Jeffrey I. Steinfeld CHEMISTRY

- B.S. 1962 Chemistry, Massachusetts Institute of Technology
- Ph.D. 1965 Physical Chemistry, Harvard University
- NSF Postdoctoral Fellowship

CV at MIT

- Professor Department of Chemistry 1980 -- present
- Education Program Director, Laboratory for Energy and Environment, 2001 -- present

Teaching includes:

- 5.23 Atmospheric Chemistry
- 5.311 Introductory Chemical Experimentation
- 5.60 Thermodynamics and Kinetics
- 5.68 Kinetics of Chemical Reactions

Funding Sources

- NASA
- EPA
- NSF
- Alliance for Global Sustainability

Program Web Site

http://lfee.mit.edu/education/

Research Summary

- High sensitivity spectroscopy for environmental measurements
- Environmentally benign chemical technology
- Introducing environment and sustainability into educational curricula

Our research is focused on developing high sensitivity spectroscopic techniques which may be employed for environmental measurements, particularly for trace gas components in the atmosphere. These techniques include IntraCavity Laser Absorption Spectroscopy and Cavity RingDown spectroscopy, both of which are capable of detecting gas phase molecules at sub-parts-per-billion levels.

We have also been investigating the application of supercritical fluids as environmentally acceptable reaction media, in collaboration with a group in Chemical Engineering. The decomposition mechanism for methyl-***tert***-butyl ether in near- and supercritical water has been established, and supercritical carbon dioxide has been investigated as a reaction medium for Diels-Alder condensations.

An additional area of interest concerns the introduction of environmental and sustainability content across the educational curriculum, both within MIT and at other institutions. We are collaborating with atmospheric monitoring groups to increase the sensitivity and selectivity of their measurements, and working with curriculum designers to incorporate significant research findings into educational programs.

Some Relevant Publications

J.I. Steinfeld, Chinese J. Chem. 17, 204 (1999).
New Spectroscopic Methods for Environmental Measurement and Monitoring.

S.F. Yang, M. Canagaratna, S. Witonsky, S. Coy, J.I. Steinfeld, R.W. Field, and A.A. Kachanov, J. Mol. Spectroscopy 201, 188 (2000)
Intensities and Collision-Broadening Coefficients for the Oxygen A-band measured by IntraCavity Laser Absorption Spectroscopy).

J.W. Tester, R.L. Danheiser, R.D. Weinstein, A. Renslo, J.D. Taylor, and J.I. Steinfeld, Chapter 22 of Green Chemical Syntheses and Processes (P.T. Anastas, L.G. Heine, and T.C. Williamson, eds.), American Chemical Society Symposium Series No. 767, pp. 270 291 (Washington, D.C., 2000).
Supercritical Fluids as Solvent Replacements in Chemical Synthesis.

J.D. Taylor, J.I. Steinfeld, and J.W. Tester, Ind. and Eng. Chem. Research 40, 67 (2001)
Experimental Measurement of the Rate of Methyl tert-Butyl Ether Hydrolysis in Sub- and Supercritical Water, Climate change and energy options: decision making in the midst of uncertainty, Fuel Proc. Technology 71, 121 (2001).

S.K. Witonsky, M.R. Canagaratna, S.L. Coy, J.I. Steinfeld, R.W. Field, and A.A. Kachanov, J. Chem. Phys. 115, 3134 (2001).
The $3\nu_1$ overtone band of trans-nitrous acid: Rotational and perturbation and absolute analysis.

J.D. Taylor, F.A. Pacheco, J.I. Steinfeld, and J.W. Tester, Ind. and Eng. Chem. Research 41, 1 (2002).
Multiscale Reaction Pathway Analysis of Methyl tert-Butyl Ether (MTBE) Hydrolysis under Hydrothermal Conditions.

M.W. Todd, R.A. Provencal, T.G. Owano, B.A. Paldus, A. Kachanov, V.I. Vodopyanov, M. Hunter, S. Coy, J.I. Steinfeld, and J.T. Arnold, Applied Physics B75, 367 (2002).
Application of mid infrared Cavity Ringdown Spectroscopy to trace explosives vapor detection using a broadly tunable optical parametric oscillator.