

Winter 2011

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EDUCATION

Doctor of Philosophy
Massachusetts Institute of Technology

Chemical Engineering 1990

Master of Science
New Jersey Institute of Technology

Chemical Engineering 1983

Bachelor of Science
New Jersey Institute of Technology

Chemical Engineering 1980

ACADEMIC EXPERIENCE

Acting Department Chairman
September 2006 – August 2007

Otto York Department of Chemical Engineering
New Jersey Institute of Technology

Professor
September 2004 – present

New Jersey Institute of Technology

Associate Professor
September 1995 – August 2004

New Jersey Institute of Technology
Tenured – September 1995

Assistant Professor
January 1990 - April 1995

New Jersey Institute of Technology

INDUSTRIAL EXPERIENCE

Project Engineer
June 1980 – December 1982

Exxon Research & Engineering Company

CONSULTING

Optomechanical Enterprises, Inc. and Poulos Technical Services, Inc., 1995 – 2000.

PATENT

US Patent 6,815,683 B2 (2004) -- “Terahertz Imaging Apparatus and Method” - J. Federici, R. Barat, and D. Gary

AWARDS

“Innovation in Engineering Education”, Newark College of Engineering - NJIT (2003).

“Excellence in Teaching Award for Lower Division and Undergraduate Instruction”, NJIT (2007).

CURRENT RESEARCH INTERESTS

Applied catalysis for hydrocarbon upgrading
Maximum Mixedness Model in combustion reactor engineering

TECHNICAL PEER-REVIEWED PUBLICATIONS

Combustion

R. Brukh, R. Barat, and S. Mitra, "The Effect of Waste Concentration on Destruction Efficiency During Incineration," *Environmental Engineering Science*, vol. 23, no. 2 (2006).

Uske, J. and Barat, R., "Estimation of Laminar Burning Velocities by Direct Digital Photography," *Journal of Chemical Education*, vol. 81, pp. 391-393 (2004).

Brukh, S., Mitra, S., and Barat, R., "Pathways to Methylene Chloride Destruction," *Combustion Science and Technology*, vol. 176, pp. 531-555 (2004).

Bass, C., Barat, R. B., and Lemieux, P., "Identification of an Ideal Reactor Model in a Secondary Combustion Chamber," *AIChE Journal*, vol. 49, no. 10, pp. 2619-2630 (2003).

Bass, C. and Barat, R., "Detailed Mechanism Simulation of a Toroidal Jet-Stirred Combustor Using a Partially Stirred Reactor Model," *Combustion and Flame*, vol. 135, no. 3, pp. 249-259 (2003).

Barat, R., "Correlating Laminar Burning Velocities Using Perfectly Stirred Reactor Theory," *Chemical Engineering Science*, vol. 56, pp. 2761-2766 (2001).

Chouvinc, P. and Barat, R. B., "Effects of CH₃Cl-Doping on Laminar CH₄/Air Flames – Impact on OH Radicals," *Advances in Environmental Research*, vol. 3, no. 3, pp. 357-367 (1999).

Mao, F. and Barat, R. B., "The Interaction of Fuel-Bound Nitrogen and Fuel-Bound Chlorine During Air-Staged Incineration," *Combustion Science and Technology*, vol. 116-117, pp. 339-357 (1996).

Mao, F. and Barat, R. B., "Combustion Inhibition by Methyl Chloride and the Effects of Steam Injection in a Two Stage Turbulent Flow Reactor," *Combustion Science and Technology*, vol. 112, no. 1-6 (1996).

Mao, F. and Barat, R. B., "Minimization of NO During Staged Combustion of CH₃NH₂," *Combustion and Flame*, vol. 105, no. 4, pp. 557-568 (1996).

Mao, F. and Barat, R. B., "Experimental and Modeling Studies of Staged Combustion Using a Reactor Engineering Approach," *Chemical Engineering Communications*, vol. 145, pp. 1-21 (1996).

Wang, L. and Barat, R. B., "The Inhibitory Effects of Chlorocarbon Addition to Fuel-Rich Methane/Air Combustion," *Hazardous Waste and Hazardous Materials*, vol 12, no. 1, pp. 51+ (1995).

Mao, F., Kretkowski, D., and Barat, R. B., "A Two Zone Turbulent Flow Reactor Facility for Studies of Staged Combustion of Simulated Hazardous Wastes," *Combustion Science and Technology*, vol. 102, no. 1-6, pp. 145+ (1994).

Wang, L., Jalvy, P., and Barat, R. B., "The Effects of CH₃Cl Addition on an Atmospheric Pressure Fuel-Lean CH₄/Air Premixed Laminar Flat Flame," *Comb. Sci. Technology*, vol. 97, no. 1-3, pp. 13+ (1994).

Barat, R. B., "Jet-Stirred Combustor Behavior Near Blow-Out: Observations and Implications," *Combustion Science and Technology*, vol. 84, no. 1-6, p. 187 (1992).

Ho, W. P., R. B. Barat, and J. W. Bozzelli, "Thermal Reactions of CH₂Cl₂ in O₂/H₂ Mixtures: Implications for Chlorine Inhibition of CO Conversion to CO₂," *Comb. Flame*, vol. 88, pp. 265+ (1992).

Brouwer, J., R. B. Barat, J. W. Bozzelli, J. P. Longwell, and A. F. Sarofim, "Modeling the Kinetics of Chlorocarbon Combustion in a Jet-Stirred Reactor," *Combustion Science and Technology*, vol. 85, no. 1-6, pp. 87+ (1992).

Barat, R. B., A. F. Sarofim, J. P. Longwell, and J. W. Bozzelli "Inhibition of a Fuel Lean Ethylene / Air Flame in a Jet-Stirred Combustor by Methyl Chloride: Experimental and Mechanistic Analyses," *Combustion Science and Technology*, vol. 74, pp. 361+ (1990).

Process Control

T. Slanvetpan and R. Barat, "Staged Combustor Control Using Artificial Neural Network-Based Process Models," *Chemical Engineering Communications*, vol. 193, no.3, pp. 386-401 (2006).

Slanvetpan, T. and Barat, R., "Control of Nitric Oxide Emissions from a Laboratory Combustor Using Artificial Neural Networks," *Combustion Science and Technology*, vol. 175, pp. 1761-1782 (2003).

Slanvetpan, T., Barat, R. B., and Stevens, J. G., "Process Control of a Laboratory Combustor Using Neural Networks," *Computers and Chemical Engineering*, vol. 27, no. 11, pp. 1605-1616 (2003).

Terahertz Applications

Z. Liu, K. Su, D. Gary, J. Federici, R. Barat, and Z-H. Michalopoulou, "Video-rate terahertz interferometric and synthetic aperture imaging" *Applied Optics*, Vol. 48, no. 19, pp. 3788-3795 (2009).

J. Federici, R. Barat, D. Gary, Z-H. Michalopoulou, 'Detection of Explosives by Terahertz Synthetic Aperture Imaging - Focusing and Spectral Classification', (Invited Paper) *Comptes rendus – Physique* 9, 248-261 (2008).

A. Sinyukov, Z. Liu, Y. Hor, K. Su, R. Barat, D. Gary, Z-H. Michalopoulou, I. Zorych, J. Federici, and D. Zimdars, 'Rapid Phase Modulation of THz Radiation for High Speed THz Imaging and Spectroscopy', *Optics Letters*, vol. 33, no. 14, pp. 1593-1595 (2008).

J. F. Federici, D. Gary, R. Barat, Z-H. Michalopoulou, "Detection of Explosives by Terahertz Imaging," in *Counterterrorist Detection Techniques of Explosives*, J. Yinon, ed., ISBN: 978-0-444-52204-7, Elsevier (2007).

J. F. Federici, D. Gary, R. Barat, and Z.-H. Michalopoulou, "T-Rays vs. Terrorists", *IEEE Spectrum*, vol. 44, no. 7, p. 47 (2007).

A. Sengupta, A. Bandyopadhyay, J. F Federici, R. B Barat, D. E Gary, M. Chen, and D B Tanner, 'Effects of scattering on THz spectra of granular solids', *Int. J. Infrared and Millimeter Waves* (2007) 28:969-978.

A. Bandyopadhyay, A. Sengupta, A. Sinyukov, R. Barat, D. Gary, Z-H. Michalopoulou, and J. Federici, "Artificial Neural Network Analysis in Interferometric THz Imaging for Detection of Lethal Agents," *International Journal of Infrared and Millimeter Waves*, vol. 27, no. 8, pp. 1145-1158 (2006).

A. Bandyopadhyay, A. Stepanov, , A. Sengupta, D. Gary, M. Federici, B. Schulkin, R. Barat, E. Michalopoulou, and D. Zimdars, J. Federici, 'Terahertz interferometric and synthetic aperture imaging', *Journal of the Optical Society of America A*, vol. 23, no. 5 (2006).

J. Federici, R. Barat, D. Gary, Z-H. Michalopoulou, and D. Zimdars, 'Stand-Off Sensing of Explosives Using Terahertz Radiation', *American Laboratory*, vol. 38, no. 12, pp. 28-33 (2006).

J. Federici, B. Schulkin, F. Huang, D. Gary, R. Barat, F. Oliveira, and D. Zimdars, 'THz Imaging and Sensing for Security Applications - Explosives, Weapons, and Drugs', *Semiconductor Science and Technology*, vol. 20, pp. S266-S280 (2005).

F. Huang, B. Schulkin, H. Altan, J. Federici, D. Gary, R. Barat, D. Zimdars, M. Chen and D. Tanner, 'Terahertz Study of 1,3,5-Trinitro-s-triazine (RDX) by Time Domain Spectroscopy and FTIR', *Applied Physics Letters*, vol. 85, 5535 (2004).

Federici, J., Gary, D., Schulkin, B., Huang, F., Altan, H., Barat, R., and Zimdars, D., "Terahertz imaging using an interferometric array," *Applied Physics Letters*, vol. 83, no. 12, pp. 2477-2479 (2003).

Environmental / Analytical

Callahan, V., Barat, R., Cedio-Fengya, D., and Stevens, J., "The Effect of Particle Size Distribution on the Deposition of Charged Particles in Tubes," *Advances in Environmental Research*, vol. 7, no. 1, pp. 105-115 (2002).

Tong, X., Barat, R., and Poulos, A., "Resonance Fluorescence Detection of Mercury Vapor in a Supersonic Jet," *Review of Scientific Instruments*, vol. 73, no. 6, pp. 2392-2397 (2002).

Bruk, R., Salem, T., Slanvetpan, T., Barat, R., and Mitra, S., "Process Modeling and On-Line Monitoring of Benzene and Other Species During the Two-Stage Combustion of Ethylene in Air," *Advances in Environmental Research*, vol. 6, pp. 359-367 (2002).

Tong, X., Barat, R., and Poulos, A., "Detection of Mercuric Bromide in a Gas Phase Flow Cell by Laser Photo-Fragment Fluorescence Spectroscopy," *Environmental Science and Technology*, vol. 33, pp. 3260-3263 (1999).

Tong, X., Barat, R., and Poulos, A., "A CCD-Based Laser Photo-Fragment Fluorescence Spectrometer for Detection of Mercury Compounds," *Review of Scientific Instruments*, vol. 70, no. 11, pp. 4180-4184 (1999).

Poulos, A. and Barat, R. B., "Detection of Mercury Compounds in the Gas Phase by Laser Photo-Fragment Fluorescence Spectroscopy," *Applied Spectroscopy* vol. 52, no. 10, pp. 1360-1363 (1998).

Callahan, V., Barat, R. B., and Stevens, J., "Electrocatalytic Control of Exhaust Soot," *Advances in Environmental Research*, vol. 2, no. 2, pp. 186-198 (1998).

Lemieux, P., Ryan, J., Bass, C., and Barat, R., "Emissions of Trace Products of Incomplete Combustion from a Pilot-Scale Incinerator Secondary Combustion Chamber," *J. Air and Waste Management Assoc.*, vol. 46, pp. 309-316 (1996).

Barat, R. B., J. P. Longwell, A. F. Sarofim, S. P. Smith, and E. Bar-Ziv, "Laser Rayleigh Scattering for Flame Thermometry in a Toroidal Jet Stirred Combustor," *Appl. Optics*, vol. 30, no. 21, pp. 3003+ (1991).

Microwave Plasma Applications

Barat, R. B. and J. W. Bozzelli, "Reactions of Chlorocarbons to HCl and Hydrocarbons in a Hydrogen Rich Microwave Induced Plasma Reactor", *Environmental Science and Technology*, vol. 23, no. 6, pp. 666-671 (1989).

Barat, R. B. and J. W. Bozzelli, "Reactions of Water Vapor or Molecular Hydrogen with Trichloroethylene in a Microwave Plasma Reactor", *Plasma Chemistry and Plasma Processing*, vol. 8, no. 3, pp. 293-314 (1988).

Barat, R. B. and J. W. Bozzelli, "Variable Power Microwave Discharge and Cavity," *Review of Scientific Instruments*, vol. 52, no. 4, pp. 612-614 (1981).

Reaction Kinetics

Barat, R. B. and J. W. Bozzelli, "Kinetic and Product Distribution Analysis of the Reaction of Atomic Hydrogen with Vinyl Chloride," *Journal of Physical Chemistry*, vol. 96, pp. 2494+ (1992).

EDUCATION PEER-REVIEWED PUBLICATIONS

Derevjanik, M., Badri, S., and Barat, R., "A Semi-Batch Reactor Experiment for the Undergraduate Laboratory," *Chemical Engineering Education*, vol. 45, no. 2 (2011).

N. Elliot, R. Barat, and K. Joshi, "What's Proof Got To Do With It: Traditional Statistics, Resampling Statistics, and Neural Networking in Usability Design," *User Experience*, vol. 7, no. 3, p. 26+ (2008).

Uske, J. and Barat, R., "Estimation of Laminar Burning Velocities by Direct Digital Photography," *Journal of Chemical Education*, vol. 81, pp. 391-393 (2004).

Delgado, P., Kasko, A., Nappi, J., and Barat, R., "An Experiment in Applied Optics in Chemical Engineering: Determination of the Kinetics of the Oxidation of an Organic Dye," *Chemical Engineering Education*, vol. 32, 3, p. 174+ (1998).

Barat, R., Federici, J., Johnson, A., Grebel, H., and Chang, T., "Optical Science and Engineering Curriculum at NJIT," *Journal of Engineering Education*, supplement, pp. 575-582 (1998).

PUBLISHED BOOK IN ENGINEERING EDUCATION

Robert B. Barat and Norbert Elliot
The Compleat Chemical Engineer: A Guide to Critical Thinking Kendall/Hunt, Dubuque, IA (1993).

PUBLISHED BOOK CHAPTER IN TECHNICAL EDUCATION

R. Barat, "Writing an Experiment" in *Professional Writing*
Norbert Elliot and Robert Lynch (eds.), Ginn Press, Needham Heights, MA (1993) pp. 178-205