they may contribute after graduation to substantive issues beyond their doctoral research.

Acceptance into the full-time Ph.D. program is generally accompanied by full financial support.

Ph.D. candidates must complete at least 30 semester hours of coursework beyond the bachelor's degree, or as few as 21 semester hours beyond the master's degree. Of these, 12 semester hours must consist of the four required core courses (with possibly some equivalent courses from a prior MS), whereas the remainder are elective courses in chemical engineering or related fields. A research project and doctoral dissertation must be completed, providing at least 36 additional credit hours toward the doctoral degree. At UH, the Ph.D. rarely requires more than five years after the B.S., with the average being just over four years.

M.S. IN PETROLEUM ENGINEERING

This degree is offered for those who wish additional training or enhanced skills in the area of petroleum production. Designed primarily for professionals employed by local industry, this program offers courses in the evenings from 5:30 to 8:30 p.m., Monday through Thursday. This degree program can be completed in two to three years of part-time study.

MASTER OF CHEMICAL ENGINEERING

A Master of Chemical Engineering degree is offered as a non-thesis program for the working professional. The program has been designed for individuals who plan careers in plant operations, design and management. It is not intended to be competitive with the Master of Science degree, which is specifically research-oriented, nor with the MBA degree. Rather, the goal of this program is to permit earlier productive use of the young engineer's technical skills and to introduce the engineer to the broad concepts of systems, analysis, advanced process economics and technical management.

Constituting the program is an MChE core of six required courses plus four elective courses, selected to meet the student's interests in the areas of process control, management and business economics, biochemical and environmental engineering, and petroleum engineering. The courses are available in the late afternoon and evening, and the degree can be completed in two to three years of part-time study.

GRADUATE COURSES

A distinctive feature of the graduate program is the regular availability of a large number of graduate courses. As can be seen from the list below, these courses span a wide spectrum of subjects in chemical engineering fundamentals and special topics. The department views these courses as an integral part of the graduate program as well as a necessary educational complement to students' experiences in their research studies.

GRADUATE CORE COURSES (required for M.S. and Ph.D.):

- **CHEE 6331: Mathematical Methods in Chemical Engineering I**
  Linear methods applied to chemical engineering, matrices, transforms, series, complex variable methods and boundary layer problems.
- **CHEE 6333: Transport Processes I**
  Advanced principles of fluid mechanics, heat and mass transfer with application to problems in research and design. Emphasis on unified view of transport process in laminar and turbulent flow situations.
- **CHEE 6335: Classical and Statistical Thermodynamics I**
  Advanced principles of chemical engineering thermodynamics. Introduction to molecular and statistical thermodynamics and its ability to predict bulk thermodynamic properties and characteristics of chemical engineering systems.
- **CHEE 6337: Advanced Reaction Engineering**
  An introduction to modern concepts and techniques of chemical reactor analysis and design.

GRADUATE ELECTIVES:

- Advanced Process Control
- Air Pollution Problems and Control
- Applied Bifurcation Theory
- Applied Nonlinear Methods for Engineers
- Biochemical Engineering Fundamentals
- Biomolecular Engineering
- Catalytic Processes
- Cellular and Bio Transport
- Chemical Processing for Microelectronics
- Colloidal and Interfacial Processes
- Energy and Environment
- Environmental Remediation
- Experimental Methods in Chemical Engineering
- Introduction to Polymer Science
- Introduction to Tissue Engineering
- Mathematical Methods in Chemical Engineering II
- Numerical Methods
- Phase Transitions in Solutions
- Physics and Chemistry of Engineering Materials
- Plasma Processing
- Petrochemical Processes

OTHER DEGREE PROGRAMS

Faculty in the department participate in a wide variety of interdisciplinary work, including advising graduate students from the biomedical engineering, environmental engineering and the materials engineering programs. Some jointly-appointed faculty associated with UH Chemical and Biomolecular Engineering also advise students through the UH graduate programs in biology and biochemistry as well as chemistry.

ADDITIONAL INFORMATION

For additional information and an application package, send an email to ChBEgrad@uh.edu, or write to the following address:

Graduate Studies Coordinator
Department of Chemical & Biomolecular Engineering
University of Houston
Houston, TX 77204-4004, USA
Phone: 713-743-4311

UNDERGRADUATE DEGREE PROGRAMS

The UH Chemical Engineering undergraduate program has been strong historically, ranking among the top programs nationwide. It is a four-year program with a total of 130 credit hours required. Our engineers graduate with a Bachelor of Science in chemical engineering, a minor in chemistry and a specialty in one of six areas of chemical engineering: chemical process engineering, biotechnology, process control, electronic materials, environmental engineering or petroleum engineering.

ADMISSION INFORMATION

Students enter the Cullen College of Engineering directly after high school or as a transfer student with some college hours. The admission requirements can be obtained from the Office of Admissions, 713-743-1010, or from the website www.uh.edu/admissions/undergraduate/.

ADVISING

The faculty of the chemical and biomolecular engineering department considers advising essential to a student's academic planning and progress. In early November and April each year, students are required to visit with their assigned faculty advisor. At these meetings, the faculty advisor will check the student's progress in the courses being taken and will assist the student with plans for the following semester(s).

When new students arrive at the department, they will be advised by the undergraduate advisor/associate chairman, Prof. Demetre Economou, usually at an orientation conference. After one year, Prof. Economou will assign students to faculty members who will work with the students until graduation. Students may talk to their advisors throughout the semester during regularly scheduled office hours for questions.

RELATED OPPORTUNITIES

The department offers scholarships up to $2,000 for qualified students from various sources, such as the American Institute of Chemical Engineers, Dow Chemical Company, Lubrizol, BP/Amoco, Halliburton, and various individual donors. The Engineering Dean's Office also offers many academic scholarships for qualified students.

The University of Houston is in the heart of the nation's petrochemical industry. This makes it easier for the faculty to interact with their industrial colleagues on a regular basis. The Engineering Career Center and the department cooperate to provide many opportunities for summer internships and full-time positions for the students. The university also has an excellent cooperative education program in the engineering college that offers many opportunities for students to receive career training in industry while financing their education and earning a degree.

Students have an opportunity to join several organizations, including the American Institute of Chemical Engineers, the Mexican-American Engineering Society, the National Society of Black Engineers and the Society of Women Engineers.

The department encourages students to join an organization. These organizations help students learn the importance of volunteerism and how to become useful members of a community.

The American Institute of Chemical Engineers typically organizes three to four plant trips each year, one seminar/meeting each month (with lunch provided), picnics and socials.

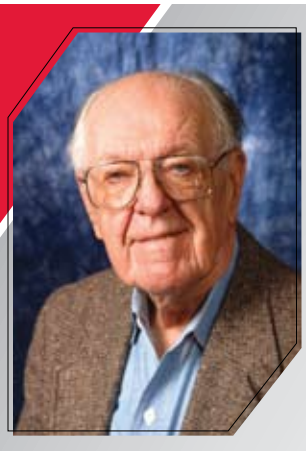
There are two national honor societies, the Omega Chi Epsilon (chemical engineering) and the Tau Beta Pi (all engineering), for junior students who have 3.25 or greater GPA and for seniors who have 3.00 or greater GPA.

Students in their senior year have the opportunity to do a research project or a Senior Honors Thesis with one of the faculty in the department. Research areas include reaction engineering, environmental engineering, electronic materials, biochemical and biomedical engineering, polymer engineering, improved oil recovery, or catalysis. Undergraduate research provides students a chance to be exposed to research and to get a feel for graduate school experience.

FOR MORE INFORMATION

To receive more information, please contact:

Sharon Gates or Prof. Demetre Economou
Department of Chemical & Biomolecular Engineering
University of Houston
Houston, TX 77204-4004, USA
Phone: 713-743-4325 or 713-743-4320



NEAL R. AMUNDSON

Cullen Professor of Chemical & Biomolecular Engineering
Professor of Mathematics

B.S. Chemical Engineering, University of Minnesota
M.S. Chemical Engineering, University of Minnesota
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RESEARCH INTERESTS:

The Aerosol Problem

A major environmental problem facing the city of Houston is the preponderance of chemicals in the aerosol particle population and also those adsorbed on solid particles. The description for modeling the atmosphere is difficult because the computational problems which this introduces into the models are extensive. The goal is to develop reasonable models that describe the situation.

Reaction and Diffusion

The field of reaction and diffusion in chemical engineering is a mature one, however there are still many problems that are not understood. One is the use of the Stefan-Maxwell equations coupled with general reactions to establish a well-posed problem from a scientific point of view.

Air Quality Modeling

While there are many models being used presently to describe what happens in the atmosphere under various pollution emission events, most of these are almost vintage and no one thus far has presented what seems to be a bigger and better model. The University of Houston is eminently equipped to do the mathematical computational side. These require the simultaneous solution of the Navier-Stokes equations, a transport equation for each chemical species and the inclusion of hundreds of species programmed for a large parallel computer. The inclusion of the appropriate boundary and initial conditions make this an interesting scientific chemical engineering problem.

HONORS/ACTIVITIES:

1997	Sc.D., Northwestern University
1996	Neal R. Amundson Award, ISCRE, Brugge, Belgium
1994	Doctor Honoris Causa, University of Guadalajara, Jalisco, Mexico
1993	Medal of Merit, University of Pennsylvania
1992	American Academy of Arts & Sciences
1992	National Academy of Science
1990	NAE Founders' Award
1989	Computing and Modeling Association's Albert Einstein Award
1986	Eng.D. (Honoris Causa), University of Notre Dame
1986	P.V. Danckwerts Memorial Lecture, London
1985	Aaron Farfel Award, University of Houston
1985	AIChE Founders' Award
1985	Sc.D. (Honoris Causa), University of Minnesota
1975	Guggenheim Fellow
1975	NATO Senior Fellow
1973	AIChE Richard H Wilhelm Award
1971	AIChE Warren K. Lewis Award
1970	ASEE Vincent Bendix Award
1970	Fellow, AIChE
1969	National Academy of Engineering
1961	AIChE William H. Walker Award
1960	ACS Industrial and Engineering Chemistry Award
1955	Guggenheim Fellow, Cambridge University, England
1954–1955	Fulbright Scholar, Cambridge University, England

SELECTED PUBLICATIONS:

1. Amundson, N.R.; Caboussat, A.; He, J.W.; Landry, C.; Seinfeld, J.H., A dynamic optimization problem related to organic aerosols. *Comptes Rendus Mathematique* 2007, 344 (8), 519-522.
2. Amundson, N.R.; Caboussat, A.; He, J.W.; Martynenko, A.V.; Landry, C.; Tong, C.; Seinfeld, J.H., A new atmospheric aerosol phase equilibrium model (UHAERO): organic systems. *Atmospheric Chemistry and Physics* 2007, 7 (17), 4675-4698.
3. Amundson, N.R.; Caboussat, A.; He, J.W.; Martynenko, A.V.; Seinfeld, J. H., A phase equilibrium model for atmospheric aerosols containing inorganic electrolytes and organic compounds (UHAERO), with application to dicarboxylic acids. *Journal of Geophysical Research-Atmospheres* 2007, 112 (D24).

VEMURI BALAKOTAIAH

John and Rebecca Moores Professor of Chemical & Biomolecular Engineering

B.Tech Chemical Engineering, I.I.T., Madras
Ph.D. Chemical Engineering, University of Houston

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RESEARCH INTERESTS:

Dr. Balakotaiah's research involves the mathematical modeling and analysis of the interactions between the transport processes and chemical reactions in various systems of engineering interest. The objective of his research is to gain a fundamental understanding of the complex behavior of these nonlinear systems and use this understanding to solve practical problems.

Chemical Reaction Engineering

- **Modeling and Analysis of Catalytic Monoliths**
  Monolithic catalytic reactors are used for pollution reduction in automobiles, oxidation of VOCs, power generation and removal of NOx from exhaust gases. Our work in this area includes the development of mathematical models of these systems and analysis and simulation of the behavior under transient/periodic operation under various catalyst compositions and chemistries.
- **Numerical Computation and Bifurcation Analysis of Homogeneous and Catalytic Reactors**
  Reacting flows exhibit multiple solutions, oscillating flow, temperature and concentration fields, spatial and temporal patterns, traveling fronts and exponentially thin boundary or internal (reaction) layers. Our work in this area includes the development and application of various analytical and computational techniques (singularity, bifurcation, group theories and dynamical systems concepts) to explore and classify the different types of behaviors in the parameter space.
- **Spatio-Temporal Patterns in Catalytic Reactions and Reactors**
  Chemical reactions carried out in open systems (reactors, living cells, neurons and complex living organisms) do not, in general, proceed to equilibrium. Instead, asymptotic states are established, at which the net rate of production of any species due to chemical transformations is exactly balanced by its net rate of removal either by flow or by molecular diffusion. When autocatalysis is present the system may exhibit a variety of asymptotic states such as periodic states in time, periodic states in space (Turing patterns) and complex spatio-temporal behavior (chemical chaos or turbulence). Our work in this area is aimed at identifying the conditions leading to pattern formation and the impact of transport effects and kinetics on the observed patterns.

Multi-Phase Flows

- **Studies on Wavy Films in Gas-Liquid Two-Phase Flows**
  The surface of a freely falling liquid film can exhibit complex spatio-temporal behavior at arbitrarily small Reynolds number. Our work in this area includes experimental, analytical and computational studies of momentum, heat and mass transfer in wavy films under different conditions (free falling, co and counter-current flows, horizontal and vertical flows and annular flows in microgravity).
- **Studies on Gas-Liquid Two-Phase Flows through Packed-Beds under Normal and Microgravity Conditions**
  Gas-liquid two-phase flows through packed-beds occur in many normal gravity applications. In addition, this is identified as an enabling technology for long duration space travel. Our work in this area is aimed at understanding of the fundamental role of capillary and viscous forces in controlling phase distribution and transport of momentum, heat and mass in gas-liquid flows through micro-channels and packed-beds under normal and microgravity conditions.

HONORS/ACTIVITIES:

2007	Flour-Daniel Faculty Excellence Award, Cullen College of Engineering
2004	Best Paper Awards, AIChE Catalysis & Reaction Engineering and Environmental Divisions
2003	Award for Excellence in Research and Scholarship, University of Houston
2002	John and Rebecca Moores Professor, University of Houston
2001	Ya. B. Zeldovich Award, The Dow Chemical Company

SELECTED PUBLICATIONS:

1. Bhatia, D.; Harold, M.P.; Balakotaiah, V., Kinetic and bifurcation analysis of the cooxidation of CO and H-2 in catalytic monolith reactors. *Chemical Engineering Science* 2009, 64 (7), 1544-1558.
2. Clayton, R.D.; Harold, M.P.; Balakotaiah, V., Performance Features of Pt/BaO Lean NOx Trap with Hydrogen as Reductant. *Aiche Journal* 2009, 55 (3), 687-700.
3. Joshi, S.Y.; Harold, M.P.; Balakotaiah, V., Low-Dimensional Models for Real Time Simulations of Catalytic Monoliths. *Aiche Journal* 2009, 55 (7), 1771-1783.
4. Kalia, N.; Balakotaiah, V., Effect of medium heterogeneities on reactive dissolution of carbonates. *Chemical Engineering Science* 2009, 64 (2), 376-390.
5. Xu, J.; Harold, M.P.; Balakotaiah, V., Microkinetic modeling of steady-state NO/H-2/O-2 on Pt/BaO/Al2O3 NOx storage and reduction monolith catalysts. *Applied Catalysis B-Environmental* 2009, 89 (1-2), 73-86.
6. Agrawal, R.; West, D.H.; Balakotaiah, V., Transport limited pattern formation in catalytic fluid-particle systems. *Chemical Engineering Science* 2008, 63 (2), 460-483.
7. Balakotaiah, V., Comment on "Taylor Dispersion with Absorbing Boundaries: A Stochastic Approach". *Physical Review Letters* 2008, 100 (2).
8. Balakotaiah, V., On the relationship between Aris and Sherwood numbers and friction and effectiveness factors. *Chemical Engineering Science* 2008, 63 (24), 5802-5812.
9. Clayton, R.D.; Harold, M.P.; Balakotaiah, V., Selective catalytic reduction of NO by H-2 in O-2 on Pt/BaO/Al2O3 monolith NOx storage catalysts. *Applied Catalysis B-Environmental* 2008, 81 (3-4), 161-181.
10. Clayton, R.D.; Harold, M.P.; Balakotaiah, V., NOx storage and reduction with H-2 on Pt/BaO/Al2O3 monolith: Spatio-temporal resolution of product distribution. *Applied Catalysis B-Environmental* 2008, 84 (3-4), 616-630.

JACINTA C. CONRAD

Assistant Professor of Chemical & Biomolecular Engineering

S.B. Mathematics, University of Chicago
M.A. Physics, Harvard University
Ph.D. Physics, Harvard University

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RESEARCH INTERESTS:

Dr. Conrad's research is focused on investigating the flow properties of complex fluid systems. Her research focuses on two main areas: first, exploiting microfluidic and microfabrication techniques to produce novel microstructured materials for transport studies and energy applications; second, elucidating the interplay between confinement and flow properties of complex fluids and soft materials, with applications in biofluid transport, microbial motility, bioremediation, and water purification.

Porous Particles and Scaffolds

The recent explosion in two- and three-dimensional microfabrication techniques has enabled the fabrication of novel materials with controlled nano- and microscale structure. However, to produce materials with additional functionality, further control over the microstructure is required. In particular, particles and scaffolds with controlled porosity have important practical applications as materials for separations, drug delivery, tissue engineering, cell culture, and catalysis. Moreover, these materials enable new investigations of flow and transport in controlled model systems. We will therefore explore techniques for producing structured porous particles and scaffolds. Initially, we will template structured porous particles, using phase separating materials including colloid-polymer suspensions and polymer blends, and investigate their assembly.

Flow and Motility of Complex Fluids and Biofluids

Processes involving the flow of complex fluids in microchannels appear prominently in technological, environmental, and physiological settings. Despite their ubiquity, the science underlying these processes remains poorly understood. To investigate confined flow, we will directly image the flow of complex fluids and biofluids in microchannels with confocal and light microscopy. By quantifying the flow behavior in a variety of controlled microscale geometries, we will directly elucidate the effects of confinement on the flow properties of complex fluids and inspire new designs for manipulating these materials on the microscale. Initially, we will investigate the confined flow behavior of soft and anisotropic colloids and biocolloids in simple and complex channel geometries.

Transport in 3-D Porous Media

Confinement effects strongly influence multiphase transport properties, and are thus relevant for technological applications involving porous media, such as gel electrophoresis and chromatography, and critical resource applications, such as water remediation and oil extraction from nonconventional sources. In addition, the effects of chemical and mechanical surface heterogeneities can strongly influence the transport properties but are not well understood. To investigate the effects of topology and surface heterogeneity on multiphase transport and deposition in porous media thus requires controlled three-dimensional models. Using advanced microfabrication techniques, we will fabricate model porous media with controlled geometry and surface properties for transport studies of polymers, colloids, and biocolloids. Initially, we will investigate the transport of colloids and surface-associating biocolloids through porous particle assemblies.

HONORS/ACTIVITIES:

2005–2007 INEST Postdoctoral Fellowship
1999–2002 NSF Graduate Fellowship

SELECTED PUBLICATIONS:

1. J.C. Conrad and J.A. Lewis, "Structure of colloidal gels in microchannels." *Langmuir* 24, 7628 (2008).
1. D.J. Harris, H. Hu, J.C. Conrad, and J.A. Lewis, "Patterning colloidal films via evaporative lithography." *Phys. Rev. Lett.* 98, 148301 (2007).
2. J.C. Conrad, P.P. Dhillon, E.R. Weeks, D.R. Reichman, and D.A. Weitz, "Slowly evolving caged clusters in supercooled fluids and glasses contribute to bulk elasticity." *Phys. Rev. Lett.* 97, 265701 (2006).
3. R.F. Shepherd, J.C. Conrad, S.K. Rhodes, D.R. Link, M. Marquez, D.A. Weitz, and J.A. Lewis, "Microfluidic assembly of homogeneous and Janus colloid-filled hydrogel granules." *Langmuir* 22, 8618 (2006).
4 P.J. Lu, J.C. Conrad, H.M. Wyss, A.B. Schofield, and D.A. Weitz, "Fluid of clusters in attractive colloids." *Phys. Rev. Lett.* 96, 028306 (2006).
5. S. Manley, H.M. Wyss, K. Miyazaki, J.C. Conrad, V. Trappe, L.J. Kaufman, D. R. Reichman, and D. A. Weitz, "Dynamic arrest in spinodal decomposition as a route to gelation." *Phys. Rev. Lett.* 95, 238302 (2005).
6 J.C. Conrad, F.W. Starr, and D.A. Weitz, "Weak correlations between local density and dynamics in liquids near the glass transition." *J. Phys. Chem. B* 109, 21235 (2005).

VINCENT M. DONNELLY

John and Rebecca Moores Professor of Chemical Engineering;
Director, Graduate Studies

B.A. Chemistry—LaSalle University, Philadelphia
Ph.D. Physical Chemistry—University of Pittsburgh

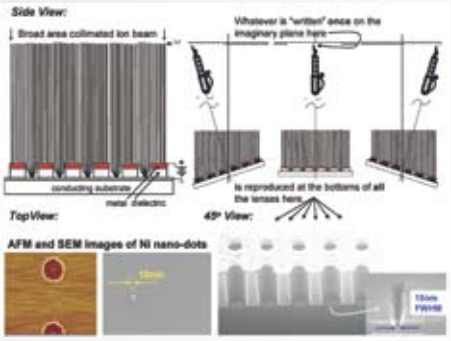
Email: Donnelly@uh.edu
www.chee.uh.edu/faculty/donnelly.htm

RESEARCH INTERESTS:

Plasmas are used to deposit and etch thin films for integrated circuits and other nanometer-scale electronic devices. Plasmas are also increasingly used in bioengineering. In plasma etching, bombardment by positive ions normal to the surface allows fine-line mask patterns to be transferred into thin films. The continued need for ever smaller features dimensions requires improved knowledge and control of the plasma physics and chemistry, as well as breakthroughs in processing and diagnostic. My current studies include:

Nanopantography

With Demetre Economou and Paul Ruchhoeft (Electrical and Computer Eng.), we are exploring this new technique for nanopatterning. A broad ion beam is directed at an array of sub-micron-diameter electrostatic lenses.



By applying appropriate voltages to the lenses, ion "beamlets" focus to spots ~100X smaller than the lens diameters. Tilting the substrate scans the focal points of the ion beamlets across the lens bottoms "writing" any desired nanopattern.

Plasma-surface interactions at a "spinning wall"

We study plasma chemistry on dynamic, reactive surfaces, using a novel spinning substrate to bring the surface from the plasma to an analysis chamber in times of less than 1 millisecond. In the analysis chamber, mass spectrometry is used to observe species that are desorbing, while Auger electron spectroscopy is used to detect such species before they leave the surface. By varying the rotation frequency, surface reaction kinetics can be determined.

Plasma etching of new microelectronic materials

We have a continuing research effort to study plasma etching of emerging materials.

Atmospheric pressure micro-discharges

In joint research with Prof. Demetre Economou, we are exploring the physics, chemistry and applications of atmospheric pressure micro-discharges.

Electron temperatures and energy distributions

Part of our ongoing research is to measure this distribution with optical emission spectroscopy.

Novel Processes

Also with Demetre Economou, we have begun to explore a new methods for atomic layer etching and deposition of nano-crystalline hydrogenated amorphous silicon.

HONORS/ACTIVITIES:

2007	Cullen College of Engineering Senior Research Award
2003	Plasma Prize, American Vacuum Society Plasma Sci. Technol. Division
1999–2001	Chair of the American Vacuum Society Plasma Science and Technology
1997	Fellow, American Vacuum Society
1995–1998	Member of the National Research Council's Plasma Science Committee
1995–2001	Sematech Plasma Diagnostics Process Technical Advisory Board member

SELECTED PUBLICATIONS:

1. "Effect of Cu contamination on recombination of O atoms on a plasma-oxidized silicon surface", J. Guha , R. Khare, L. Stafford. V.M. Donnelly, S. Sirard and E. Hudson, *J. Appl. Phys.,* 105, 113309 (2009).
2. "Electron energy distribution functions in low-pressure oxygen plasma columns sustained by propagating surface waves", L. Stafford, R. Khare, V.M. Donnelly, J. Margot, and M. Moisan, *Appl. Phys. Lett.* 94, 021503 (2009).
3. "Measurement of Electron Temperature and Density in an Argon Microdischarge by Laser Thomson Scattering", S.G. Belostotskiy, R. Khandelwal, Q. Wang, V.M. Donnelly, D.J. Economou, N. Sadeghi, *Appl. Phys. Lett.* 92 (2008).
4. "Mechanisms and Selectivity for Etching of HfO2 and Si in BCl3 Plasmas", C. Wang and V.M. Donnelly, *J. Vac. Sci. Technol.* A 26 (2008).
5. "In-situ surface recombination measurements of oxygen atoms on anodized aluminum in an oxygen plasma", J. Guha, P. Kurunczi, L. Stafford and V.M. Donnelly, *J. Phys. Chem. C,* 112, 8963 (2008).
6. "Etching of nanopatterns in silicon by nanopantography", L. Xu, A. Nasrullah, Z. Chen, P. Ruchhoeft, D.J. Economou and V.M. Donnelly, *Appl. Phys. Letters,* 92, 013124 (2008).
7 "Auger electron spectroscopy of surfaces during exposure to gaseous discharges", J. Guha, Y-K. Pu, and V.M. Donnelly, *J. Vac. Sci. Technol. A,* 25, 347 (2007).
8. "Plasma-Surface Reactions at a Spinning Wall", P.F. Kurunczi, J. Guha, and V.M. Donnelly, *Phys. Rev. Lett.* 96, 018306 (2006).
9. "Nanopantography: A New Method for Massively Parallel Nano-Patterning over Large Areas", L. Xu, S.C. Vemula, M. Jain, S.K. Nam, V.M. Donnelly, D. J. Economou and P. Ruchhoeft, *Nanoletters,* 5, 2563 (2005).

MANOLIS DOXASTAKIS

Assistant Professor of Chemical & Biomolecular Engineering

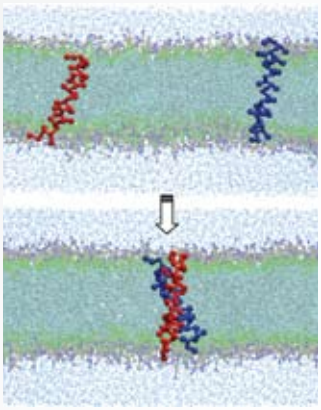
Diploma Chemical Engineering,
National Technical University of Athens
Ph.D. Chemical Engineering, University of Patras

RESEARCH INTERESTS:

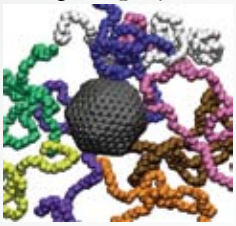
Prof. Manolis Doxastakis' research focuses on the development and application of molecular modeling methodologies to study equilibrium structures, fluctuations, and dynamics of multicomponent systems consisting of polymers, proteins and lipids. Together with the use of advanced experimental techniques, molecular simulations provide a unique molecular level view of cell membranes, membrane proteins and self-assembly and dynamics of mixtures of macromolecules. Specific projects in Dr. Doxastakis' group include the design of large-scale parallel computational techniques to study the factors controlling the association of transmembrane proteins, examine the microscopic wettability of surfaces and design nanocomposites and novel thermoresponsive polymeric materials at the molecular level.

Association of transmembrane proteins

We develop large-scale parallel Monte Carlo methods to model the association events of transmembrane proteins. Our goal is to provide a route for direct thermodynamic estimates of the factor controlling such important processes. Using models that account for sequence specificity and membrane composition, we extract quantitative estimate of free energy of association as a function of separation of the proteins in lipid bilayers..



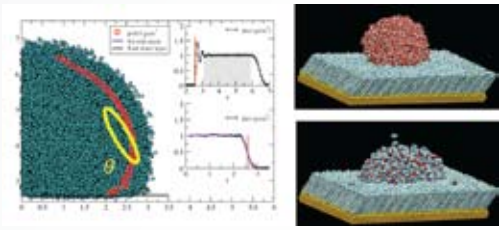
Design of polymer nanocomposites



Detailed atomistic simulations in our group provide unique insight into the molecular arrangements of polymers in the proximity of nanoparticles. Using connectivity-altering Monte Carlo algorithms and recently developed topological analysis techniques we evaluate the particle-induced changes in structure and rheology of polymer melts. Following a hierarchical multiscale approach, from atomistic simulations to simpler coarse-grain models we aim at linking chemical architecture to morphological characteristics of these materials that are critical to their performance.

Microscopic wettability phenomena

Surface properties can be controlled by changes in the chemistry of self-assembled monolayers. Our group performs molecular modeling of alkanethiol monolayers formed on a gold surface to evaluate their characteristics. Detailed assessment of wettability is performed by geometrical analysis of the droplet as well as direct molecular investigation of hydrogen bonding interactions.



HONORS/ACTIVITIES

2009	AIChE National Meeting, Chair in "Multiscale Characterization of Polymers"
2009	Invited Talk, 6th International Discussion Meeting on Relaxation in Complex Systems, Rome, Italy
2009	Invited Talk, 37th Annual Conference of North American Thermal Analysis Society, Lubbock, TX
2008	Invited Talk, W. M. Keck Center for Interdisciplinary Bioscience Training, GCC-Rice University, Houston, TX
2008	UH AIChE Student Chapter Faculty Advisor

SELECTED PUBLICATIONS:

1. L. Janosi and M. Doxastakis, "Accelerating flat-histogram methods for potential of mean force calculations", *J. Chem. Phys.,* 131, 054105, 2009.
2. M. Doxastakis, S. Ohtake, V. Garcia Sakai, J.K. Maranas and J.J. de Pablo, "A molecular view of melting in anhydrous phospholipidic membranes", *Biophys. J.,* 92, 147, 2007.
3. G.J. Papakonstantopoulos, M. Doxastakis, P.F. Nealey, J.L. Barrat and J.J. de Pablo, "Calculation of local mechanical properties of filled polymers", *Phys. Rev. E.,* 75, 031803, 2007.
4. M. Doxastakis, A.K. Sum, and J.J. de Pablo, "Modulating membrane properties: The effect of trehalose and cholesterol on a phospholipid bilayer", *J. Phys. Chem. B.,* 109, 24173, 2005.
5. M. Doxastakis, Y.-L. Chen, J.J. de Pablo, "Potential of mean force between two nanometer-scale particles in a polymer solution", *J. Chem. Phys.* 123, 034901, 2005.
6. G.J. Papakonstantopoulos, Yoshimoto K., M. Doxastakis, P.F. Nealey, and J.J. de Pablo, "Local mechanical properties of polymeric nanocomposites", *Phys. Rev. E.*

DEMETRE J. ECONOMOU

John and Rebecca Moores Professor
Associate Chairman of Chemical & Biomolecular Engineering
Director, Plasma Processing Laboratory

Diploma, Chemical Engineering, National Technical University of Athens, Greece
Ph.D., Chemical Engineering, University of Illinois at Urbana-Champaign

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RESEARCH INTERESTS:

Dr. Economou's research focuses on plasma science and technology as applied to etching and deposition of thin solid films for microelectronic device fabrication, nanotechnology, and surface modification of materials (e.g., biomaterials). A combined modeling-simulation-experimental program is underway to develop fundamental understanding of plasma processes, and to use this understanding in the design of new and improved plasma reactors and devices. The projects described below are in collaboration with V.M. Donnelly.

Plasma Modeling and Plasma Diagnostics

Continuum and particle (Particle-In-Cell, Monte Carlo) simulations are used to understand plasma flow in complex reactor geometries. Plasma "molding" over surface topography is studied, especially the energy and angular distributions of ions bombarding the substrate. Mathematical models are complemented with experimental measurements with emphasis on real-time non-intrusive spatially-resolved optical diagnostics.

Atomic Layer Etching

Current plasma etching techniques do not have the level of control or damage- free nature that is needed for patterning delicate structures with atomic layer precision. This project will develop the principles and techniques for a practical method of etching surfaces, one atomic layer at a time, using a combination of pulsed plasma and monoenergetic ion bombardment. This novel Atomic Layer Etching (ALET) method will fill a critical need for advancing nanoscience and nanotechnology.

Nanopantography

This project deals with the fabrication of orderly arrays of nanofeatures (few nm in size) with pre-defined shapes and patterns over large areas (10s of cm2). These can find application in growth of orderly arrays of singe wall carbon nanotubes, nanoelectronics, and nanocatalysis. Simulations of ion extraction from a plasma and ion beam focusing on the wafer to form nanofeatures by etching or deposition are used to guide experimentation.

Micro-Discharge Plasma Reactors

Miniaturized (~100s of microns) high pressure (~1 atm) micro-discharges are investigated for sensor and micro-electro-mechanical systems (MEMS) applications. Spatially resolved (5 micron resolution) diagnostics and modeling aid in understanding micro-discharge operation to facilitate applications of these micro-reactors.

Plasma Enhanced Deposition for Photovoltaics

A novel rotating reactor is being developed to grow nanocrystalline silicon (nc-Si) films for solar cell applications by plasma enhanced chemical vapor deposition (PECVD). The substrates are alternately exposed to film deposition (silane) and film crystallization (hydrogen) plasmas. The layer-by-layer control of alternating deposition and crystallization reactions, along with the wide parameter space possible with this unique system, could produce nanocrystalline films with superior properties for photovoltaic cells and other applications.

HONORS/ACTIVITIES:

2009	Esther Farfel Award (Highest honor accorded to a UH faculty member)
2008	Plasma Prize, American Vacuum Society
2008	Fluor-Daniel Faculty Excellence Award, College of Engineering
2008	Senior Faculty Award for Excellence in Research, UH
2003	Fellow, American Vacuum Society
2003	Outstanding Teaching Award, College of Engineering
2002	Sigma Xi Research Award
1996–Present	John and Rebecca Moores Professor

SELECTED PUBLICATIONS:

1. Belostotskiy, S.G.; Donnelly, V.M.; Economou, D.J.; Sadeghi, N., Spatially resolved measurements of argon metastable density in a high pressure microdischarge using diode laser absorption spectroscopy. *IEEE Transactions on Plasma Science* 2009, 37 (6), 852-858.
2. Economou, D.J., Modeling and simulation of fast neutral beam sources for materials processing. *Plasma Processes and Polymers* 2009, 6 (5), 308-319.
3. Chen, Z.; Donnelly, V.M.; Economou, D.J.; Chen, L.; Funk, M.; and Sundararajan, R., Measurement of electron temperatures and electron energy distribution functions in dual frequency capacitively-coupled CF4/O2 plasmas using trace rare gases-optical emission spectroscopy (TRG-OES). *Journal of Vacuum Science and Technology A.,* 2009, 27(5),1165.
4. Belostotskiy, S.G.; Donnelly, V.M.; Economou, D.J., Influence of gas heating on high pressure dc microdischarge I-V characteristics. *Plasma Sources Science & Technology* 2008, 17 (4), 045018.
5. Economou, D.J., Fast (tens to hundreds of eV) neutral beams for materials processing. *Journal of Physics D-Applied Physics* 2008, 41 (2), 024001.
6. Xu, L.; Nasrullah, A.; Chen, Z.; Jain, M.; Ruchhoeft, P.; Economou, D.J.; Donnelly, V.M., Etching of nanopatterns in silicon using nanopantography. *Applied Physics Letters* 2008, 92 (1), 013124.
7. Economou, D.J., *Fundamentals and applications of ion-ion plasmas, Applied Surface Science,* 2007, 253, 6672-6680.
8. Nam, S.K.; Economou, D.J.; Donnelly, V.M., Generation of fast neutral beams by ion neutralization in high-aspect-ratio holes: A particle-in-cell simulation study. *IEEE Transactions on Plasma Science* 2007, 35 (5), 1370-1378.
9. Wang, Q.; Doll, F.; Donnelly, V.M.; Economou, D.J.; Sadeghi, N.; Franz, G.F., Experimental and theoretical study of the effect of gas flow on gas temperature in an atmospheric pressure microplasma. *Journal of Physics D-Applied Physics* 2007, 40 (14), 4202-4211.

RAYMOND W. FLUMERFELT

Professor of Chemical & Biomolecular Engineering

B.S. Chemical Engineering, Lamar University
M.S Chemical Engineering, Northwestern University
Ph.D. Chemical Engineering, Northwestern University

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RESEARCH INTERESTS:

Our current interest is in the development of new generation materials and manufacturing processes for large scale wind energy turbine blades. These systems pose many problems because of their scale (up to 80 m in length) and the need for long service life. Current systems are overdesigned and sub optimal, have life cycles much shorter than desired, and involve challenging and complex manufacturing processes. Here we focus on the development of new materials and composite systems which will provide lighter, more reliable, and more durable blades. The research is carried out within the UH National Wind Energy Center and encompasses thermoplastic and thermoset polymers, polymer foams, polymer composites, advance fibers and nanomaterials, as well as the integration of these material elements into new advanced composites. We are also interested in bonding and fatigue issues as well as more efficient manufacturing processes.

Specific current projects and interests include:

- Epoxy and nanophased composite foams and materials
- Integrated microcellular materials
- Modeling and development of new manufacturing approaches for large scale composite structures
- Static and dynamic testing of composite structures
- Thermoplastic composite turbine blades
- Modular composite turbine blades with advanced bonding and joining

HONORS/ACTIVITIES:

2009	Vice Director, UH National Wind Energy Center
2007	PI on the Joint UH/NREL Large Blade Test Facility CRADA at Ingleside, Texas
2007	Principal in the formation of the Lone Star Wind Energy Alliance (now the Wind Alliance)
2005	Principal in the formation of the Greater Houston Energy Collaborative
2002	Principal in the formation of the Texas Energy Center
2001	NASA Honor Medal for Civilian Public Service
2000	Elizabeth D. Rockwell Dean and Chair, University of Houston
1996	Dean of Engineering, University of Alabama
1988–1996	Department Head; Associate Dean; Vice Chancellor of Engineering, Texas A&M
1990	Outstanding Professor, Chemical Engineering, Texas A&M University
1984	Visiting NSF Scholar/Professor, Japan
1980, 1982	Best Fundamental Paper Awards, AICHE, STS
1972–1990	Outstanding Teacher Citations
1963–1966	Walter P. Murphy Procter & Gamble Fellow

- Honorary: Tau Beta Pi, Omega Chi Epsilon, Sigma Xi
- Professional AIChE, ACS, AIME SPE, ASEE
- Trustee, Southwest Research Institute

SELECTED PUBLICATIONS:

1. Flumerfelt, R. W., Wang, S.S., "Wind Turbines," in 2009 *Yearbook of Science & Technology,* McGraw-Hill, 425-429 (2009).
2. Di Maio, E., Mensitieri, G., Iannace, S., Li, W., and R.W. Flumerfetl, "Structure Optimization of Polycaprotactone Foams by Using Mixtures of CO2 and H2 as Blowing Agents," *Polymer Engineering & Science,* 45 (3), 432-441 (2005).
3. Shafi, M.A. and R.W. Flumerfelt, "Initial Bubble Growth in Polymer Foam Processes," *Chem. Eng. Sci.,* **52** (4), 627–33, 1997.
4. Su, Y.Z. and R.W. Flumerfelt, "A Continuum Approach to Microscopic Surface Tension for the n-Alkanes," *Industrial & Engineering Chemistry Research,* 35 (10), 3399–3402, 1997.
5. Shafi, M.A., K. Joshi and R.W. Flumerfelt, "Bubble Size Distributions in Freely Expanded Polymer Foams," *Chem. Eng. Sci.,* **52** (4), 635–44, 1997.
6. Lee, J.G. and R.W. Flumerfelt, "A Refined Approach to Bubble Nucleation and Polymer Foam Processing: Dissolved Gas and Cluster Size Effects," *J. Colloid & Interface Science,* 184, 335–48, 1996.
7. Su, Y.Z. and R.W. Flumerfelt, "The Effect of Dissolved Gas on Foam Nucleation Rates in Polymer Melts," Annu. Tech. Conf.—Society of Plastic Engineers, 54th, 1937–40, 1996.
8. Shafi, M.A., J.G. Lee and R.W. Flumerfelt, "Prediction of Cellular Structure in Free Expansion Polymer Foaming Processes," *Polymer Engineering & Science,* 36 (14), 1950–59, 1996.
9. Lee, J.G. and R.W. Flumerfelt, "Nitrogen Solubilities in Low Density Polyethylene at High Temperatures and Pressures," *J. Appl. Polymer Sci.,* 58, 2213–19, 1995.

MICHAEL P. HAROLD

Professor of Chemical & Biomolecular Engineering

B.S. Pennsylvania State University
Ph.D. Chemical Engineering, University of Houston

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RESEARCH INTERESTS:

Our research is in the area of catalytic engineering with a focus on energy and environmental applications. We carry out fundamental experiments complemented by modeling and simulation to elucidate interactions between the catalytic chemistry and transport processes encountered within the catalytic reactor. Our experimental facilities span ultrahigh vacuum reactors (TAP® reactor), bench-scale reactors, catalyst synthesis and inorganic membrane and characterization equipment, and a heavy-duty dynamometer. Some current projects include:

NOx Reduction in Lean Burn Engine Exhaust

We are investigating the catalytic reduction of NOx to nitrogen in the oxidizing atmosphere of lean burn and diesel vehicles. One approach involves the use of an adsorptive reactor in which the NOx is trapped as a nitrite/ nitrate on an alkaline earth oxide and then reduced by the intermittent feed of a reductant.

The challenge is to achieve high NOx conversion with minimal fuel penalty while sustaining long catalyst life. We are carrying out bench-scale reactor and transient kinetics studies, microkinetic mechanistic-based and reactor modeling to determine optimal reactor designs, catalyst formulations, and operating strategies.

Inorganic Membranes for High Temperature Reaction and Separation

We are researching catalytic reactors that combine reaction with selective separation of a product or distributed feed of reactants. We utilize sol-gel and plating techniques to synthesis thin films of both nanoporous oxides and dense metals that have permselective features. We are developing a high temperature fuel processor that combines hydrocarbon reforming with hydrogen separation in a compact reactor.

HONORS/ACTIVITIES:

2009	Abraham Dukler Distinguished Faculty Award, UH Engineering Alumni Association.
2009	Consulting Editor, AIChE Journal, 2009 – present
2008	ACS Fuel Division Richard A. Glenn Award for the Best Paper presented at ACS 2007 National Meeting in Division of Fuel Chemistry (first out of 285 papers)
2008	Senior Faculty Research Excellence Award, Cullen College of Engineering, University of Houston
2007	Best Applied Paper Award – Southwest Section of AIChE.
2007	Chair, AIChE Publications Committee
1999	Chair, Catalysis and Reaction Engineering Division of AIChE.
1999	Invited participant in National Academy of Engineering "Frontiers of Engineering Symposium," Irvine, California..
1991	Visiting Research Fellow, University of Twente, The Netherlands.
1990	Outstanding Junior Faculty Award, College of Engineering, University of Massachusetts

SELECTED PUBLICATIONS:

1. Bhatia, D.; Balakotaiah, V.; Harold, M.P.; McCabe, R.; Experimental and kinetic study of NO Oxidation on model Pt catalysts, *J. Catalysis* 2009, 266, 106-119.
2. Clayton, R.D.; Harold, M.P.; Balakotaiah, V., Performance Features of Pt/BaO Lean NOx Trap with Hydrogen as Reductant. *AIChE Journal* 2009, 55 (3), 687-700.
3. Israni, S.H.; Nair, B.K.R.; Harold, M.P., Hydrogen generation and purification in a composite Pd hollow fiber membrane reactor: Experiments and modeling. *Catalysis Today* 2009, 139 (4), 299-311.
4. Kumar, A.; Medhekar, V.; Harold, M.P.; Balakotaiah, V.; NO Decomposition and Reduction on Pt/Al2O3 Powder and Monolith Catalysts Using the TAP Reactor, *Appl. Catal. B. Environmental* 2009, 90, 642-651.
5. Joshi, S.Y.; Harold, M.P.; Balakotaiah, V., Low-Dimensional Models for Real Time Simulations of Catalytic Monoliths. *AIChE Journal* 2009, 55 (7), 1771-1783.
6. Xu, J.; Harold, M.P.; Balakotaiah, V., Microkinetic modeling of steady state NO/H2/O2 on Pt/BaO/Al2O3 NOx storage and reduction monolith catalysts. *Applied Catalysis B-Environmental* 2009, 89 (1-2), 73-86.
7. Clayton, R.D.; Harold, M.P.; Balakotaiah, V., Selective catalytic reduction of NO by H2 in O2 on Pt/BaO/Al2O3 monolith NOx storage catalysts. *Applied Catalysis B-Environmental* 2008, 81 (3-4), 161-181.
8. Clayton, R.D.; Harold, M.P.; Balakotaiah, V., NOx storage and reduction with H2 on Pt/BaO/ Al2O3 monolith: Spatio-temporal resolution of product distribution. *Applied Catalysis B-Environmental* 2008, 84 (3-4), 616-630.
9. Israni, S.H.; Nair, B.K.R.; Harold, M.P., Hydrogen generation and purification in a composite Pd hollow fiber membrane reactor: Experiments and modeling. *Catalysis Today* 2009, 130 (4), 299-311.
10. Muncrief, R.L.; Rooks, C.W.; Cruz, M.; Harold, M.P., Combining biodiesel and exhaust gas recirculation for reduction in NOx and particulate emissions. *Energy & Fuels* 2008, 22 (2), 1285-1296.
11. Nair, B.K.R.; Harold, M.R., Experiments and modeling of transport in composite Pd and Pd/Ag coated alumina hollow fibers. *Journal of Membrane Science* 2008, 311 (1-2), 53-67.
12. Lattner, J.R., and M.P. Harold, Autothermal Reforming of Methanol: Experiments and Modeling, *Catalysis Today,* 2007, 120, 78-89.
13. Nair, B.K.R.; Choi, J.; Harold, M.P., Electroless plating and permeation features of Pd and Pd/Ag hollow fiber composite membranes. *Journal of Membrane Science* 2007, 288 (1-2), 67-84.

ERNEST J. HENLEY

Professor Emeritus of Chemical & Biomolecular Engineering

B.S. Chemical Engineering, University of Delaware
M.S. Chemical Engineering, Columbia University
Ph.D. Engineering Science, Columbia University

Email: henleyej@aol.com
www.chee.uh.edu/faculty/henley/

RESEARCH INTERESTS:

- Reliability Engineering and Risk Assessment
- Biomedical Engineering

HONORS/ACTIVITIES:

2002	American Society for Engineering Education CACHE Award, Chemical Engineering Division
2001	Who's Who in America
2001	Who's Who in the World
1998	McGraw-Hill Award for Outstanding Personal Achievement in Chemical Engineering
1993	Fellow of the American Institute of Chemists and the American Institute of Chemical Engineers
1993	US-Japan Ministry of Science Award
1988–Present	Co-editor, Critical Reviews of Physical Medicine and Rehabilitation, Begell Publishing Co., New York

SELECTED PUBLICATIONS:

1. J.D. Seader, E.J. Henley, J.K. Roper, *Separation Process Principles - Chemical and Biochemical,* J. Wiley, 2005.
1. Seader, J.D. and E.J. Henley, *Separation Process Design*, John Wiley & Sons, 1998.
2. Henley, E.J., *Legal and Regulatory Problems for American Business,* Kinokunia Press, Tokyo, 1997. In Japanese; transl. by Dr. H. Kumamoto.
3. Kumamoto, H. and E.J. Henley, *Probabilistic Risk-Analysis and Management for Engineers and Scientists* (2nd edition), IEEE Press, 1996. ISBN 0-7803-1004-7.

PATENTS (US ONLY):

3,760,800, 4,498,462, 4,214,576, 4,893,626, 5,069,908

RAMANAN KRISHNAMOORTI

Dow Chair Professor and Chair, Department of Chemical & Biomolecular Engineering
Professor of Chemistry

B.Tech Chemical Engineering, Indian Institute of Technology, Madras
Ph.D. Chemical Engineering, Princeton University

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RESEARCH INTERESTS:

The goals of our research are to develop (a) materials with tailored properties through a detailed understanding and manipulation of molecular level structure, synthesis and most uniquely processing methodologies and (b) understand and tailor soft materials for applications as multifunctional materials, in energy applications and in biomedical and drug delivery applications.

While the importance of structure-property correlations for materials has been recognized, the importance of processing conditions on the evolution of structure and hence properties in the case of soft materials have not been fully understood. We are pursuing a detailed research program, in collaboration with researchers in industry and national laboratories, to address the role of processing on the structure and properties of multi-phase polymers including polymer blends, block copolymers and microemulsions. Specific research focuses on understanding traditional polyolefin and polydiene materials and developing amphiphilic block, graft and star polymers for a number of technological applications.

The potential for the use of highly anisotropic nanoparticles such as layered silicates and carbon nanotubes dispersed in polymeric matrices promises the ability to develop combinations of physical, mechanical and thermal properties while not increasing weight and thus a new paradigm in materials technology. We have focused our efforts in developing fundamental understanding of the dispersion of the nanoparticles, characterization methodologies that span from the nano to macro length scales, develop correlations to properties and understand how processing can lead to unique microstructures and properties. Our recent efforts focus on multifunctional applications and energy applications including developing super-strong fibers, strengthened and piezoelectric elastomers, materials for fuel cells, longer life lithium ion batteries, materials for wind turbine applications, solar energy applications and oil and gas applications.

Drug and gene delivery methods are increasingly using bio-inspired membranes as carriers and targeting vehicles. We are currently involved in characterizing and modeling the ability of lipid based materials and polymeric materials to provide spatio-temporal stability for such bio-membranes using a range of novel experimental and molecular modeling techniques. Further, we are collaborating with a number of researchers from the medical community in Houston towards the synthesis, characterization and development of delivery vehicles using phospholipids and their polymeric analogs and towards the development of a new generation of biomedical materials for tissue engineering and wound healing.

HONORS/ACTIVITIES:

2009	Associate Director, Alliance for NanoHealth
2008	Fellow, American Physical Society
2006	Journal of Polymer Science: Polymer Physics Prize, John Wiley
2005	Award for Excellence in Research and Scholarship, University of Houston
2001–2006	Editorial Board, Journal of Polymer Science Part B: Polymer Physics
2001	Award for Excellence in Research and Scholarship, University of Houston
2000	Junior Faculty Research Award, Cullen College of Engineering, University of Houston
1999	NSF Career Award, Division of Materials Research

SELECTED PUBLICATIONS:

1. Xu, L.; Nakajima, H.; Manias, E.; Krishnamoorti, R., Tailored Nanocomposites of Polypropylene with Layered Silicates. *Macromolecules* 2009, 42 (11), 3795-3803.
2. Chatterjee, T.; Jackson, A.; Krishnamoorti, R., Hierarchical structure of carbon nanotube networks. *Journal of the American Chemical Society* 2008, 130 (22), 6934-6935.
3. Chatterjee, T.; Krishnamoorti, R., Steady shear response of carbon nanotube networks dispersed in poly(ethylene oxide). *Macromolecules* 2008, 41 (14), 5333-5338.
4. Jeon, K.; Krishnamoorti, R., Morphological Behavior of Thin Linear Low-Density Polyethylene Films. *Macromolecules* 2008, 41 (19), 7131- 7140.
5. Chatterjee, T.; Krishnamoorti, R., Dynamic consequences of the fractal network of nanotube-poly(ethylene oxide) nanocomposites. *Physical Review E* 2007, 75 (5).
6. Chatterjee, T.; Mitchell, C.A.; Hadjiev, V.G.; Krishnamoorti, R., Hierarchical polymer-nanotube composites. *Advanced Materials* 2007, 19 (22), 3850-+.
7. Heinz, H.; Vaia, R.A.; Krishnamoorti, R.; Farmer, B.L., Self-assembly of alkylammonium chains on montmorillonite: Effect of chain length, head group structure, and cation exchange capacity. *Chemistry of Materials* 2007, 19 (1), 59-68.
8. Krishnamoorti, R.; Vaia, R.A., Polymer nanocomposites. *Journal of Polymer Science Part B-Polymer Physics* 2007, 45 (24), 3252-3256.
9. Mitchell, C.A.; Krishnamoorti, R., Dispersion of single-walled carbon nanotubes in poly(epsilon-caprolactone). *Macromolecules* 2007, 40 (5), 1538-1545.
10. Putz, K.; Krishnamoorti, R.; Green, P.F., The role of interfacial interactions in the dynamic mechanical response of functionalized SWNT-PS nanocomposites. *Polymer* 2007, 48 (12), 3540-3545.
11. Semler, J.J.; Jhon, Y.K.; Tonelli, A.; Beevers, M.; Krishnamoorti, R.; Genzer, J., Facile method of controlling monomer sequence distributions in random copolymers. *Advanced Materials* 2007, 19 (19), 2877-2883.

DAN LUSS

Cullen Professor of Chemical & Biomolecular Engineering

B.S. Chemical Engineering, Technion, Israel
M.S. Chemical Engineering, Technion, Israel
Ph.D. Chemical Engineering, University of Minnesota

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RESEARCH INTERESTS:

Improved reduction of soot emission from the exhaust of diesel engines. Diesel engine powered vehicles emit particulate matter (PM) that needs to be removed as it entails respiratory problems. The current most efficient technology for reduction of this PM emission is by use of Diesel Particlute Filtwers (DPFs). Experience shows that in some cases some very hot regions develop in the DPF ceramic filter which causes local melting and requires its replacement. It is still an open question what causes this unexpected temperature rise. We are conducting both experimental and theoretical-simulation studies to determine what can lead to such temperature rise and the dependence of its amplitude on the operating conditions and filter design. The results will guide designers of these filters how to circumvent this deleterious effect and enhance its stability and operability.

Novel Synthesis Method of Complex Oxides

Complex oxides have many industrial applications, such as synthesis of components of fuel cells, superconducting materials, etc. We have developed a novel, economic combustion method for the synthesis of these oxides which is more economical than other existing methods.. We conduct research to determine the behavioral features of the process that are needed for a rational optimized scale-up.

Development of nano-enetgetic materials.

In many applications it is desired to be able to generate a rapid very high pressure release by a l reaction of a small solids mixture. We are conducting research the use of various nano particles mixtures to achieve this goal. Of particular emphasis is the relations between the size of the nano-particles and the rate and intensity of the chemical reaction that leads to the gas release.

HONORS/ACTIVITIES:

2005	Founders Award, AIChE
2003	Sartorius India's Chemcon Distinguished Speaker Award
1996	Research Award by the Alexander von Humboldt Foundation, Germany
1990	Fellow, AIChE
1986	Wilhelm Award, AIChE
1985	ASEE Chemical Engineering Division Lectureship Award
1984	National Academy of Engineering
1979	Professional Progress Award, AIChE
1972	Allan P. Colburn Award, AIChE

SELECTED PUBLICATIONS:

1. K. Chen, K.S. Martirosyan and D. Luss, Soot combustion dynamics in a planar diesel particulate filter, *Ind. Eng. Chem. Res.,* 48, 3323-3330, (2009).
2. K.S. Martirosyan, L Wang, A. Vicent, and D. Luss, "Fabrication of Metal Oxides Nanoparticles by Highly Exothermic Reactions", *Chem. Eng. & Tech.,* 32, No. 9, 1 (2009).
3. K.S. Martirosyan and D. Luss, Fabrication of metal oxides Nanoparticles by highly exothermic reactions, *Chem. Eng. Techn.,* 32, 9, 1376-1383 (2009).
4. K. Chen, K.S. Martirosyan and D. Luss, Wrong-way behavior of soot combustion in a planar diesel particulate filter, *Ind. Eng. Chem. Res.,* 48 8451-8456, (2009).
5. K.S. Martirosyan, K. Chen and D. Luss, Behavior Features of Soot Combustion in Diesel Particulate Filter, *Chem. Eng. Sci.* to be published in (2009).
6. K.S. Martirosyan, L. Wang, A. Vicent, and D. Luss, Nanoenrgetic Gas-Generator: Design and Performance, Propellants, Explosives, Pyrotechnics, to be published in (2009).
7. K.S. Martirosyan, L Wang, A. Vicent, and D. Luss, Fabrication of Bismuth Trioxide Nanoparticles for gas Generators Applications, *NSTI-NANO Tech.,* 1, 82-85 (2009).
8. K.S. Martirosyan, L Wang, A. Vicent, and D. Luss, Fabrication of Bismuth Trioxide Nanoparticles for gas Generators Applications, *NSTI-Nanotechnology,* 20, 82- 85 (2009).
9. K.S. Martirosyan, L Wang, A. and D. Luss, Novel nanoenergetic system based on iodine pentoxide, *Chem. Phys. Lett.,* to be published in (2009).
10. Hamilton, P.; Hill, D.R.; Luss, D., Optical and infrared study of individual reacting metallocene catalyst particles. *Aiche Journal* 2008, 54 (4), 1054-1063.
11. Hamilton, P.; Luss, D., Catalyst particle design for optimum polyolefin productivity. *Industrial & Engineering Chemistry Research* 2008, 47 (9), 2905-2911.
12. Martirosyan, K.S.; Galstyan, E.; Xue, Y.Y.; Luss, D., The fabrication of YBCO superconductor polycrystalline powder by CCSO. *Superconductor Science & Technology* 2008, 21 (6).
13. Viswanathan, G.A.; Sheintuch, M.; Luss, D., Transversal Hot Zones Formation in Catalytic Packed-Bed Reactors. *Industrial & Engineering Chemistry Research* 2008, 47 (20), 7509-7523.
14. Gerdes, K.; Luss, D., Oxygen flux increases through MIEC membranes by enhanced surface exchange. *Aiche Journal* 2007, 53 (5), 1389-1391.
15. Hamilton, P.; Song, H.; Luss, D., Dual-site supported metallocene catalyst design for bimodal polyolefin synthesis. *Aiche Journal* 2007, 53 (3), 687-694.
16. Martirosyan, K.S.; Chang, L.; Rantschler, J.; Khizroev, S.; Luss, D.; Litvinov, D. In Carbon combustion synthesis and magnetic properties of cobalt ferrite nanoparticles, 2007; pp 3118-3120.
17. Martirosyan, K.S.; Luss, D., Carbon combustion synthesis of ferrites: Synthesis and characterization. *Industrial & Engineering Chemistry Research* 2007, 46 (5), 1492-1499.
18. Pinkerton, B.; Luss, D., Hot zone formation during hydrogenation of ethylene and acetylene mixtures in a shallow packed bed reactor. *Industrial & Engineering Chemistry Research* 2007, 46 (7), 1898-1903.

MICHAEL NIKOLAOU

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RESEARCH INTERESTS:

Hard to define yet easy to recognize, intelligence as a feature in the operation of engineered systems is highly desirable and increasingly possible. Whether one deals with a chemical plant, an offshore oil-production platform, a food-processing facility, a microchip making factory, or a medicated human patient, intelligent operation of a system offers distinct advantages, ranging from high return on investment to improved quality, reliability, and safety. Computer software and hardware (from a simple chip to a full computer) and their interaction with humans are at the heart of intelligent operations. The ubiquitous concept of feedback is the basic underlying principle. While the computer is the "brains", all elements of a feedback loop (including sensors, actuators, and transmission/communication lines) are important and have experienced unprecedented advancement in recent years. In this context, our research aims at the development of:

- new fundamental methods for the solution of broad classes of intelligent operations problems, and
- solutions for specific problems of real-world importance.

There are several tools of quantitative analysis employed by our group, including system modeling and identification, optimization, statistics, and feedback control. In addition, domain expertise in the various fields where we conduct our research is of paramount importance. As a consequence, our work has a strong interdisciplinary flavor and often builds on collaboration with investigators from other fields. Solutions proposed by our work are tested using computer simulations, laboratory experiments, or industrial-site tests. Examples of on-going research areas include the following:

- Oil and Gas Production Systems: What hardware and software technologies can be used in the field to safely maximize return-on-investment for drilling and production operations?
- Effective Development and Use of Antibiotics: How can new antibiotics and clinical practices be designed that maximize the killing effect of antibiotics on pathogenic bacteria while minimizing toxicity for human patients?

Our collaboration with field practitioners is an essential element in our quest for fundamental solutions to problems or relevance to the real world. Many of our students conduct part of their research at industrial collaborator sites—both in the Houston area and elsewhere—a practice that offers many clear benefits to all parties involved. Over 20 Ph.D. students graduating from our group have landed successful careers in diverse industrial areas, such as oil and gas, refining, chemicals, semiconductor, engineering design, and food processing, as well as in academia.

HONORS/ACTIVITIES:

2007	CAST Directors Poster Paper Award (with M. Darby), AIChE Annual Meeting,
2007	Top 2% Reviewer, Automatica
2007	Cullen College of Engineering Teaching Excellence Award
2005	3rd place, Keck Center 2005 Annual Research Conference Poster Contest
1996–1997	TEES Fellow, Texas A&M University
1993–1994	Professor of the Year, Student Chapter of AIChE, Texas A&M University
1993	TEES Select Young Faculty (Junior TEES Fellow), Texas A&M University
1992	Dow Excellence in Teaching Award, Texas A&M University

SELECTED PUBLICATIONS:

1. Darby, M.L.; Nikolaou, M., Multivariable system identification for integral controllability. *Automatica,* 2009, 45(10), 2194-2204.
2. Lim, T.P.; Ledesma, K.R.; Chang, K.T.; Hou, J.G.; Kwa, A.L.; Nikolaou, M.; Quinn, J.P.; Prince, R.A.; Tam, V.H., Quantitative assessment of combination antimicrobial therapy against multidrug-resistant Acinetobacter baumannii. *Antimicrobial Agents and Chemotherapy* 2008, 52 (8), 2898-2904.
3. Tam, V.H.; Ledesma, K.R.; Vo, G.; Kabbara, S.; Lim, T.P.; Nikolaou, M., Pharmacodynamic Modeling of Aminoglycosides against Pseudomonas aeruginosa and Acinetobacter baumannii: Identifying Dosing Regimens To Suppress Resistance Development. *Antimicrobial Agents and Chemotherapy* 2008, 52 (11), 3987-3993.
4. Darby, M.L.; Nikolaou, M. In *A parametric programming approach to moving-horizon state estimation,* 2007; pp 885-891.
5. Nikolaou, M.; Schilling, A.N.; Vo, G.; Chang, K.T.; Tam, V.H. In *Modeling of microbial population responses to time-periodic concentrations of antimicrobial agents,* 2007; pp 1458-1470.
6. Tam, V.H.; Schilling, A.N.; Poole, K.; Nikolaou, M. In *Mathematical modelling response of Pseudomonas aeruginosa to meropenem,* 2007; pp 1302-1309.

JAMES T. RICHARDSON

Professor of Chemical & Biomolecular Engineering

B.A. Physics, Rice University
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RESEARCH INTERESTS:

Professor Richardson's research involves experimental heterogeneous catalysis as related to industrial catalytic processes. Topics include:

- Heterogeneous catalysis and catalytic processes, reactor engineering, catalyst preparation and characterization, and catalyst design
- Solar energy, solar receiver design and solar related chemical processes
- Catalytic processes for the destruction of hazardous wastes
- Gas to liquid conversion processes
- High-temperature super conductivity and processing of ceramic superconductors
- Solid oxide fuel cells and ceramic membrane reactors
- Combinatorial catalysis
- Combustion catalysts
- Fuel processors for fuel cells

HONORS/ACTIVITIES:

2007	Best Applied Paper Award, South Texas Section, AIChE
2004	Best Fundamental Paper Award, South Texas Section, AIChE
1999	Best Applied Paper Award, South Texas Section, AIChE
1997	Abraham Dukler Distinguished Faculty Award, Cullen College of Engineering Alumni, University of Houston
1993	Senior Faculty Research Award, Cullen College of Engineering, University of Houston
1989	Best Applied Paper Award, South Texas Section, AIChE

SELECTED PUBLICATIONS:

1. Peng, Y. and Richardson, J.T., "Properties of Ceramic Foam Catalyst Supports: One Dimensional and Two-Dimensional Heat Transfer Correlations," *Appl. Catal. A: Gen.,* 266, 235, 2004.
2. Richardson, J.T.; Scates,R.M. and Twigg, M.V., "X-Ray Diffraction Study of the Hydrogen Reduction of NiO/a-Al2O3 Steam Reforming Catalysts," *Appl. Catal. A: Gen.,* 267, 35, 2004.
3. Shafiei, M. and Richardson, J.T., "Dechlorination of Chlorinated Hydrocarbons by Catalytic Steam Reforming," *Appl. Catal. B: Environ.,* 54, 211, 2004.
4. Richardson, J.T.; Scates, R. and Twigg, M.V., "X-Ray Diffraction Study of Nickel Oxide Reduction by Hydrogen," *Appl. Catal. A: Gen.,* 246, 137, 2003.
5. Richardson, J.T.; Remue, D., and Hung, J.-K., "Properties of Ceramic Foam Catalyst Supports: Mass and Heat Transfer," *Appl. Catal. A: Gen.,* 250, 319, 2003.
6. Richardson, J.T.; Garrait, M., and Hung, J.-K., "Carbon Dioxide Reforming with Rh and Pt-Re Catalysts Dispersed on Ceramic Foam Supports," *Appl. Catal. A: Gen.,* 255, 69, 2003.
7. Twigg, M.V. and Richardson, J.T., "Theory and Application of Ceramic Foam Catalysts," *IChemE Trans. Part A—Chem. Eng. Res. and Design,* 80, 183, 2002.
8. Nersesyan, M.D.; Ritchie, J.T.; Filimov, I.A.; Richardson, J.T., and Luss, D., "Electric Fields Produced by High-Temperature Metal Oxidation," *J. Electrochem. Soc.,* 149, J11–17, 2002.
9. Avakyan, P.B.; Nersesyan, M.D.; Merzhanov, A.G., and Richardson, J.T., *"Continuous SHS Technology and Properties of Soft Magnetic Ferrites,"* Proceedings of VI International Symposium on of SHS, 17, Haifa, Israel, 2002.
10. McMinn, T.E.; Moates, F.C., and Richardson, J.T., "Catalytic Steam-Reforming of Chlorocarbons: Catalyst Deactivation," *Appl. Catal. B: Environ.,* 31, 93, 2001.
11. Ritchie, J.T.; Richardson, J.T., and Luss, D., "Ceramic Membrane Reactor for Synthesis Gas Production," *AIChE J.,* 47, 2092, 2001.
12. Nersesyan, M.D.; Claycomb, J.R.; Ritchie, J.T.; Miller, Jr., J.H.; Richardson, J.T., and Luss, D., "Electric and Magnetic Fields Generated by SHS," *J. Mat. Syn. and Proc.,* 9, 63, 2001.
13. Twigg, M.V. and Richardson, J.T., "Effects of Alumina Incorporation in Coprecipitated NiO-Al2O3 Catalysts," *Appl. Catal. A: Gen.,* 190, 61, 2000.
14. Richardson, J.T.; Peng, Y., and Remue, D., "Properties of Ceramic Foam Catalyst Supports: Pressure Drop," *Appl. Catal. A: Gen.,* 204, 2000.
15. Ming, Q.; Nersesyan, M.D.; Richardson, J.T.; Luss, D., and Shiryaev, A.A., "A New Route to Synthesize La1-xSrxMnO3," *J. Mat. Res.,* 35, 3599–3606, 2000.
16. Coute, N. and Richardson, J.T., "Steam Reforming of Chlorocarbons: Chlorinated Aromatics," *Appl. Catal. B: Environ.,* 26, 217, 2000.
17. Coute, N. and Richardson, J.T., "Catalytic Steam Reforming of Chlorocarbons: Polychlorinated Biphenyls (PCBs)," *Appl. Catal. B: Environ.,* 26, 265, 2000.
18. Moates, F.C.; McMinn, T.E., and Richardson, J.T., "A Radial Reactor for Trichloroethylene Steam Reforming," *AIChE J.,* 45, 2411, 1999.
19. Intarajang, K. and Richardson, J.T., "Catalytic Steam Reforming of Chlorocarbons: Catalyst Comparisons," *Appl. Catal. B: Environ.,* 22, 27, 1999.
20. Coute, N.; Ortego, Jr., J.D.; Richardson, J.T., and Twigg, M.V., "Catalytic Steam Reforming of Chlorocarbons: Trichloroethane, Trichloroethylene and Perchloroethylene," *Appl. Catal. B: Environ.,* 19, 175, 1998.
21. Richardson, J.T., *Principles of Catalyst Development,* Plenum Press, New York, 1989.

JEFFREY RIMER

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B.S., Chemistry, Allegheny College
B.S., Chemical Engineering, Washington University in St. Louis
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RESEARCH INTERESTS:

- Microporous Materials Synthesis and Characterization for Catalytic and Biomedical Applications; Pathological Biomineralization of Kidney Stones and Vascular Calcification; Crystal Engineering; Nanomaterials Self-Assembly; X-Ray and Neutron Scattering; Atomic Force Microscopy My research program focuses on crystal engineering, nanomaterials selfassembly, and pathological biomineralization at both the microscopic and macroscopic levels to address challenges of materials design for applications in catalysis and medicine. Research projects involve collaborative partnerships with both industry and medical centers to investigate fundamental problems in three general areas:

Design of Microporous Nanomaterials: we use bio-inspired approaches for selectively tuning zeolite properties through tailored growth inhibitors that bind to specific faces on zeolite surfaces via molecular recognition and alter crystal habit. Interactions of growth inhibitors with zeolite surfaces and their effect on growth kinetics are investigated at an interfacial level using atomic force microscopy. We seek to exploit this approach of controlled zeolite crystallization to improve nanomaterials for applications in catalysis and separations, and for nanoparticle toxicology studies of elongated mineral particles.

Mechanism of Vascular Calcification: we investigate calcium phosphate formation in arterial plaque using surfaces that mimic endothelial cells to examine in vitro self-assembly of calcium deposits, the effect of arterial constituents, such as proteins and lipids, on heterogeneous nucleation and crystal growth, and the role of calcification in the adverse physiological effects of heart disease.

Pathological Biomineralization of Kidney Stones: we focus on the formation of calcium oxalate monohydrate and L-cystine stones to quantitatively investigate crystal nucleation and growth at various physiological conditions and in the presence of urinary proteins that are integral in regulating stone formation. We explore therapeutic approaches for treating stone disease through tailored growth inhibitors, which significantly alter crystal habit, yield, and growth kinetics. This approach is an alternative to current therapies, which suppress but do not completely prevent stone formation, and often cause adverse side effects, such as nausea, fatigue, and skin allergies.

HONORS/ACTIVITIES:

2006	Philadelphia Catalysis Club Poster Award, Wilmington, DE
2005	Robert L. Pigford Teaching Assistant Award, University of Delaware
2001	Dual Degree Chemical Engineering Award, Washington University in St. Louis
1999–2001	Harold P. Brown Fellowship, Washington University in St. Louis
1996–1999	Presidential Honor Scholarship, Allegheny College
1999	Sandra Doane Turk Award, Allegheny College
1998	Most Outstanding Junior Chemist Award, Allegheny College
1998	ACS Polymer Division Award for Outstanding Performance in Organic Chemistry
1997	ACS Most Outstanding Freshman Chemistry Student

SELECTED PUBLICATIONS:

1. Viswanathan, P., Rimer, J.D., Beshensky, A.M., Ward, M.D., Wesson, J.A., Kleinman, J.G.. Calcium Oxalate Monohydrate Aggregation is Induced by Desialylated Tamm-Horsfall Protein, (2009, submitted to Kidney International).
2. Rimer, J.D., Trofymluk, O., Lobo, R.F., Navrotsky, A., Vlachos, D.G.. Thermodynamics of Silica Nanoparticle Self-Assembly in Basic Solutions of Monovalent Cations, *J. Phys. Chem. C,* 112 (2008) 14754-14761.
3. Rimer, J.D., Roth, D.D., Lobo, R.F., Vlachos, D.G.. Self-Assembly and Phase Behavior of Germanium Oxide Nanoparticles in Basic Aqueous Solutions, *Langmuir,* 23 (2007) 2784-2791.
4. Rimer, J.D., Trofymluk, O., Navrotsky, A., Lobo, R.F., Vlachos, D.G.. Kinetic and Thermodynamic Studies of Silica Nanoparticle Dissolution, *Chem. Mater.* 19 (2007) 4189-4197.
5. Rimer, J.D., Fedeyko, J.M., Vlachos, D.G., Lobo, R.F.. Silica Self-Assembly and the Synthesis of Microporous and Mesoporous Silicates, *Chem. Eur. J.* 12 (2006) 2926-2934.
6. Rimer, J.D., Lobo, R.F., Vlachos, D.G.. Physical Basis for the Formation and Stability of Silica Nanoparticles in Basic Solutions of Monovalent Cations, *Langmuir* 21 (2005) 8960-8971.
7. Rimer, J.D., Vlachos, D.G., Lobo, R.F.. Evolution of Self-Assembled Silica Tetrapropylammonium Nanoparticles at Elevated Temperatures, *J. Phys. Chem. B* 109 (2005) 12762-12771.
8. Fedeyko, J.M., Rimer, J.D., Lobo, R.F., Vlachos, D.G.. Spontaneous Formation of Silica Nanoparticles in Basic Solutions of Small Tetraalkylammonium Cations, *J. Phys. Chem. B* 108 (2004) 12271-12275.
9. Kragten, D.D., Fedeyko, J.M., Sawant, K.R., Rimer, J.D., Vlachos, D.G., Lobo, R.F.. Structure of the Silica Phase Extracted from Silica/(TPA)OH Solutions Containing Nanoparticles, *J. Phys. Chem. B* 107 (2003) 10006-10016.

GILA STEIN

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RESEARCH INTERESTS:

Our research focuses on structure-property-processing correlations in polymer-based electronic materials. Applications for our work include integrated circuit manufacturing and optoelectronic devices. We are currently concentrating on three core research areas:

Image formation in chemically-amplified resists. Projection lithography is the primary technology used to pattern integrated circuits. High-throughput manufacturing requires sensitive (fast) imaging materials based on ``chemical amplification.'' Chemically-amplified (CA) resists have two principal components: A polymer with an acid-labile pendant group, and a photoacid generator. Exposing the resist to radiation generates a strong acid, and when heated at moderate temperature the acid will catalyze the decomposition of pendant groups along the polymer backbone. We are developing techniques to measure the coupled reaction-diffusion process in three-dimensions with nanoscale resolution. The feedback acquired enables construction of process models that include complex spatiotemporal polymer properties. The long term goal of this program is to develop methods for rapid materials screening.

Block copolymer self-assembly. Thin films of block copolymers self-assemble into periodic mesophases, offering a simple and inexpensive route for large-area nanopatterning. We study the impact of copolymer architecture and chemistry on the size, shape, and roughness of the block copolymer domains. We emphasize factors that are relevant for semiconductor manufacturing, such as nanostructure aspect ratio, mechanical stability, line-edge roughness, and size polydispersity. ``Directed self-assembly'' techniques are evaluated for controlled domain placement. Our goals are to understand the fundamental materials limitations, and to develop predictive models for the performance of block copolymers in high-resolution lithography.

Design and optimization of solar cells based on conjugated polymers. Conjugated polymers show promise as the active components in low-cost "plastic" solar cells, but controlling the nanoscale morphology is essential to optimize the photo-generation of charge-carriers. Most devices are based on a "bulk heterojunction:" This is a co-continuous structure that results from spinodal decomposition of a donor-acceptor blend, producing domain sizes on the order of 10 to 100 nm. Our group uses advanced nanofabrication techniques to template uniform nanoscale domains, which enables construction of well-defined prototypes. The long-term aim of this program is to correlate the power-conversion efficiency of polymer solar cells with the nanoscale structure, thereby generating a set of guidelines for design optimization while providing insight into the device photophysics.

HONORS/ACTIVITIES:

2007–2008	NRC Postdoctoral Research Award, National Institute of Standards and Technology
2008	Polymers/soft materials science team, APS renewal workshop
2006	UCSB-MROP Poster Award for graduate student research
2002	AIChE Zeisberg Award for Technical Writing, Delaware Valley Region
2002	ACS Scholastic Achievement Award
2002	Milton Rosenberg Scholarship
2001	Hess Foundation Scholarship in Chemical Engineering
1997–2002	A.J. Drexel Scholarship

SELECTED PUBLICATIONS:

1. Tang, C.B., J. Bang, G.E. Stein, et al., Square packing and structural arrangement of ABC triblock copolymer spheres in thin films. *Macromolecules,* 2008. 41(12): p. 4328-4339.
2. Stein, G.E., E.J. Kramer, X. Li, et al., Single-crystal diffraction from two-dimensional block copolymer arrays. *Physical Review Letters,* 2007. 98(8).
3. Stein, G.E., E.J. Kramer, X.F. Li, et al., Layering transitions in thin films of spherical-domain block copolymers. *Macromolecules,* 2007. 40(7): p. 2453-2460.
4. Stein, G.E., E.W. Cochran, K. Katsov, et al., Symmetry breaking of in-plane order in confined copolymer mesophases. *Physical Review Letters,* 2007. 98(15).
5. Bang, J., B.J. Kim, G.E. Stein, et al., Effect of humidity on the ordering of PEO-based copolymer thin films. *Macromolecules,* 2007. 40(19): p. 7019-7025.
6. Stein, G.E., W.B. Lee, G.H. Fredrickson, et al., Thickness dependent ordering in laterally confined monolayers of spherical-domain block copolymers. *Macromolecules,* 2007. 40(16): p. 5791-5800.
7. Khanna, V., E.W. Cochran, A. Hexemer, et al., Effect of chain architecture and surface energies on the ordering behavior of lamellar and cylinder forming block copolymers. *Macromolecules,* 2006. 39(26): p. 9346-9356.
8. Hexemer, A., G.E. Stein, E.J. Kramer, et al., Block copolymer monolayer structure measured with scanning force microscopy moire patterns. *Macromolecules,* 2005. 38(16): p. 7083-7089.

NAVIN VARADARAJAN

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RESEARCH INTERESTS:

The thrust of the technologies in our lab will be aimed at developing high-throughput screens designed to characterize a wide range of functions ranging from the properties of proteins in single cells to antigen mediated cellular cytotoxicity. The development of these assays should serve as versatile platforms for the systemic investigation of B cells and antibodies in autoimmune diseases; characterizing T cell responses (CD4/CD8) in cancer and engineering therapeutic enzymes/antibodies and will lead to comprehensive programs directed towards both, vaccine development based on T cell characterization in disease states, and therapeutic intervention to target antibodies/B cells against auto-antigens in autoimmune diseases. Specifically, the three main areas of focus will be:

1. Characterize primary Cytotoxic T Lymphocyte (CTL) responses in cancer. The phenotype, functionality, and genetic transcriptional profile of tumor-specific CTLs capable of restricting tumor-cells in comparison to those that cannot, is currently unknown. Defining these characteristics at the single cell level will allow us to categorize the immunologic and genetic correlates that must be elicited through vaccination to drive the expansion of tumor-restrictive CD8+ T cells.
2. Study of autoreactive B cells/antibodies in rheumatoid arthritis. Autoimmunity towards citrulline-modified proteins underlies arthritis (at least in rodents). The adoptive transfer of monoclonal antibodies against citrullinated proteins has demonstrated a critical role for autoantibodies in the progression of arthritis. Isolating autoreactive B cells, and subsequent characterization of the autoantibodies and protein eptiopes responsible for generating these antibodies should aid both early diagnosis and therapeutic intervention in rheumatoid arthritis.
3. Engineering substrate specificity of proteases as a pathway for the catalytic inactivation of target proteins. Inhibitors of tumor-necrosis factor alpha (TNF-α) have shown considerable efficacy in chronic inflammatory diseases like rheumatoid arthritis. Most inhibitors are, however based on small molecules or monoclonal antibodies, and hence act in a stoichiometric manner. A catalytic inactivation approach, by modifying the substrate-specificity of human caspases to selectively hydrolyze TNF-α, will be attempted. It is anticipated that the screening assays, once optimized in the contexts described above, can be readily adapted to addressing similar research objectives.

   For example, the approach that will be described for the isolation of autoantibodies in rheumatoid arthritis can also be applied to identify the mechanism, sequence and clonal diversity of naturally proteolytic antibodies in hemophilia.

HONORS/ACTIVITIES:

2009–Present Member, American Institute of Chemical Engineers.
2006–Present Member, American Chemical Society.
1998–2001 Indian Institute of Science, Integrated PhD fellowship.

SELECTED PUBLICATIONS:

1. Varadarajan, N., Pogson M., Georgiou, G. and Iverson, B.L. (2009) 'A three color multi-substrate flow-cytometric assay to engineer protease specificity for nitro-tyrosine' *J. Am. Chem. Soc.* in press.
2. Varadarajan, N., Cantor, J., Georgiou, G. and Iverson, B.L. (2009) 'Construction and flow-cytometric screening of targeted enzyme libraries' *Nature Protocols* 4(6):893-901.
3. Varadarajan, N., Rodriguez, S., Hwang, B.Y., Georgiou, G., Iverson, B.L. (2008) 'Engineering a family of highly active and selective endopeptidases with programmed substrate specificities' *Nature Chemical Biology* 4(5):290-4.
4. Varadarajan, N., Georgiou, G., Iverson, B.L. (2008) 'Engineered proteases that cleave specifically after sulfated tyrosine for the detection of post-translationally modified peptides' *Angew Chem. Intl. Ed.* 47(41):7861.
5. Hwang, B.Y., Varadarajan, N., Li, H., Rodriguez, S., Iverson, B.L., Georgiou, G. (2007) 'Substrate specificity of the Escherichia coli outer membrane protease ompP' *J. Bacteriology* 189: 522-30.
6. Varadarajan, N., Gam, J., Olsen, M.J., Georgiou, G., Iverson, B.L., (2005) 'Engineering of protease variants exhibiting high catalytic activity and exquisite substrate selectivity' *Proc Natl Acad Sci USA.* 102:6855-60.

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Professor of Chemistry

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RESEARCH INTERESTS:

We study the phase transitions occurring in solutions of biological macromolecules. These include the formation of a variety of solid phases, such as polymers, fibrils, crystals and precipitates, as well as liquid and gel-like phases. We start from the intermolecular interactions that underlie the solution thermodynamics, through the phase diagrams and the kinetics of nucleation of the phase transitions, though the interactions between the phases, all the way to the mechanism of the growth of the new, in most cases, condensed phase on the molecular, capillary, and transport length scales. Two recent foci of investigations are (i) the polymerization of sickle cell hemoglobin, which is the primary pathogenic event of sickle cell anemia, and (ii) the general mechanisms of nucleation of solid phases in solution.

The major areas of investigation are:

- Protein intermolecular interactions and phase diagrams
- Nucleation mechanisms of ordered and disordered phases
- Mesoscopic protein phases: rationale and consequences
- Design of protein nano-arrays
- Physico-chemical aspects of sickle-cell anemia
- Protein crystallization
- Mechanisms of crystallization of membrane proteins

HONORS/ACTIVITIES:

2009	Program Committee Member, 17th American Conference on Crystal Growth and Epitaxy
2007	Chair, Gordon Conference on Thin Film and Crystal Growth Mechanisms
2006	Executive Committee Member, American Crystal Growth Association
2006	UH Excellence in Research and Scholarship Award
2005	Vice-Chair, Gordon Conference on Thin Film and Crystal Growth Mechanisms
2004	Executive Council Member, International Organization for Biological Crystallization
2004	Lead Organizer, Symposium Q: Nucleation—Dynamics and Structures, 2004 Spring MRS Meeting, San Francisco, California
2003	Member, U.S. National Committee for Crystallography
2002	DuPont Research Award
2002	Program Committee, Ninth International Conference on Crystallization of Biological Macromolecules (ICCBM-9), Jena, Germany
2002	Topic Editor, Crystal Growth and Design
2001	Foundation Research and Creative Achievement Award, University of Alabama, Huntsville
2001	Lead Organizer, Symposium R: Morphology and Dynamics of Crystal Surfaces in Molecular and Colloid Systems, 2001 Spring Materials Research Society Meeting, San Francisco, California
2000	Editorial Board, Eighth International Conference on Crystallization of Biological Macromolecules (ICCBM-8) Sandestin, Florida
1995	International Union of Crystallography Young Scientist Award, Sixth International Conference on Crystallization of Biological Macromolecules, Hiroshima, Japan
1993	Research Award, International Human Frontiers Science Program
1992	Research Award, Science and Technology Agency, Government of Japan
1990	First Prize, Annual Research Session, Institute of Crystallography, Russian Academy Science
1986	Shubnikov Prize, Russian Academy of Sciences
1984	Gold Medal, Ministry of Highest Education of the USSR
1980	Diploma, Twelfth International Chemical Olympiad, Linz, Austria

SELECTED PUBLICATIONS:

1. Maruyama, M.; Tsukamoto, K.; Sazaki, G.; Nishimura, Y.; Vekilov, P.G., Chiral and Achiral Mechanisms of Regulation of Calcite Crystallization. *Crystal Growth & Design* 2009, 9 (1), 127-135.
2. Pan, W. C.; Filobelo, L.; Pham, N.D.Q.; Galkin, O.; Uzunova, V.V.; Vekilov, P. G., Viscoelasticity in Homogeneous Protein Solutions. *Physical Review Letters* 2009, 102 (5).
3. Shah, M.; Galkin, O.; Vekilov, P.G., Localized Generation of Attoliter Protein Solution Droplets by Electrofocused Liquid-Liquid Separation. *Journal of Physical Chemistry B* 2009, 113 (20), 7340-7346.
4. Vekilov, P.G. In *Metastable Mesoscopic Phases in Concentrated Protein Solutions,* Sadhal, S. S., Ed. 2009; pp 377-386.
5. Canterino, J.E.; Galkin, O.; Vekilov, P.G.; Hirsch, R.E., Phase separation and crystallization of hemoglobin C in transgenic mouse and human erythrocytes. *Biophysical Journal* 2008, 95 (8), 4025-4033.
6. Maruyama, M.; Tsukamoto, K.; Sazaki, G.; Nishimura, Y.; Vekilov, P.G., Chiral and Achiral Mechanisms of Regulation of Calcite Crystallization. *Crystal Growth & Design* 2009, 9 (1), 127-135.
7. Pan, W.C.; Filobelo, L.; Pham, N.D.Q.; Galkin, O.; Uzunova, V.V.; Vekilov, P.G., Viscoelasticity in Homogeneous Protein Solutions. *Physical Review Letters* 2009, 102 (5).
8. Vekilov, P.G., Chemical engineers and the fundamental understanding of human disease. *AICHE Journal* 2008, 54 (10), 2508-2515.
9. Vekilov, P.G.; Galkin, O.; Pettitt, B.M.; Choudhury, N.; Nagel, R.L., Determination of the transition-state entropy for aggregation suggests how the growth of sickle cell hemoglobin polymers can be slowed. *Journal of Molecular Biology* 2008, 377 (3), 882-888.
10. Galkin, O.; Nagel, R.L.; Vekilov, P.G., The kinetics of nucleation and growth of sickle cell hemoglobin fibers. *Journal of Molecular Biology* 2007, 365 (2), 425-439.

RICHARD C. WILLSON

Professor of Chemical & Biomolecular Engineering
Professor of Biochemical & Biophysical Sciences

B.S., M.S., Chemical Engineering, Caltech
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Post-Doc Biochemistry, MIT

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RESEARCH INTERESTS:

Dr. Willson's research focuses on molecular recognition, and its applications in bioseparations and molecular diagnostics.

Biomolecular Recognition

We're interested in the structural determinants of molecular recognition in complexes of proteins with recognition agents such as monoclonal antibodies and aptamers. Our primary techniques are expression, mutagenesis, fluorescence anisotropy (kinetics) and titration calorimetry. Topics include the recognition of hen egg lysozyme by a "homologous series" of antibodies differing in combining site rigidity and cross-reactivity (with S. Smith-Gill of NIH), and the biophysical chemistry of aptamer/protein recognition.

Biomolecular Separations

- Nanostructured Adsorbents
  Conventional bioseparations adsorbents (e.g., ion exchangers) are derivitized with functional groups, randomly distributed over their surface area. This produces a functional polyclonality or heterogeneity, in that the binding properties are heterogeneous, and the selectivity for purification (e.g., of protein pharmaceuticals) or analysis (e.g., proteomics) is inherently limited.

  We are controlling the distribution of charges on a nanometer scale by immobilizing groups of charges all at once. This reduces the heterogeneity of adsorption, and confers interesting new specificity for proteins displaying clusters of charges on their surfaces. We are now also exploring nanoclustered metal-chelates for DNA/RNA separations.

Molecular Diagnostics and Sensors

- Nano- and Micro-Scale Molecular Labels
  Many methods in diagnostics, genomic technology, and proteomics rely upon the sensitive detection of labels added to target or reporter molecules, to facilitate the detection of an analyte or a binding event. With Paul Ruchhoeft of UH, we are making 5-micron cubic retroreflectors (small-scale analogs of the lunar retroreflectors which are possibly the most detectable objects ever produced by mankind) for use as labels and in one-step assays based on self-assembly. With Dmitri Litvinov of UH (formerly Seagate) we are seeking to adapt GMR technology to produce a biosensor array of extremely high feature density and number (millions), capable of single-molecule detection (using 50 nm magnetic particle labels) and magnetic pull-off "melting curves" for each spot to ensure high data quality.

HONORS/ACTIVITIES:

2005 & 2008	Senior Faculty Research Excellence Award, Fluor-Daniel Award, UH Cullen College of Engineering
2004–2008	President, International Society for Molecular Recognition
2001	van Lanen Award, ACS
1999–Present	Chair, Division of Biochemical Technology, American Chemical Society
1999	Elected Fellow, American Institute of Medical and Biological Engineering
1990–1995	NSF Presidential Young Investigator Editorial Boards: Journal of Molecular Recognition, Journal of Biological Physics and Chemistry, Biotechnology and Applied Biochemistry, Biotechnology Progress, Faculty of 1000 (Structural Biology)

SELECTED PUBLICATIONS:

1. Anez-Lingerfelt, M.; Fox, G. E.; Willson, R.C., Reduction of DNA contamination in RNA samples for reverse transcription-polymerase chain reaction using selective precipitation by compaction agents. *Analytical Biochemistry* 2009, 384 (1), 79-85.
2. Mohan, S.; Kourentzi, K.; Schick, K.A.; Uehara, C.; Lipschultz, C. A.; Acchione, M.; DeSantis, M.E.; Smith-Gill, S.J.; Willson, R.C., Association Energetics of Cross-Reactive and Specific Antibodies. *Biochemistry* 2009, 48 (6), 1390-1398.
3. Potty, A.S.R.; Kourentzi, K.; Fang, H.; Jackson, G.W.; Zhang, X.; Legge, G.B.; Willson, R.C., Biophysical Characterization of DNA Aptamer Interactions with Vascular Endothelial Growth Factor. *Biopolymers* 2009, 91 (2), 145-156.
4. Basile, L.J.; Willson, R.C.; Sewell, B.T.; Benedik, M.J., Genome mining of cyanide-degrading nitrilases from filamentous fungi. *Appl. Microbiology and Biotechnology* 2008, 80 (3), 427-435.
5. Jackson, G.W.; McNichols, R.J.; Fox, G.E.; Willson, R.C., Toward universal Flavivirus identification by mass cataloging. *Journal of Molecular Diagnostics* 2008, 10 (2), 135-141.
6. Kourentzi, K.; Srinivasan, M.; Smith-Gill, S.J.; Willson, R.C., Conformational flexibility and kinetic complexity in antibody-antigen interaction. *J. Molec. Recogn.* 2008, 21 (2), 114-121.
7. Taylor, J.N.; Darugar, Q.; Kourentzi, K.; Willson, R.C.; Landes, C.F., Dynamics of an anti-VEGF DNA aptamer: A single-molecule study. *Biochemical and Biophysical Research Communications* 2008, 373 (2), 213-218.
8. Vu, B.V.; Litvinov, D.; Willson, R.C., Gold nanoparticle effects in polymerase chain reaction: Favoring of smaller products by polymerase adsorption. *Analytical Chemistry* 2008, 80 (14), 5462-5467.
9. Fu, J.V.; Balan, S.; Potty, A.; Nguyen, V.; Willson, R.C., Enhanced protein affinity and selectivity of clustered-charge anion-exchange adsorbents. *Analytical Chem.* 2007, 79 (23), 9060.
10. Jackson, G.W.; McNichols, R.J.; Fox, G.E.; Willson, R.C., Universal bacterial identification by mass spectrometry of 16S ribosomal RNA cleavage products. *International Journal of Mass Spectrometry* 2007, 261 (2-3), 218-226.

RIGOBERTO ADVINCULA

Professor of Chemistry
Professor of Chemical & Biomolecular Engineering

B.S. Chemistry, University of the Philippines
Ph.D. Chemistry, University of Florida
Post-Doctoral Research,
Max Planck Institute for Polymer Research,
Dept.Chemical Engineering, Stanford University

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RESEARCH INTEREST:

Dr. Advincula's research focuses on the design and synthesis of organic macromolecules and oligomers capable of controlled-assembly or self-organization as ultrathin films. This includes functional amphiphile synthesis, polymerization on surfaces, network formation, and preparation of π-electron conjugated polymers.

HONORS/ACTIVITIES:

- Research Excellence Award, University of Houston
- NSF CAREER Award
- Alexander von Humboldt Research Fellow
- Phi Beta Kappa

SELECTED PUBLICATIONS:

1. Park, J. Y.; Liu, M.; Mays, J.; Dadmun, M.; Advincula, R., Nano-donuts from pH-dependent block restructuring in amphiphilic ABA triblock copolymer vesicles at the air-water interface. *Soft Matter* 2009, 5 (4), 747-749.
2. Wang, W.; Zhang, S.S.; Chinwangso, P.; Advincula, R.C.; Lee, T.R., Electric Potential Stability and Ionic Permeability of SAMs on Gold Derived from Bidentate and Tridentate Chelating Alkanethiols. *Journal of Physical Chemistry C* 2009, 113 (9), 3717-3725.
3. Advincula, R., Nnaostructured conjugated polymer network ultrathin film using the precursor polymer approach. *Jct Coatingstech* 2008, 5 (2), 34-37.
4. Bang, G.S.; Chang, H.; Koo, J.R.; Lee, T.; Advincula, R.C.; Lee, H., High-fidelity formation of a molecular-junction device using a thickness-controlled bilayer architecture. *Small* 2008, 4 (9), 1399-1405.
5. Fulghum, T.M.; Estillore, N.C.; Vo, C.D.; Armes, S.P.; Advincula, R.C., Stimuli-responsive polymer ultrathin films with a binary architecture: combined layer-by-layer polyelectrolyte and surface-initiated polymerization approach. *Macromolecules* 2008, 41 (2), 429-435.
6. Fulghum, T.M.; Taranekar, P.; Advincula, R.C., Grafting hole-transport precursor polymer brushes on ITO electrodes: Surface-initiated polymerization and conjugated polymer network formation of PVK. *Macromolecules* 2008, 41 (15), 5681-5687.
7. Huang, C.Y.; Jiang, G.Q.; Advincula, R., Electrochemical cross-linking and patterning of nanostructured polyelectrolyte - Carbazole precursor ultrathin films. *Macromolecules* 2008, 41 (13), 4661-4670.
8. Kaewtong, C.; Jiang, G.; Felipe, M.J.; Pulpoka, B.; Advincula, R., Self-assembly and electrochemical oxidation of polyamidoamine - Carbazole dendron surfmer complexes: Nanoring formation. *Acs Nano* 2008, 2 (8), 1533-1542.
9. Kaewtong, C.; Jiang, G.Q.; Park, Y.; Fulghum, T.; Baba, A.; Pulpoka, B.; Advincula, R., Azacalix[3]arene-carbazole conjugated polymer network ultrathin films for specific cation sensing. *Chemistry of Materials* 2008, 20 (15), 4915-4924.
10. Kawakami, A.; Katsuki, K.; Advincula, R.C.; Tanaka, K.; Ogino, K.; Usui, H. In I*nterface control by surface-initiated deposition polymerization and its application to organic light-emitting devices,* 2008; pp 3156-3161.
11. Park, J.Y.; Koenen, N.; Forster, M.; Ponnapati, R.; Scherf, U.; Advincula, R., Interplay of vesicle and lamellae formation in an amphiphilic polyfluorene-b-polythiophene all-conjugated diblock copolymer at the air-water interface. *Macromolecules* 2008, 41 (16), 6169-6175.
12. Park, Y.; Taranekar, P.; Park, J.Y.; Baba, A.; Fulghum, T.; Ponnapati, R.; Advincula, R.C., Hybrid CdSe nanoparticle-carbazole dendron boxes: Electropolymerization and energy-transfer mechanism shift. *Advanced Functional Materials* 2008, 18 (14), 2071-2078.
13. Parka, M.K.; Sakellariou, G.; Pispas, S.; Hadjichristidis, N.; Advincula, R., On the quantitative adsorption behavior of multi-zwitterionic end-functionalized polymers onto gold surfaces. *Colloids and Surfaces a-Physicochemical and Engineering Aspects* 2008, 326 (3), 115-121.
14. Patton, D.L.; Taranekar, P.; Fulghum, T.; Advincula, R., Electrochemically active dendritic-linear block copolymers via RAFT polymerization: Synthesis, characterization, and electrodeposition properties. *Macromolecules* 2008, 41 (18), 6703-6713.
15. Reznik, C.; Darugar, Q.; Wheat, A.; Fulghum, T.; Advincula, R.C.; Landes, C.F., Single ion diffusive transport within a poly(styrene sulfonate) polymer brush matrix probed by fluorescence correlation spectroscopy. *Journal of Physical Chemistry B* 2008, 112 (35), 10890-10897.
16. Sriwichai, S.; Baba, A.; Deng, S.X.; Huang, C.Y.; Phanichphant, S.; Advincula, R.C., Nanostructured ultrathin films of alternating sexithiophenes and electropolymerizable polycarbazole precursor layers investigated by electrochemical surface plasmon resonance (EC-SPR) spectroscopy. *Langmuir* 2008, 24 (16), 9017-9023.
17. Taranekar, P.; Huang, C.; Fulghum, T.M.; Baba, A.; Jiang, G.; Park, J. Y.; Advincula, R.C., Nanocomposite films of a polyfluorene copolymer and carbazole-thiol-capped gold nanoparticles: Electrochemical crosslinking and energy-transfer properties. *Advanced Functional Materials* 2008, 18 (2), 347-354
18. Advincula, M.C.; Petersen, D.; Rahemtulla, F.; Advincula, R.; Lemons, J.E., Surface analysis and biocorrosion properties of nanostructured surface sol-gel coatings on Ti6Al4V titanium alloy implants. *Journal of Biomedical Materials Research Part B-Applied Biomaterials* 2007, 80B (1), 107-120.
19. Ji, H.; Sakellariou, G.; Advincula, R.C.; Smith, G.D.; Kilbey, S.M.; Dadmun, M.D.; Mays, J.W., Synthesis and characterization of well-defined [polystyrene-b-poly(2-vinylpyridine)]n star-block copolymers with poly(2-vinylpyridine) corona blocks. *Journal of Polymer Science Part a-Polymer Chemistry* 2007, 45 (17), 3949-3955.
20. Ji, H.N.; Farmer, B.S.; Nonidez, W.K.; Advincula, R.C.; Smith, G.D.; Kilbey, S.M.; Dadmun, M.D.; Mays, J.W., Anionic synthesis of epoxy end-capped polymers. *Macromolecular Chemistry and Physics* 2007, 208 (8), 807-814.

AKHIL BIDANI

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RESEARCH INTERESTS:

Mechanisms of Cell Ion and pH Regulation

This project involves measurements of cell pH, Ca2+, cell volume and membrane potential using fluorescent probes in alveolar macrophages, important lung immune cells. These experimental studies are analyzed using detailed biophysical models of cell and ion regulation.

Kinetics of Respiratory Burst

This project involves development of mathematical models of NADPH-mediated superoxide anion release and nitric oxide production in macrophages. Experimental measurements are used to analyze the underlying rate-limiting cellular biochemical and biophysical processes.

Organ Support Therapies in Critical Illness

This project in collaboration with colleagues at Rice, at UTMB (Galveston) and at LSU (Shreveport) involves the development of innovative therapies to support heart, lung and renal function in critically ill patients. Complex mathematical models of device and whole body hemodynamics and gas exchange are used to analyze data in experimental animals.

Inhalation Toxicology

This project involves the analyses of the transport and reaction processes involved in the uptake of inhaled toxicants such as ozone and nitrogen dioxide. This allows the prediction of site-specific toxic gas uptake and associated cellular and lung toxicity.

Microvascular and Whole Body Acid-Base Balance

This project involves the modeling of reaction and transport processes involved in gas exchange and acid-base balance in blood and tissues. These studies are useful in analyzing abnormalities in critically ill patients with multi-organ failure.

HONORS/ACTIVITIES:

2005	Fellow, Association of Clinical Scientists
2004	Editorial Board, American Society of Artificial Internal Organs (ASAIO)
1991	American Society of Clinical Investigation
1991	Fellow, American College of Critical Care Medicine
1990	Fellow, American College of Chest Physicians
1990	Southern Society for Clinical Investigation
1988–1999	Editorial Board: Journal of Applied Physiology
1986	Clinician-Scientist Award, American Heart Association (Greater Los Angeles Affiliate)
1981	J.B. Kass Award for Excellence in Research, UTMB
1981	W.L. Marr Award for Excellence in Medicine, UTMB

SELECTED PUBLICATIONS:

1. Benedik, P.S.; Baun, M.M.; Keus, L.; Jimenez, C.; Morice, R.; Bidani, A.; Meininger, J.C., Effects of Body Position on Resting Lung Volume in Overweight and Mildly to Moderately Obese Subjects. *Respiratory Care* 2009, 54 (3), 334-339.
2. Chakraborty, S.; Balakotaiah, V.; Bidani, A., Multiscale model for pulmonary oxygen uptake and its application to quantify hypoxemia in hepatopulmonary syndrome. *Journal of Theoretical Biology* 2007, 244 (2), 190-207.

STANKO BRANKOVIC

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B.S. Chemical and Biochemical Engineering,
University of Belgrade
Ph.D. Science and Engineering of Materials,
Arizona State University

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RESEARCH INTEREST:

Dr. Brankovich's research interest is in the general area of electrochemistry and electrochemical nanofabrication and nanomaterial syntheis. Specific focus is monolayer catalyst desing for fuel cells and biomolecular devices, sensors, mangetic materials and nanostrucures and surface morphology evoltuion during nonequillibrium depostion/errosion processs.
His research opus complements the research of several Chemical & Biomolecular Engineering faculty members, opening up opportunities for collaborations.

HONORS/ACTIVITIES:

2008–2009	Cullen College of Engineering Junior Faculty Research Award
2007–Present	Member of the NSF and ACS-Petroleum Fund Proposal Review Panels
2006–Present	Member of the Executive Committee of the Electrodeposition Division of the Electrochemical Society
1997–1998	Arizona State University Graduate Scholarship
1994	Serbian Academy of Arts and Sciences' Student Award
1992–1994	Paja S Tutundzic Student Award

SELECTED PUBLICATIONS:

1. Critical Parameters of Solution Design for Electrodeposition of 2.4 T CoFe Alloys, J. George, S.-E. Bae, D. Litvinov, and S.R. Brankovic, *Electrochemical Society Transactions,* 16, 75 (2009).
2. Sulfur and Saccharin Incorporation into Electrodeposited CoFe Alloys, J George, S.-E. Bae, D. Litvinov, J. Rancheler, and S.R. Brankovic, *J. Electrochemical Society,* 155, D589 (2008)
3. Fe3+ Effect on Magnetic Moment of Electrodeposited CoFe Alloys - Experimental Study and Analytical Model, S. R. Brankovic, S.-E. Bae, D. Litvinov, *Electrochimica Acta,* 53, 5934 (2008)
4. Cu Surface Morphology Evolution during Electropolishing, S. Shivareddy, S.-E. Bae and S.R. Brankovic, *Electrochem. Solid State Lett.* 11, D13 (2008).
5. Electrochemical Transducers - A New Approach to Ultrasound Sensor Design, A. Shamsi, S.-E. Bae, G. Majkic and S.R. Brankovic, *Electrochemical Society Transactions,* 11, 15 (2008)
6. Physical Incorporation of Saccharin Molecules into Electrodeposited Soft High Magnetic Moment CoFe Alloys, S.R. Brankovic , Ryan Haislmaier, and Natasa Vasiljevic, *Electrochemical and Solid State Lett.* 10, (6), D67 (2007).
7. Close-Packed Noncircular Nanodevice Pattern Generation by Self-Limiting Ion-Mill Process, V.A. Parekh, A. Ruiz, P Ruchhoeft, S.R. Brankovic, and Dmitri Litvinov, *Nano Letters.* 7, 3246 (2007).
8. Electrodeposition of 2.4 T Co37Fe63 Alloys at Nanoscale for Magnetic Recoding Application, S.R. Brankovic, X.M. Yang, T.J. Klemmer, and M. Siegler, *IEEE Transactions on Magnetics,* 42, 132 (2006).

JAMES M. BRIGGS

Associate Professor of Biochemistry and Chemistry
Associate Professor of Chemical & Biomolecular Engineering

B.S. Chemistry, University of Texas, El Paso
Ph.D. Theoretical Organic Chemistry, Purdue University

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RESEARCH INTERESTS:

Computer Simulation of Biomolecules

Activities currently underway involve the use and development of computer programs on high-performance computers to study the kinetic and thermodynamic properties of enzymes and receptors. Application areas include structural and mechanistic studies and inhibitor design for HIV-1 integrase, botulinum and anthrax toxins, alanine racemases, and beta-tubulin. Docking from 3D structural databases, molecular mechanics, molecular and Brownian dynamics, electrostatics, quantum mechanics, QSAR and other methods are used in the work.

HIV-1 Integrase Inhibitor Design

The HIV-1 integrase splices the viral genome into the host DNA thereby tricking the host cell machinery into making viral proteins. This enzyme, for which no good inhibitors are known, represents the third of the main enzyme targets in HIV. Work on this project is performed in collaboration with five other research groups (x-ray crystallography, virology, organic synthesis, computational chemistry and marine biology) that represent a complete structure-based inhibitor design cycle/team. Early results on this project are providing some clues about the detailed structure of the active site. Initial small molecule docking studies have revealed hot spots for new functional group types that are being incorporated into newly designed lead compounds.

Re-Engineering of Enzyme Substrate Specificity

In addition to the "drug design" projects, we have interests in the reengineering of enzyme substrate specificity, and in a number of basic science areas centering on electrostatic properties of biomolecules. We are involved in a collaboration with biochemists at the University of Houston to assist in the rational redesign of the substrate binding and proofreading pockets for the leucyl tRNA synthetase. Use of the redesigned enzyme will allow non-natural amino acids to be more easily incorporated into proteins during protein biosynthesis. The redesigned proteins will have biomedical, engineering, and technology applications.

HONORS/ACTIVITIES:

2007–2010	NIH/Molecular Structure and Function Study Section D (MSFD), Charter member
2009–Present	Honorary Editorial Board Member, Open Access Bioinformatics
2008–Present	Honorary Editorial Board Member, Computational Biology and Chemistry: Advances and Applications
2008–Present	Associate Editor, PLoS Computational Biology
2007–Present	Editorial Advisory Board, Current Bioinformatics (journal)
2004	Teaching Excellence Award, College of Natural Sciences and Mathematics, University of Houston
2004–Present	University of Houston Training Director, W.M. Keck Center for Computational and Structural Biology, Rice University
2003–Present	Associate Director, Institute for Molecular Design, University of Houston
2003–Present	Honorary Member, Golden Key International Honor Society
2000	Special Recognition for Outstanding Service to Students with Disabilities, University of Houston
1999–2000	Oak Ridge Associated Universities New Faculty Development Award
1998–Present	Member, Institute for Molecular Design, University of Houston
1998–Present	Member, W.M. Keck Center for Computational and Structural Biology, Rice University

SELECTED PUBLICATIONS:

1. Joshi, M.; Ebalunode, J.O.; Briggs, J.M., Computational insights into the interaction of the anthrax lethal factor with the N-terminal region of its substrates. *Proteins-Structure Function and Bioinformatics* 2009, 75 (2), 323-335.
2. Mandal, P.K.; Limbrick, D.; Coleman, D.R.; Dyer, G.A.; Ren, Z.Y.; Birtwistle, J.S.; Xiong, C.Y.; Chen, X.M.; Briggs, J.M.; McMurray, J.S., Conformationally Constrained Peptidomimetic Inhibitors of Signal Transducer and Activator of Transcription 3: Evaluation and Molecular Modeling. *Journal of Medicinal Chemistry* 2009, 52 (8), 2429-2442.
3. Huang, H.C.; Jupiter, D.; Qiu, M.; Briggs, J.M.; VanBuren, V., Cluster analysis of hydration waters around the active sites of bacterial alanine racemase using a 2-ns MD simulation. *Biopolymers* 2008, 89 (3), 210-219.
4. Jawanda, N.; Ebalunode, J.; GrIbenko, A.; Briggs, J.; Lee, J.C.; Tu, S.C., A single-residue mutation destabilizes Vibrio harveyi flavin reductase FRP dimer. *Archives of Biochemistry and Biophysics* 2008, 472 (1), 51-57.
5. Singh, N.; Briggs, J.M., Molecular Dynamics Simulations of Factor Xa: Insight into Conformational Transition of Its Binding Subsites. *Biopolymers* 2008, 89 (12), 1104-1113.
6. Nunthaboot, N.; Pianwanit, S.; Parasuk, V.; Kokpol, S.; Briggs, J.M., Computational studies of HIV-1 integrase and its inhibitors. *Current Computer-Aided Drug Design* 2007, 3 (3), 160-190.
7. Fu, W.; Shen, J.H.; Luo, X.M.; Zhu, W.L.; Cheng, J.G.; Yu, K.Q.; Briggs, J.M.; Jin, G.Z.; Chen, K.X.; Jiang, H. L., Dopamine d1 receptor agonist and d2 receptor antagonist effects of the natural product (-)-stepholidine: Molecular Modeling and dynamics Simulations. *Biophysical Journal* 2007, 93 (5), 1431-1441.
8. Nunthaboot, N.; Pianwanit, S.; Parasuk, V.; Ebalunode, J.O.; Briggs, J.M.; Kokpol, S., Hybrid quantum mechanical/molecular mechanical molecular dynamics simulations of HIV-1 integrase/inhibitor complexes. *Biophysical Journal* 2007, 93 (10), 3613-3626.
9. Zhai, Y.X.; Nawaz, M.H.; Lee, K.W.; Kirkbride, E.; Briggs, J.M.; Martinis, S. A., Modulation of substrate specificity within the amino acid editing site of leucyl-tRNA synthetase. *Biochemistry* 2007, 46 (11), 3331-3337.

SHANKAR CHELLAM

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Professor of Chemical & Biomolecular Engineering

B.E. (Hons) Mechanical Engineering, Birla Institute of Technology and Science, India
M.Sc. (Hons) Chemistry, Birla Institute of Technology and Science, India
M.S. Environmental Science and Engineering, Rice University
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RESEARCH INTERESTS:

The principal motivation for our research is reducing adverse health risks associated with municipal drinking water and ambient air. My overall research focuses on the characterization and transport of environmental colloids specifically with applications towards water purification and urban tropospheric aerosols. We are quantitatively (i) elucidating mechanisms underlying the performance of polymeric membrane filters employed for water and wastewater treatment, (ii) characterizing lanthanoids metals to track particulate emissions to the local atmosphere from petroleum refining operations, and (iii) determining the environmental impacts of nanomaterials especially towards microorganisms.

Water treatment membranes. Working in collaboration with Dr. Kevin Rosso, Prof. Nick Cogan, Prof. Dennis Clifford and Prof. Ruth Baltus we are delineating hindered transport phenomena in nano- and micro-filtration membranes employed to control colloidal and dissolved substances of interest in both environmental and pharmaceutical applications (e.g. amino acids, bacteria, viruses, natural organic matter, etc.). This aspect of our research also considers the role of extracellular polymeric substances on bacterial fouling as well as developing innovative coagulation-based pretreatment methods to improve permeate flux and contaminant removal. Elemental composition of urban atmospheric fine particulate matter. Detailed analysis of trace elements in airborne fine particles is critical because they may contribute to adverse biological activity in humans (a.k.a. metals hypothesis) and can also serve as distinctive tracers for anthropogenic activities. We have developed novel ICP-MS based methods for trace to ultra-trace level measurements of lanthanoids metals in fine particulate matter from urban environments. We are also collaborating with Prof. Matt Fraser to quantify both routine and episodic emissions of particles from FCC refining operations in petrochemical industries using rare earths as unique elemental markers.

Environmental impacts of engineered nanoparticles. We are undertaking experimental investigations of the potential toxicity of manufactured nanoparticles towards environmental microfauna including bacteria and bacteriophages that are the foundation of all ecosystems and food chains, and also play important roles in biogeochemical cycles. Working in collaboration with Prof. Mark Wiesner, we are documenting reactive oxygen species production by photosensitized (exposure to sunlight) fullerene-based nanoparticles and their ability to inactivate viruses and bacteria. Recently, we established that photoinactivation of non-enveloped bacteriophages by fullerol nanoparticles is likely caused by singlet oxygen mediated oxidative cross-linking of capsid proteins.

HONORS/ACTIVITIES:

2008	Excellence in Review Award, Environmental Science and Technology
2007	W.T. Kittinger Outstanding Teacher Award, Cullen College of Engineering. (College's highest teaching award)
2006 & 2003	Outstanding Teacher Award, Cullen College of Engineering, University of Houston,
2005	Distinguished Service Award for Outstanding Service as Chair of the Masters Thesis Award Subcommittee, Association of Environmental Engineering and Science Professors, 2005
2004	Certificate of Merit, Division of Environmental Chemistry, American Chemical Society
2003	Junior Faculty Research Award, Cullen College of Engineering, University of Houston
2002	National Science Foundation CAREER award
1993 & 1992	Eleanor and Mills Bennett Fellowship, Rice University
1992	Larson Aquatic Research Scholarship, American Water Works Association

SELECTED PUBLICATIONS:

1. Badireddy, A.R., E.M. Hotze, S. Chellam, and M.R. Wiesner, (2009). Mechanisms of Bacteriophage Inactivation via Singlet Oxygen Generation in UV Illuminated Fullerol Suspensions. *Environmental Science and Technology,* 43 (17) 6639-6645.
2. Cogan, N.G. and S. Chellam (2009). Incorporating Pore Blocking, Cake Filtration, and EPS Production in a Model for Constant Pressure Bacterial Fouling During Dead-end Microfiltration. *Journal of Membrane Science,* 345 (1-2) 81–89.
3. Baltus, R; A.R. Badireddy, W. Xu, and S. Chellam, (2009). Analysis of Configurational Effects on Hindered Convection of Nonspherical Bacteria and Viruses across Microfiltration Membranes. *Industrial & Engineering Chemistry Research,* 48 (5) 2404-2413.
4. Badireddy, A.R., S. Chellam, S. Yanina, P.L. Gassman, and K.M. Rosso, (2008). Bismuth Dimercapto-propanol (BisBAL) Inhibits the Expression of Extracellular Polysaccharides and Proteins in Brevundimonas diminuta: Implications for Membrane Microfiltration. *Biotechnology and Bioengineering,* 99 (3) 634-643. (highlighted as cover art in the journal issue).
5. Bagga, A., S. Chellam, and D.A. Clifford, (2008). Evaluation of Iron Chemical Coagulation and Electrocoagulation Pretreatment for Microfiltration of Surface Water. *Journal of Membrane Science,* 309 (1-2) 82-93.
6. Badireddy, A.R., B.R. Korpol, S. Chellam, P. L. Gassman, M. H. Engelhard, A. S. Lea, and K. M. Rosso, (2008). Spectroscopic Characterization of Extracellular Polymeric Substances from Escherichia coli and Serratia marcescens: Suppression using Sub-Inhibitory Concentrations of Bismuth Thiols. *Biomacromolecules*, 9 (11) 3079-3089.
7. Sharma, R.R. and S. Chellam, (2008). Solute Rejection by Porous Thin Film Composite Nanofiltration Membranes at High Feed Water Recoveries. *Journal of Colloid and Interface Science,* 328 (2) 353-366.

GEORGE E. FOX

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www.bchs.uh.edu/People/Fox_G/Fox_G.html

RESEARCH INTERESTS:

The unifying theme behind the projects in our laboratory is RNA structure, function and evolution. Applied research is being conducted on RNA technology and methods for microbial monitoring. Our research group generally includes individuals of various backgrounds including the biological sciences, chemistry, computer science and engineering. Projects range from bench top molecular biology to completely theoretical projects in bioinformatics. Some current projects include:

Microbial Resistance to Ultraviolet Light and radiation

We are using genome sequencing to identify changes in bacteria adaptated to ultraviolet light and radiation. Such organisms can survive in clean rooms and therefore are problematic for the food industry and space missions where forward contamination of planetary objects must be avoided.

RNA Design

RNA is involved in regulating gene expression in fundamental ways. Naturally occurring riboswitches illustrate the possibility of developing complex sensors and nanomachines based on RNA. In order to facilitate this technology development it is important to develop RNA design principles. To accomplish this we are developing extensive databases of non-standard interactions in known RNA structures in order to find sequence patterns that correlate with various local folding motifs. As part of this effort we will be using the University's 800MHz NMR facility to determine the structure of key small RNAs at atomic resolution.

Artificial RNA Technology

We have developed a novel method of producing artificial RNAs that persist in bacterial cells for long durations. Possible applications include distinguishing repeated releases of otherwise identical recombinant bacteria in the environment and the expression of small polypeptides within the cell in order to provide desirable properties such as toxic metal resistance. Of special interest are attempts to use this technology to produce commercial quantities of siRNAs at low cost.

HONORS/ACTIVITIES:

2009	UT Grad. School Biomedical Sci., Adjunct Professor
2008	Member-Science Team- Phobos-Life mission
2008–2010	Vice-Chair (2008), Chair (2010) Origin of Life Gordon Conference
2006	UH, Moores Professor Biology & Biochemistry
2003–2009	Member, Advisory Council USRA Life Science Division
2003–2008	National Advisory Committee, NASA/TSU Research Center
2000–2003	Member, USCF/J. Roger Porter Award Nominating Committee
2002	Elected as Fellow of American Institute for Medical and Biological Engineering
1997	University of Houston Research Award
1995	Elected Fellow, American Association Advancement of Science
1994–Present	Member, W.M. Keck Center for Computational Biology
1994	Elected Fellow, American Academy of Microbiology

SELECTED PUBLICATIONS:

1. Anez-Lingerfelt, M.; Fox, G.E.; Willson, R.C., Reduction of DNA contamination in RNA samples for reverse transcription-polymerase chain reaction using selective precipitation by compaction agents. *Analytical Biochemistry* 2009, 384 (1), 79-85.
2. Warmflash, D.; Chu, H.Y.; Siefert, J.; Fox, G.E., Life Detection Using Glucose and Tetrasaccharide Enantiomer Pairs. *Astrobiology* 2009, 9 (3), 297-303.
3. Zhang, X.; Potty, A.S.R.; Jackson, G.W.; Stepanov, V.; Tang, A.; Liu, Y.; Kourentzi, K.; Strych, U.; Fox, G.E.; Willson, R. C., Engineered 5S ribosomal RNAs displaying aptamers recognizing vascular endothelial growth factor and malachite green, *Journal of Molecular Recognition* 2009, 22, 154-161.
4. Zhang, Z.D.; Nayar, M.; Ammons, D.; Rampersad, J.; Fox, G.E., Rapid in vivo exploration of a 5S rRNA neutral network. *Journal of Microbiological Methods* 2009, 76 (2), 181-187.
5. Yerrapragada, S.; Siefert, J.L.; Fox, G.E., Horizontal gene transfer in cyanobacterial signature genes, *Methods Mol Biol.* 2009, 532, 339-366.
6. Wang, J.; Dasgupta, I.; Fox, G.E., Many non-universal Archaeal ribosomal proteins are found in conserved gene clusters. *Archaea* 2009, 2, 241-251.
7. Rastogi, R.; Wu, M.; Dasgupta, I.; Fox, G.E., Visualization of ribosomal RNA operon copy number distribution, *BMC Microbiology,* in press.
8. Anez, M.; Putonti, C.; Fox, G.E.; Fofanov, Y.; Willson, R.C., Exhaustive computational identification of pathogen sequences far-distant from background genomes: Identification and experimental verification of human-blind dengue PCR primers. *Journal of Biotechnology* 2008, 133 (3), 267-276.
9. Jackson, G.W.; McNichols, R.J.; Fox, G.E.; Willson, R.C., Toward universal Flavivirus identification by mass cataloging. *Journal of Molecular Diagnostics* 2008, 10 (2), 135-141.
10. Highlander, S.K.; Hulten, K.G.; Qin, X.; Jiang, H.; Yerrapragada, S.; Mason, E.O.; Shang, Y.; Williams, T.M.; Fortunov, R.M.; Liu, Y.; Igboeli, O.; Petrosino, J.; Tirumalai, M.; Uzman, A.; Fox, G.E.; Cardenas, A.M.; Muzny, D.M.; Hemphill, L.; Ding, Y.; Dugan, S.; Blyth, P.R.; Buhay, C.J.; Dinh, H.H.; Hawes, A.C.; Holder, M.; Kovar, C.L.; Lee, S.L.; Liu, W.; Nazareth, L.V.; Wang, Q.; Zhou, J.; Kaplan, S.L.; Weinstock, G.M., Subtle genetic changes enhance virulence of methicillin resistant and sensitive Staphylococcus aureus. *Bmc Microbiology* 2007, 7.

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RESEARCH INTERESTS:

The synthesis and properties of transition metal oxide systems with layered or framework structures are one focus of research in my group. We study the synthesis of new compounds with open framework structures with potential applications in selective separations and catalysis. Compounds studied include transition metal silicates and hybrid inorganic-organic frameworks, for example, the metal terephthalates. We also study synthetic strategies for the synthesis of homochiral solids for enantiomeric separations and the growth of nano particles in porous oxides.

The synthesis and properties of oxides that have applications in high temperature ionic devices, such as fuel cells, oxygen transport membranes and sensors is a second research area. The major part of our work centers on mixed metal oxides with the ABO3 and A2BO4 perovskite related structures. We investigate new compositions to establish structure-property relationships. We use a variety of techniques to characterize the surface reactivity and bulk transport properties of materials. We use oxygen permeation through membranes, electrical conductivity relaxation, dc conductivity, ac impedance spectroscopy and other techniques to establish transport properties at high temperature in a variety of gas atmospheres. Isotope exchange together with secondary ion mass spectroscopy depth profiling, gives important and complementary information about ionic transport across interfaces.

HONORS/ACTIVITIES:

2004	Esther Farfel Award, University of Houston
2000–2003	Member, National Materials Advisory Board
1999–2004	US Editor, Solid State Ionics
1999	Visiting Lecturer, Nanjing Institute of Chemical Technology, China
1998	Research Excellence Award, University of Houston
1997	Sigma Xi Research Faculty Award, University of Houston.

- Associate Editor, Solid State Ionics, Materials Research Bulletin
- Editorial Advisory Board, Progress in Solid State Chemistry, Journal of Solid State Chemistry, Solid State Sciences

SELECTED PUBLICATIONS:

1. Abeykoon, A.M. M.; Li, J.; Castro-Colin, M.; Moss, S.C.; Jacobson, A.J., Structure of selenium clusters in the framework of zeolite Nd-Y. *Physical Review B* 2009, 79 (13).
2. LeBeau, J.M.; Findlay, S.D.; Wang, X.Q.; Jacobson, A.J.; Allen, L.J.; Stemmer, S., High-angle scattering of fast electrons from crystals containing heavy elements: Simulation and experiment. *Physical Review B* 2009, 79 (21).
3. Liu, L.M.; Wang, X.Q.; Jacobson, A.J. In *Vanadium (IV) benzenedicarboxylate: A novel adsorbent for selective separations,* 2009; pp 1901-1905.
4. Rungrochaipon, P.; Wang, X.Q.; Jacobson, A.J., Syntheses and structures of Ta-2(WO2)(0.87)H-0.26(PO4)(4) and Ta-2(MoO2)(PO4)(4). *Materials Research Bulletin* 2009, 44 (3), 688-692.
5. Abeykoon, A.M.M.; Castro-Colin, M.; Anokhina, E.V.; Iliev, M.N.; Donner, W.; Brunelli, M.; Jacobson, A.J.; Moss, S.C. In *X-Ray Scattering Studies of HgSe Nanoclusters in Zeolite,* 2008; pp 3179-3183.
6. Abeykoon, A.M.M.; Castro-Colin, M.; Anokhina, E.V.; Iliev, M. N.; Donner, W.; Jacobson, A.J.; Moss, S.C., Synchrotron x-ray and optical studies of the structure of HgSe semiconductor nanoclusters confined in zeolite L and zeolite Y. *Physical Review B* 2008, 77 (7).
7. Jacobson, A.J., What Should a Theory of Vision Look Like? *Philosophical Psychology* 2008, 21 (5), 585-599.
8. Vougo-Zanda, M.; Anokhina, E.V.; Duhovic, S.; Liu, L.M.; Wang, X. Q.; Oloba, O.A.; Albright, T.A.; Jacobson, A.J., Octahedral tilting in MM'X-4 metal-oxide organic layer structures. *Inorganic Chemistry* 2008, 47 (11), 4746-4751.
9. Vougo-Zanda, M.; Huang, J.; Anokhina, E.; Wang, X.Q.; Jacobson, A.J., Tossing and Turning: Guests in the Flexible Frameworks of Metal(III) Dicarboxylates. *Inorganic Chemistry* 2008, 47 (24), 11535-11542.
10. Zhao, J.P.; Huang, D.X.; Chen, Z.Y.; Chu, W.K.; Makarenkov, B.; Jacobson, A.J.; Bahrim, B.; Rabalais, J.W., Amorphous Ge quantum dots embedded in SiO2 formed by low energy ion implantation. *Journal of Applied Physics* 2008, 103 (12).
11. Go, Y.B.; Jacobson, A.J., Solid solution precursors to gadolinia-doped ceria prepared via a low-temperature solution route. *Chemistry of Materials* 2007, 19 (19), 4702-4709.
12. Go, Y.B.; Wang, X.Q.; Jacobson, A.J., (6,3)-honeycomb structures of Uranium(VI) benzenedicarboxylate derivatives: The use of noncovalent interactions to prevent interpenetration. *Inorganic Chemistry* 2007, 46 (16), 6594-6600.
13. Kim, G.; Wang, S.; Jacobson, A.J.; Reimus, L.; Brodersen, P.; Mims, C.A., Rapid oxygen ion diffusion and surface exchange kinetics in PrBaCo2O5+x with a perovskite related structure and ordered A cations. *Journal of Materials Chemistry* 2007, 17 (24), 2500-2505.
14. Kim, G.T.; Wang, S.Y.; Jacobson, A.J.; Yuan, Z.; Chen, C.L., Impedance studies of dense polycrystalline thin films of La2NiO4+delta. *Journal of Materials Chemistry* 2007, 17 (13), 1316-1320.
15. Vougo-Zanda, M.; Wang, X.Q.; Jacobson, A.J., Influence of ligand geometry on the formation of In-O chains in metal-oxide organic frameworks (MOOFs). *Inorganic Chemistry* 2007, 46 (21), 8819-8824.
16. Yuan, Z.; Liu, J.; Chen, C.L.; Wang, C.H.; Luo, X.G.; Chen, X.H.; Kim, G.T.; Huang, D.X.; Wang, S.S.; Jacobson, A.J.; Donner, W., Epitaxial behavior and transport properties of PrBaCo2O5 thin films on (001) SrTiO3. *Applied Physics Letters* 2007, 90 (21).

T. RANDALL LEE

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RESEARCH INTERESTS:

Research in the Lee group explores the preparation and characterization of nanoscale materials, with a particular focus on carbon nanotubes, polymers, organic thin films, and nano-particles. A common thread that ties these research areas together is the use of synthesis—be it organic, inorganic, organometallic, or solid-state— to prepare new materials for emerging technologies.

Current studies of polymer-nanotube composites target the development of new ultra-strong but lightweight structural materials for use in mobile transports, such as automobiles, airplanes, and space vehicles. Research in the area of organic thin films utilizes self-assembled monolayers (SAMs) to generate thin-film coatings (e.g., nanoscale Teflon) for use as lubricants in miniature electronic devices and inert coatings for biomedical implants. Research on complex interfaces targets the development of new SAMs to elicit molecular recognition (e.g., biosensor devices) and/or catalysis (e.g., artificial enzymes). Studies of biologically active interfaces utilize SAMs to enhance the growth of protein crystals and to template cell adhesion and proliferation for growing artificial tissue and bone. In the nanoparticle area, research efforts seek to grow nanoshell particles for use as discrete drug delivery vehicles in the treatment of cancer and related illnesses.

Since much of the work in the Lee group is collaborative in nature, students often work side-by-side with chemical engineers, physicists, electrical engineers, biochemists, and biomedical engineers. In this type of environment, students gain knowledge and skills beyond those typically encountered in traditional chemistry laboratories.

HONORS/ACTIVITIES:

2000	HAO Outstanding Faculty Award
1999	Enron Teaching Excellence Award
1999	University of Houston Research Excellence Award
1995–2000	NSF Career Award
1993–1998	Camille and Henry Dreyfus New Faculty Award

SELECTED PUBLICATIONS:

1. Battaglieri, M.; De Vita, R.; Szczepaniak, A.P.; et al. Measurement of Direct f(0)(980) Photoproduction on the Proton. *Physical Review Letters* 2009, 102 (10).
2. Bethencourt, M.I.; Srisombat, L.O.; Chinwangso, P.; Lee, T.R., SAMs on Gold Derived from the Direct Adsorption of Alkanethioacetates Are Inferior to Those Derived from the Direct Adsorption of Alkanethiols. *Langmuir* 2009, 25 (3), 1265-1271.
3. Fedotov, G.V.; Mokeev, V.I.; Burkert, V.D.; et al. Electroproduction of p pi(+)pi(-) off protons at 0.2 < Q(2) < 0.6 GeV2 and 1.3 < W < 1.57 GeV with the CLAS detector. *Physical Review C* 2009, 79 (1).
4. Leem, G.; Sarangi, S.; Zhang, S.S.; Rusakova, I.; Brazdeikis, A.; Litvinov, D.; Lee, T.R., Surfactant-Controlled Size and Shape Evolution of Magnetic Nanoparticles. *Crystal Growth & Design* 2009, 9 (1), 32-34.
5. Srisombat, L.; Khamman, O.; Yimnirun, R.; Ananta, S.; Lee, T.R., Phase and Chemical Characterization of Perovskite Lead Nickel Niobate Ceramics Fabricated Via a Columbite Precursor Method. *Chiang Mai Journal of Science* 2009, 36 (1), 69-76.
6. Trabelsi, S.; Zhang, S.S.; Zhang, Z.C.; Lee, T.R.; Schwartz, D.K., Semi-fluorinated phosphonic acids form stable nanoscale clusters in Langmuir-Blodgett and self-assembled monolayers. *Soft Matter* 2009, 5 (4), 750-758.
7. Wang, W.; Zhang, S.S.; Chinwangso, P.; Advincula, R.C.; Lee, T.R., Electric Potential Stability and Ionic Permeability of SAMs on Gold Derived from Bidentate and Tridentate Chelating Alkanethiols. *Journal of Physical Chemistry C* 2009, 113 (9), 3717-3725.
8. Aiamsen, P.; Anuragudom, P.; Saowsupa, S.; Phanichphant, S.; Lee, T. R., Structural characterization and optical properties of light-emitting poly(9,9-didecylfluorenyl-2,7-vinylene) (PFV) generated via Horner-Emmons polycondensation. *Journal of Photopolymer Science and Technology* 2008, 21 (3), 339-346.
9. Alexander, W.A.; Day, B.S.; Moore, H.J.; Lee, T.R.; Morris, J.R.; Troya, D., Experimental and theoretical studies of the effect of mass on the dynamics of gas/organic-surface energy transfer. *Journal of Chemical Physics* 2008, 128 (1).
10 Aznauryan, I.G.; Burkert, V.D.; Kim, W.; Park, K.; et al. Electroexcitation of the Roper resonance for 1.7 < Q(2)< 4.5 GeV2 in ep -> en pi(+). *Physical Review C* 2008, 78 (4).
11. Bang, G.S.; Chang, H.; Koo, J.R.; Lee, T.; Advincula, R.C.; Lee, H., High-fidelity formation of a molecular-junction device using a thickness-controlled bilayer architecture. *Small* 2008, 4 (9), 1399-1405.
12. Chunsheng, E.; Rantschler, J.; Zhang, S.; Khizroev, S.; Lee, T.R.; Litvinov, D. In *Low temperature vacuum annealing study of (Co/Pd)(n) magnetic multilayers,* 2008.
13. Cimatu, K.; Moore, H.J.; Barriet, D.; Chinwangso, P.; Lee, T.R.; Baldelli, S., Sum frequency generation imaging microscopy of patterned self-assembled monolayers with terminal -CH3, -OCH3, -CF2CF3, -C = C, -phenyl, and -cyclopropyl groups. *Journal of Physical Chemistry C* 2008, 112 (37), 14529-14537.
14. De Masi, R.; Garcon, M.; Zhao, B.; Amaryan, M.J.; et al. Measurement of ep -> ep pi(0) beam spin asymmetries above the resonance region. *Physical Review C* 2008, 77 (4).
15. Girod, F.X.; Niyazov, R.A.; Avakian, H.; Ball, J.; Bedlinskiy, I.; et al. Measurement of deeply virtual compton scattering beam-spin asymmetries. *Physical Review Letters* 2008, 100 (16).
16. Kim, J.H.; Bryan, W.W.; Lee, T.R., Preparation, characterization, and optical properties of gold, silver, and gold-silver alloy nanoshells having silica cores. *Langmuir* 2008, 24 (19), 11147-11152.
17. Lee, S.; Park, J.S.; Lee, T.R., The wettability of fluoropolymer surfaces: Influence of surface dipoles. *Langmuir* 2008, 24 (9), 4817-4826.

DMITRI LITVINOV

Professor of Electrical & Computer Engineering
Professor of Chemical & Biomolecular Engineering

B.S. Applied Physics and Technology, Moscow Institute of Physics
M.S. Physics, University of Miami
M.S.E. Electrical Engineering, University of Michigan
Ph.D. Applied Physics, University of Michigan

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www.uh.edu/cns/litvinov/

RESEARCH INTEREST:

My research interests span a range of topics related to the development and applications of novel magnetic materials and devices at nanoscale dimensions. These include micro- and nanomagnetic materials and devices directly related to the current and future magnetic storage technologies such as disk drive storage, probe storage based on MEMS and MRAM. Among the investigated issues are fabrication and device physics of magnetic probe heads at nanoscale dimensions (the recording heads with dimensions down to few tens of nanometers have been routinely fabricated using focused ion-beam nanofabrication techniques); development and characterization of nanocrystalline materials for advanced recording media applications; micromagnetic behavior of soft magnetic materials; recording properties of nanocrystalline alloy and superlattice-based media materials; recording processes at nanoscale dimensions, etc. Record track densities in excess of 400ktpi (~60nm track width) were demonstrated using above-mentioned nanoprobe recording heads and specially prepare media. The micromagnetic behavior of magnetic 'nanotubes' was for the first time experimentally observed.

The current research activities are focused on applications of nanocrystalline materials and nanoscale devices for achieving extremely high density recording (above 1Terabit/in 2). The current state-of-the-art in magnetic recording is 160x40x10nm magnetic features (corresponding to areal density of 100Gbin/in 2) recorded into a magnetic recording medium. The individual magnetic grains forming the recording medium are ~9nm in diameter. At these dimensions, the conventional recording schemes employed today are rapidly approaching the fundamental (superparamagnetic) limit in areal bit density, above which the recording data become unstable. It is widely believed that longitudinal recording will run out of steam at approximately 200Gbin/in 2 . Perpendicular magnetic recording will enable us to sustain the current great strides in technological advances for the next several generations of mass storage solutions. The technology is technically the closest alternative to conventional longitudinal recording, while it is capable of extending the superparamagnetic density limit beyond what is achievable with longitudinal recording. The recording densities above 1Terabit/in^2 (recording features as small as 50x12x10nm) are conceivable utilizing perpendicular recording. To support such a nanoscale technology, major innovations in both magnetic recording heads and media are necessary.

SELECTED PUBLICATIONS:

1. Amos, N.; Lavrenov, A.; Fernandez, R.; Ikkawi, R.; Litvinov, D.; Khizroev, S. In *High-resolution and high-coercivity FePtL1(0) magnetic force microscopy nanoprobes to study next-generation magnetic recording media,* 2009.
2. Leem, G.; Sarangi, S.; Zhang, S.S.; Rusakova, I.; Brazdeikis, A.; Litvinov, D.; Lee, T.R., Surfactant-Controlled Size and Shape Evolution of Magnetic Nanoparticles. *Crystal Growth & Design* 2009, 9 (1), 32-34.
3. Chunsheng, E.; Rantschler, J.; Zhang,, S.; Khizroev, S.; Lee, T.R., and Litvinov, D., Low temperature vacuum annealing study of (Co/Pd)n magnetic multilayers, *J. Appl. Phys.,* 103, 07B510/1-07B510/3 (2008).
4. Chunsheng, E.; Rantschler, J.; Khizroev, S.; and Litvinov, D., Micromagnetics of signal propagation in magnetic cellular logic data channels, *J. Appl. Phys.,* 104, 054311/1-054311/4 (2008).
5. George, J.; Rantschler, J.; Bae, S.E.; Litvinov, D.; and Brankovic, S.R., Sulfur and Saccharin Incorporation into Electrodeposited CoFe Alloys: Consequences for Magnetic and Corrosion Properties, *J. Electrochem. Soc.,* 155, D589-D594 (2008).
6. Martirosyan, K. S.; Wang, Y.J.; Chang, L.; Luss, D., and Litvinov, D., Fabrication of hexagonal barium ferrite nanoparticles by carbon combustion synthesis, TMS 2008, *Annu. Meet. Exhib., Suppl. Proc.,* 137th, 1,, 137-142 (2008).
7. Chunsheng E.; Rantschler, J.O.; Khizroev, S., and Litvinov, D., Micromagnetic study of domain wall dynamics in bit-patterned nanodots, *J. Appl. Phys.,* 103, 113910/1-113910/5 (2008).
8. Brankovic, S.R.; Bae, S.E., and Litvinov, D., The effect of Fe3+ on magnetic moment of electrodeposited CoFe alloys - Experimental study and analytical model, *Electrochim. Acta,* 53, 5934-5940 (2008).
9. Amos, N.; Fernandez, R.; Ikkawi, R.; Lee, B.; Lavrenov, A.; Krichevsky, A.; Litvinov, D., and Khizroev, S., Magnetic force microscopy study of magnetic stripe domains in sputter deposited Permalloy thin films, *J. Appl. Phys.,* 103, 07E732/1-07E732/3 (2008).
10. Vu, B.V.; Litvinov, D., and Willson, R.C., Gold Nanoparticle Effects in Polymerase Chain Reaction: Favoring of Smaller Products by Polymerase Adsorption, *Anal. Chem.* (Washington, DC, U. S.), 80, 5462-5467 (2008).
11. Chunsheng, E.; Parekh, V.; Ruchhoeft, P.; Khizroev, S., and Litvinov, D., Magnetization reversal in patterned (Co/Pd)n multilayers, *J. Appl. Phys.,* 103, 063904/1-063904/4 (2008).
12. Smith, D.; Parekh, V.; Chunsheng, E.; Zhang, S.; Donner, W.; Lee, T.R.; Khizroev, S., and Litvinov, D., Magnetization reversal and magnetic anisotropy in patterned Co/Pd multilayer thin films, *J. Appl. Phys.,* 103, 023920/1-023920/3 (2008).
13. Amos, N.; Ikkawi, R.; Krichevsky, A.; Fernandez, R.; Stefanescu, E.; Dumer, I.; Litvinov, D.; Khizroev, S., Multilevel three-dimensional nanomagnetic recording. *Journal of Nanoelectronics and Optoelectronics* 2007, 2 (3), 257-268.
14. Amos, N.; Lavrenov, A.; Ikkawi, R.; Gomez, P.; Candocia, F.; Chomko, R.; Litvinov, D.; Khizroev, S., Nanomagnetic probes to image patterned media for information densities beyond ten terabit-per-square-inch. *Journal of Nanoelectronics and Optoelectronics* 2007, 2 (2), 202-204.
15. Gomez, P.; Litvinov, D.; Khizroev, S., A method to design high SNR nanoscale magnetic sensors using an array of tunnelling magneto-resistance (TMR) devices. *Journal of Physics D-Applied Physics* 2007, 40 (15), 4396-4404.

VINCENT H. TAM

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Associate Professor of Chemical & Biomolecular Engineering

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Pharm.D., Albany College of Pharmacy

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RESEARCH INTEREST:

Dr. Tam's research in the general area of pharmacokinetics, pharmacodynamics of antimicrobials, mathematical modeling and simulation of biological processes and understanding the mechanisms of bacterial resistance. These complement the research of several ChBE faculty members, opening up opportunities for improving existing collaboratives and forging new ones.

HONORS/ACTIVITIES:

Editorial Board
2007–Present Antimicrobial Agents and Chemotherapy
2004–Present Diagnostic Microbiology and Infectious Disease

SELECTED PUBLICATIONS:

1. Singh, R., Ledesma, K.R., Chang, K.T., Hou, J.G., Prince, R.A., Tam, V.H. Pharmacodynamics of moxifloxacin against a high inoculum of Escherichia coli in an in vitro infection model. *J. Antimicrob. Chemother.* 2009; 64(3): 556-62.
2. Tam, V.H., Ledesma, K.R., Schilling, A.N., Lim, T.P., Yuan, Z., Ghose, R., Lewis, R.E. In-vivo dynamics of carbapenem-resistant Pseudomonas aeruginosa selection following sub-optimal dosing. *Diagn. Microbiol. Infect. Dis.* 2009; 64(4): 427-33.
3. Tam, V.H., Ledesma, K.R., Vo, G., Kabbara, S., Lim, T.P., Nikolaou, M. Pharmacodynamic modeling of aminoglycosides against Pseudomonas aeruginosa and Acinetobacter baumannii: identifying dosing regimens to suppress resistance development. *Antimicrob. Agents Chemother.* 2008; 52(11): 3987-93.
4. Lim, T.P., Ledesma, K.R., Chang, K.T., Hou, J.G., Kwa, A.L., Nikolaou, M., Quinn, J.P., Prince, R.A., Tam, V.H. Quantitative assessment of combination antimicrobial therapy for multi-drug resistant Acinetobacter baumannii. *Antimicrob. Agents Chemother.* 2008; 52(8): 2898-904.
5. Kwa, A.L.H., Lim, T.P., Low, J.G.H., Hou, J.G., Kurup, A., Prince, R.A., Tam, V.H. Pharmacokinetics of polymyxin B1 in patients with multi-drug resistant gram-negative bacterial infections. *Diagn. Microbiol. Infect. Dis.* 2008; 60(2): 163-7.
6. Tam, V.H., Louie, A., Fritsche, T.R., Deziel, M., Liu, W., Brown, D.L., Deshpande, L., Leary, R., Jones, R.N., Drusano, G.L. Impact of drug exposure intensity and duration of therapy on emergence of Staphylococcus aureus resistnace to a quinolone antimicrobial. *J. Infect Dis.* 2007; 195(12): 1818-27.
7. Nikolaou, M., Schilling, A.N., Vo, G., Chang, K.T., Tam, V.H. Modeling of microbial population responses to time-periodic concentrations of antimicrobial agents. *Ann Biomed Eng* 2007; 35(8): 1458-70.
8. Tam, V.H., Schilling, A.N., Poole, K., Nikolaou, M. Mathematical modeling response of Pseudomonas aeruginosa to meropenem. J. Antimicrob. Chemother. 2007; 60(6): 1302-9.
9. Nikolaou, M., Tam, V.H. A new modeling approach to the effect of antimicrobial agents on heterogeneous microbial populations. *J. Math. Biol.* 2006; 52(2): 154-82.
10. Boucher, A.N., Tam, V.H. Mathematical formulation of additivity for antimicrobial agents. *Diagn. Microbiol. Infect. Dis.* 2006; 55(4): 319-325.
11. Tam, V.H., Kabbara, S. Comparative performance of different methods to simulate drug exposure and variability in a population. *Diagn. Microbiol. Infect. Dis.* 2006; 56(2): 185-8.
12. Tam, V.H., Kabbara, S., Yeh, R.F., Leary, R.H. Impact of sample size on the performance of multiple-model pharmacokinetic simulations. *Antimicrob. Agents Chemother.* 2006; 50(11): 3950-2.
13. Tam, V.H., Schilling, A.N., Nikolaou, M. Modeling time-kill studies to discern the pharmacodynamics of meropenem. *J. Antimicrob. Chemother.* 2005; 55(5): 699-706.
14. Tam, V.H., Schilling, A.N., Lewis, R.E., Melnick, D.A., Boucher, A.N. A novel approach to characterize combined pharmacodynamic effects of antimicrobial agents. *Antimicrob. Agents Chemother.* 2004; 48(11): 4315-21.
15. Jumbe, N., Louie, A., Leary, R., Liu, W., Deziel, M.R., Tam, V.H., Bachhawat, R., Freeman, C., Kahn, J.B., Bush, K., Dudley, M.N., Miller, M.H., Drusano, G.L. Application of a mathematical model to prevent in-vivo amplification of antibiotic-resistant bacterial populations during therapy. *J. Clin. Invest.* 2003; 112(2): 275-85.
16. Tam, V.H., Preston, S.L., Drusano, G.L. Optimal sampling schedule design for populations of patients. *Antimicrob. Agents Chemother.* 2003; 47(9): 2888-91.

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gsbs.gs.uth.tmc.edu/tutorial/annapragada.html

RESEARCH INTERESTS:

Ananth Annapragada is an Associate Professor of Bioinformatics, in the School of Health Information Sciences at the University of Texas Health Sciences Center at Houston. He holds additional positions at the Graduate School of Biomedical Sciences at UT, and in the Keck Institute for Computational and Structural Biology. He is an Adjunct Faculty at the University of Houston, in the Department of Chemical & Biomolecular Engineering. He joined UT in August 2003, after 3 years at the Cleveland Clinic/Cleveland State University Program in Biomedical Engineering, where he was Associate Professor and Program Director.

Ananth received his Ph.D. in Chemical Engineering from The University of Michigan in 1989. After Post-Doctoral Fellowships at the University of Minnesota and MIT, he joined Abbott Laboratories as a Research Scientist in 1991. In 1996, he joined SEQUUS Pharmaceuticals, Menlo Park, CA. He stayed with SEQUUS through its merger with ALZA, and left to his first academic position in Cleveland in 2000, when ALZA was acquired by Johnson and Johnson. In 2003, he moved to Texas to pursue current position.

Ananth directs the Laboratory for Computational Biology and Delivery Systems (LCBDS) at UT. His research interests are in drug delivery, particularly physical and receptor targeting processes. About half of his current lab is dedicated to pulmonary drug delivery, and the remaining to cancer targeting, for therapeutic and diagnostic purposes. Details of the LCBDS current projects is available on the Web at www.sahs.uth.tmc.edu/aannapragada/.

HONORS/ACTIVITIES:

2007	Chief Scientific Officer, Marval Biosciences Inc.
2006–2007	Adjoint Professor of Biomedical Engineering, UT Austin-UT Houston-MD Anderson Department of Biomedical Engineering.
2004	Chandran Lecture in Neuro-Oncology, Duke University
2004	Invitee to National Academy of Sciences/Keck Futures Initiative Nanotechnology in Medicine Conference (one of 100 invitees nationwide)

SELECTED PUBLICATIONS:

1. Karathanasis, E., Suryanarayanan, S., Balusu, S.R., McNeeley, K., Sechopoulos, I., Karellas, A., Annapragada, A.V., Bellamkonda, R.V. Imaging nanoprobe for prediction of nanoparticle chemotherapy using mammography, *Radiology* 2009 vol. 250 (2) pp. 398-406.
2. Mukundan, S. Jr., Badea, C.T., Hedlund, L.W., Provenzale, J.M., Johnson, G.A., Ghaghada, K.B., Chen, E., Annapragada, A., Kao, C.-Y., and Bellamkonda, R.V. *"A Nanoscale, Liposomal Contrast Agent for Preclinical Micro-CT Imaging of the Mouse,"* AJR Am. J. Roentgenol, accepted.
3. Karathanasis, E., Chan, L., Balusu, S.R., D'Orsi, C.J., Annapragada, A.V., Sechopoulos, I., Bellamkonda, R.V. Multifunctional nanocarriers for mammographic quantification of tumor dosing and prognosis of breast cancer therapy, *Biomaterials* 2008 vol. 29 (36) pp. 4815-4822 .
4. Ghaghada, K.B., Hawley, C., Kawaji, K., Annapragada, A., Mukundan, S. "T1 Relaxivity of Core-encapsulated Gadolinium Liposomal Contrast Agents – Effect of Liposome Size and Internal Gadolinium Concentration", *Academic Radiology* 2008 vol. 15 (10) pp. 1259-63
5. Karathanasis, E., Park, J., Agarwal, A., Patel, V., Zhao, F., Annapragada, A.V., Hu, X., Bellamkonda, R.V. MRI mediated, non-invasive tracking of intratumoral distribution of nanocarriers in rat glioma, *Nanotechnology* 19 315101 (9pp) 2008.
6. Karathanasis, E., Ayyagari, A.L., Bhavane, R., Bellamkonda, R.V., and Annapragada, A.V., "Preparation of In Vivo Cleavable Agglomerated Liposomes Suitable for Modulated Pulmonary Drug Delivery," *Journal of Controlled Release,* 103 (1), 159–175, 2005.
7. Ghaghada, K., Saul, J., Bellamkonda, R., and Annapragada, A. "Folate Targeting of Drug Carriers—A Mathematical Model," *J. Cont. Rel.,* 104 (1), 113–128, 2005.
8. Bhavane, R., Karathanassis, S., and Annapragada, A., "Agglomerated Vesicles for Pulmonary Drug Delivery," *J. Cont. Rel.,* 93, 15–28, 2003.
9. Kao, C.-Y., Bellamkonda, R., and Annapragada, A. "A Long-Circulating Blood Pool Contrast Agent for CT Imaging," *Acad. Radiol.,* 10 (5), 475–483, 2003.
10. Nowak, N., Kakade, P., and Annapragada, A. "CFD Simulation of Airflow and Drug Deposition in Human Lungs," *Ann. Biomed. Eng.,* 31, 2003.
11. Saul, J., Annapragada, A., Natarajan, J., and Bellamkonda, R. "Controlled Targeting of Liposomal Doxorubicin via the Folate Receptor in Vitro," *Journal of Controlled Release,* 92, 49–67, 2003.

ALI DANESHY

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B.S. Mining Engineering, University of Tehran
M.S. Mineral Engineering, University of Minnesota
Ph.D. Mining Engineering (Rock Mechanics),
University of Missouri-Rolla

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RESEARCH INTERESTS:

Hydraulic Fracturing

Under natural flow conditions the production rate of many oil and gas fields is not sufficient to make them economical. This is particularly true for many of the onshore fields in U.S. Hydraulic fracturing is the most common method of well productivity enhancement. Oil and gas industry spends billions of dollars each year for fracturing services. Even though the subject has been covered in many technical publications, there is still much that is not known about the mechanics of fracture propagation in heterogeneous reservoir formations at great depths.

Modern Well Architectures

Recent technologies in the oil and gas industry have made it possible to produce oil and gas from a network of branches connected to a mother wellbore. The success of this technology depends on ability to very precisely locating these branches within the reservoir, measurement of flow parameters in the high pressure and temperature underground environment, and ability to regulate production from individual branches through surface-controlled downhole flow regulators.

Rock Mechanics

Many oil and gas operations require knowledge of the mechanical behavior of rocks. These include exploring, drilling, fracturing, sand control, compaction and reservoir subsidence, and many more. Unlike man-made materials, rocks have very complex and heterogeneous behaviors and react differently to physical and chemical stimuli.

HONORS/ACTIVITIES:

2004–2007	Director, Society of Petroleum Engineers
2004	SPE Distinguished Lecturer
1996	Chairman, SPE Distinguished Service Award Committee
1993	SPE Distinguished Service Award
1992	SPE Distinguished Member Award
1991–1993	Chairman, SPE Global Forum Series Coordination Committee
1986–88	Executive Editor, SPE Production Engineering Journal
1984–86	Chairman, SPE Publications Review Committee
1980	Chairman, SPE Cedrick K. Ferguson Medal Committee

SELECTED PUBLICATIONS:

1. Daneshy, A.A., *"Proppant Distribution and Flowback in Off-Balance Hydraulic Fractures,"* SPEPE, 41–46, 2005.
2. Daneshy, A.A., *"Pressure Variation Inside the Hydraulic Fracture and its Impact on Fracture Propagation, Conductivity, and Screen-out,"* SPE 95355, SPE ATCE, Dallas, Oct. 9–12, 2005.
3. Daneshy, A.A., *"Impact of Off-Balance Fracturing on Borehole Stability and Casing Failure,"* SPE 93620, SPE Western Regional Meeting, Irvine, March 30–April 1, 2005.
4. Daneshy, A.A., *"On the Accuracy of In-situ Stress Measurements by Hydraulic Fracturing,"* ARMA/NARMS paper 459, Gulf Rocks 2004, the 6th North America Rock Mechanics Symposium (NARMS): Rock Mechanics Across Borders and Disciplines, Houston, June 5–9, 2004.
5. Daneshy, A.A., *"Analysis of Off-Balance Fracture Extension and Fall-Off Pressures,"* SPE 86471, International Symposium and Exhibition on Formation Damage, Lafayette, Feb. 18–20, 2004.
6. Daneshy, A.A., *"Off-Balance Growth: A New Concept in Hydraulic Fracturing,"* JPT, 78–85, 2003.
7. Valko, P., Norman, L., and Daneshy, A.A. *"Well Stimulation,"* Chapter 17, Petroleum Well Construction, Edited by M. Economides, L. Watters and S. Dunn-Norman, John Wiley, & Sons, 1998.
8. Daneshy, A.A., *"Proppant Transport,"* Chapter 10, SPE Monograph Vol. 12, Recent Advances in Hydraulic Fracturing, Edited by Gidley, Holditch, Nierode, and Veatch, 1989.
9. Daneshy, A.A., et al., *"In-Situ Stress Measurement During Drilling,"* JPT, 891–98, 1986.
10. Daneshy, A.A., *"Numerical Solution of Sand Transport in Hydraulic Fracturing,"* JPT, 132, 1978.
11. Daneshy, A.A., *"Hydraulic Fracture Propagation in Layered Formations,"* SPEJ, 1978.
12. Daneshy, A.A., *"On the Design of Vertical Hydraulic Fractures,"* JPT, 1973.
13. Daneshy, A.A., *"Experimental Investigation of Hydraulic Fracturing through Perforations,"* JPT, 1973.
14. Daneshy, A.A., *"A Study of Inclined Hydraulic Fractures,"* SPEJ, 1973.

MICHAEL J. ECONOMIDES

Adjunct Professor of Chemical & Biomolecular Engineering

B.S. Chemical Engineering, University of Kansas
M.S. Chemical Engineering, University of Kansas
Ph.D. Petroleum Engineering, Stanford University

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RESEARCH INTERESTS:

Michael J. Economides is one of the most instantly recognizable names in the energy, petroleum and chemical industries for his seminal contributions to the global articulation of the critical issues and his significant role in technology development and application.

Economides is a Professor at the Cullen College of Engineering, University of Houston, teaching and conducting research in both chemical and petroleum engineering. His areas of interest include petroleum production and petroleum management, a particular emphasis on natural gas, natural gas transportation, LNG, CNG and processing, advances in process design of very complex operations, economics and geopolitics.

Publications include authoring/co-authoring of 11 textbooks and about 200 journal papers and chapters in books. His texts are used in almost all of the Petroleum Engineering departments in the United States, several overseas universities, and in the training programs of most of the major companies in the petroleum industry.

He has had professional activities in over 70 countries, has taught courses in 30 and has interacted with almost all major multinational and national petroleum companies.

He advises Fortune 500 companies and national oil companies at the country level. He has written for numerous newspapers and specialized publications and provides expert commentary for the major TV networks as well as CBC, CNBC, Bloomberg, Reuters and National Public Radio. He is co-author of the bestselling book, The Color Of Oil.

He gives a large number of lectures each year to industry and professional groups and he is often the keynote speaker in national conventions.

HONORS/ACTIVITIES:

2004	Recipient of the Kapitsa Gold Medal of Honor and the Albert Einstein Medal of Honor from the Russian Academy of Natural Sciences for "Contributions to the Field of Petroleum Engineering"
2004	University of Kansas Hall of Fame
2001	Doctor Honoris Causa, Petroleum and Gas University, Ploeisti, Romania
2000	Russian Academy of Natural Sciences, Inducted as Foreign Member
1997	Production Engineering Award, Society of Petroleum Engineers
1994	Distinguished Member, Society of Petroleum Engineers
1994	Doctor Honoris Causa and Honorary Professor, The Gubkin Russian State Academy of Oil and Gas, Moscow
1991–1992	Distinguished Lecturer, Society of Petroleum Engineers
1984	Outstanding Faculty Award, School of Mineral Industry, University of Alaska
1978	Sigma Xi (National Honor Research Society)
1976–1978	Earl C. Anthony Scholar, University of California, Berkeley
1974	Tau Beta Pi
1969–1974	Fulbright Scholar, University of Kansas

- Managing Partner, Dr. Michael J. Economides, Consultants, Inc.
- Editor-in-Chief, World Energy Monthly Review

SELECTED PUBLICATIONS:

1. Economides, M.J.; Xie, X.N., Climate Change - What Does the Research Mean? *Chemical Engineering Progress* 2009, 105 (6), 20-25.
2. Song, G.B.; Hu, Z.P.; Sun, K.; Ma, N.; Economides, M.J.; Robello, S.G.; Ehlig-Economides, C., An innovative ultradeepwater subsea blowout preventer control system using shape-memory alloy actuators. *Journal of Energy Resources Technology-Transactions of the Asme* 2008, 130 (3).
3. Economides, M.J.; Mikhailov, D.N.; Nikolaevskiy, V.N., On the problem of fluid leakoff during hydraulic fracturing. *Transport in Porous Media* 2007, 67 (3), 487-499.
4. Economides, M.J.; Mokhatab, S., Compressed natural gas - Another solution to monetize stranded gas. *Hydrocarbon Processing* 2007, 86 (1), 59-+.

MICKY FLEISCHER

Adjunct Professor of Chemical & Biomolecular Engineering

B.S. Chemical Engineering, Universidad Católica de Chile
B.S. Industrial Engineering, Universidad Católica de Chile
M.S. Chemical Engineering, University of Houston
Ph.D. Chemical Engineering, University of Houston

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RESEARCH INTERESTS:

My current interest is in the area of economics. The last position I held before retiring from Shell Chemicals in 2003 was as Economics Manager, with accountabilities for the investment decision framework in Shell Chemicals from an economics standpoint. Some of the responsibilities included:

- Promoting standards and tools and ensuring consistency to proposals and decisions for projects and ventures above $10 million of capital expenditures
- Ensuring consistent application of premises and assumptions
- Promoting learning and developing competencies in Shell Chemicals
- Taking full account of relevant learnings and developments in the field of economic thinking and related subjects such as value based management, risk management and capital structuring

HONORS/ACTIVITIES:

2004–Present	UH Adjunct Professor
2002	Awarded Champions of Excellence by Shell Chemicals
2000–Present	CEO of Fleischer International Trading, a private enterprise that imports and distributes fine wines in the US
1999–2003	UH Adjunct Associate Professor
1997, 1998, 2001 & 2004	Most Outstanding Lecturer Award, Cullen College of Engineering, University of Houston
1977	Air Pollution Control Association Best Paper Award
1975–1998	Lecturer of the Chemical Engineering Department

- 26 years with Shell in increasingly responsible positions
- 7 Special Recognition Awards as an individual contributor or in leadership positions in Shell
- Shell Ph.D. recruiter at Stanford University, University of California - Berkeley and the University of Houston
- Leader and/or participant of many community organizations

SELECTED PUBLICATIONS:

1. Fleischer, M.T., "Mathematical Modeling of Chemical Spills on Land," Ecolibrium, 11, 10–13, 1982.
2. Fleischer, M.T. and D.M. Prett, "Simplified Techniques for Simulating Complex Columns," Chemical Engineering Progress, 2, 72–75, 1981.
3. Fleischer, M.T. and D.M. Prett, "Simplified Simulation Speeds Olefins Plant Optimization," Oil & Gas Journal, April 6, 85–89, 1981.
4. Fleischer, M.T., "Spills: An Evaporation/Air Dispersion Model for Chemical Spills on Land," Proceedings of 1980 National Conference on Control of Hazardous Materials Spills, 375–380, 1980.
5. Fleischer, M.T. and D.M. Prett, "Simplified Techniques for Simulation of Complex Distillation Columns," 88th National Meeting of the AIChE, 1980.
6. Fleischer, M.T. and F.L. Worley, Jr., "Orthogonal Collocation—Application to Diffusion from Point Sources," *Atmospheric Environment,* 12, 1349–1357, 1978.

CHARLES ROOKS

Research and Instructional Professor of Chemical & Biomolecular Engineering
Director, Chemical Engineering Undergraduate Laboratory
Director, Texas Diesel Testing and Research Center

B.S. Chemical Engineering, University of Mississippi
M.S. Chemical Engineering, University of Oklahoma
Ph.D. Chemical Engineering, University of Oklahoma

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RESEARCH INTERESTS:

Undergraduate Laboratory

One of his primary missions is the continuous improvement of the Undergraduate Chemical & Biomolecular Engineering Laboratory. This includes upgrading the instrumentation in the lab and modernizing the experiments to more closely reflect what students will find in industry when they graduate.

Diesel Emission Controls

Evaluating various strategies for the control of NOx, SOx, and particulates in diesel exhausts. We are currently working with the State of Texas, EPA, DOE and others to devise a method of accurately evaluating various emission reduction technologies for the diesel fleets.

HONORS/ACTIVITIES:

- American Institute of Chemical Engineers
- American Chemical Society
- Tau Beta Pi
- Southwest Catalysis Society
- North American Catalysis Society

PATENTS:

- U.S. Patent 4,272,399, "Conversion of Carbon Containing Materials to Synthesis Gas", June 9, 1981.
- U.S. Patent 4,272,555, "Conversion of Carbon Containing Materials to Carbon Monoxide" June 9, 1981.
- U.S. Patent 4,367,160, "Oxidant for Gasifying Carbon Containing Materials". January 4, 1983.
- U.S. Patent 5,892,132, "Transport Hydroxylation Reactor", April 6, 1999.
- Patent Application: "Method of Rapidly Converting an Acrylonitrile Reactor to Methanol Feed and Back to Propylene Feed". Patent in process in 2004.22(2), 1285 – 1296, 2008.

SELECTED PUBLICATIONS:

1. DEER Conference Poster 2005 Meeting – Detroit, Mich
2. DEER Conference Poster 2006 Meeting – Detroit, Mich
3. DEER Conference Poster 2007 Meeting – Detroit, Mich
4. DEER Conference Poster 2008 Meeting – Detroit, Mich
5. Muncrief, R., Rooks, C.W., Cruz, M., Harold, M.P. "Combining Biodiesel and Exhaust Gas Recirculation for Reduction of NOx and Particulate Emissions" *Energy and Fuels,* 2008, 22(2), 1286–1296.

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The department's Industrial Advisory Board meets biannually to discuss issues of mutual interest to educators and industrial employers. The primary mutual value of our IAB is to help our department ensure that the preparation and quality of our graduating students remain in step with the evolving needs of industry. The IAB also provides input and advice to the department on such issues as student recruitment, curriculum content, graduate research programs, and university-industry partnerships.

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THE UNIVERSITY OF HOUSTON

The UH campus incorporates 548 acres of parks, fountains, plazas, sculptures and recreational fields surrounding modern classroom, laboratory and study facilities, affording students a comfortable and well-equipped setting for academic pursuits and proximity to the downtown area of the nation's fourth-largest city.

UH researchers collaborate extensively with workers in the Texas Medical Center, NASA's Johnson Space Center, and the Houston-area Keck Center for Computational Biology (cohesion.rice.edu/centersandinst/gcc/keck.cfm).

UH's more famous alumni include founder of Compaq Computers Rod Canion; Astronauts Bonnie Dunbar and Bernard Harris; ABC News anchor Tom Jarriel; CBS sportscaster Jim Nantz; singer/songwriter Larry Gatlin; actors Dennis and Randy Quaid; and Olympian Carl Lewis.

The UH discovery of high-temperature superconductors led to the establishment of the Texas Center for Superconductivity at UH, the largest university superconductivity research effort in the United States. The Institute for Scientific Information recently named a TCSUH researcher one of the world's most cited research authors.

UH ranked tenth in the nation in citation frequency in the physical sciences (physics, chemistry, earth sciences, engineering, mathematics and applied sciences) according to Nature.

HOUSTON

Houston is the fourth-largest city in the United States, with nearly two million city residents and 4.5 million in the metropolitan region. Houston is home to the largest medical center in the world, employing more than 62,000 with a local economic impact of $14 billion. A $600-million biotechnology commercialization park is now under development.

Houston has the lowest crime rate and second-lowest cost of living among major American cities. In addition, Houston has the most affordable housing of the 10 most populated metropolitan areas, 39 percent below the average of U.S. cities with a population of more than 1.5 million.

Among the 10 largest U.S. cities, Houston ranks second in the rate of job growth. Houston also ranks eighth out of 354 U.S. metro areas in overall quality of life.* Home to 18 Fortune 500 companies and more than 5,000 energy-related firms, Houston is considered by many as the Energy Capital of the world. More than 90 languages are spoken throughout the Houston area.

Houstonians dine out (in more than 11,000 restaurants) more than residents of any other city. The Houston Theater District is second only to New York City with its concentration of seats in one geographic area. A youthful city, 37 percent of Houstonians are 24 years old or younger, and 71 percent are under 44.

For three consecutive years, Houston has ranked first in the nation in new business growth. In the most recent survey, more than 31,000 new local businesses were started in Houston. Los Angeles was a distant second with 16,780.

*Source: Places Rated Almanac

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