Stanford

Tom Bowman

Professor of Mechanical Engineering

CONTACT INFORMATION

- **Administrative Contact**

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Bio

BIO

Professor Bowman studies reacting flows, primarily through experimental means, and the processes by which pollutants are formed and destroyed in flames. In addition, he is interested in the environmental impact of energy use, specifically greenhouse gas emissions from use of fossil fuels.

ACADEMIC APPOINTMENTS

- Professor, Mechanical Engineering

HONORS AND AWARDS

- Research Prize, Humboldt (1997)
- Zeldovich Gold Medal, Combustion Institute (1998)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Member, National Academy of Engineering (2013 - present)

PROFESSIONAL EDUCATION

- PhD, Princeton , Aerospace and Mechanical Sciences (1966)

Teaching

COURSES

2021-22

- Combustion Applications: ME 372 (Spr)
- Combustion Fundamentals: ME 371 (Win)
- Physical Gas Dynamics: ME 362A (Aut)

2020-21

- Combustion Applications: ME 372 (Spr)
- Combustion Fundamentals: ME 371 (Win)

2019-20

- Combustion Applications: ME 372 (Spr)
- Combustion Fundamentals: ME 371 (Win)
- Physical Gas Dynamics: ME 362A (Aut)

2018-19

- Combustion Applications: ME 372 (Spr)
- Energy Systems I: Thermodynamics: ME 370A (Aut)
- High Temperature Gasdynamics Laboratory Research Project Seminar: ME 390A (Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Emeric Boigne, Veronika Korneyeva, Luke Zaczek, Yue Zhang

Master's Program Advisor

Kyle Casey, Poom Prasopsukh, Jiaxuan Su

Publications

PUBLICATIONS

- **Professor Irvin Glassman** *COMBUSTION SCIENCE AND TECHNOLOGY*
  Bowman, C. T., Dryer, F. L.
  2021; 193 (4): 539–40
- **Impact of vitiation on flow reactor studies of jet fuel combustion chemistry** *COMBUSTION AND FLAME*
  Wang, K., Xu, R., Bowman, C. T., Wang, H.
  2021; 224: 66–72
- **Professor Irvin Glassman (1923-2019) IN MEMORIAM** *COMBUSTION AND FLAME*
  Bowman, C. T., Dryer, F. L.
  2021; 223: A1
- **A physics-based approach to modeling real-fuel combustion chemistry - V. NOx formation from a typical Jet A** *COMBUSTION AND FLAME*
  Saggese, C., Wan, K., Xu, R., Tao, Y., Bowman, C. T., Park, J., Lu, T., Wang, H.
  2020; 212: 270–78
- **Kinetic analysis of distinct product generation in oxidative pyrolysis of four octane isomers** *PROCEEDINGS OF THE COMBUSTION INSTITUTE*
  Wang, K., Bowman, C. T., Wang, H.
  2019; 37 (1): 531–38
- **A Physics-based approach to modeling real-fuel combustion chemistry - III. Reaction kinetic model of JP10** *COMBUSTION AND FLAME*
  Tao, Y., Xu, R., Wang, K., Shao, J., Johnson, S. E., Movaghar, A., Han, X., Park, J., Lu, T., Brezinsky, K., Egolfopoulos, F. N., Davidson, D. F., Hanson, et al
  2018; 198: 466–76
- **A physics based approach to modeling real-fuel combustion chemistry - IV. HyChem modeling of combustion kinetics of a bio-derived jet fuel and its blends with a conventional Jet A** *COMBUSTION AND FLAME*
  Wang, K., Xu, R., Parise, T., Shao, J., Movaghar, A., Lee, D., Park, J., Gao, Y., Lu, T., Egolfopoulos, F. N., Davidson, D. F., Hanson, R. K., Bowman, et al
  2018; 198: 477–89
- **A physics-based approach to modeling real-fuel combustion chemistry - II. Reaction kinetic models of jet and rocket fuels** *COMBUSTION AND FLAME*
  Xu, R., Wang, K., Banerjee, S., Shao, J., Parise, T., Zhu, Y., Wang, S., Movaghar, A., Lee, D., Zhao, R., Han, X., Gao, Y., Lu, et al
  2018; 193: 520–37

- **A physics-based approach to modeling real-fuel combustion chemistry - I. Evidence from experiments, and thermodynamic, chemical kinetic and statistical considerations** *COMBUSTION AND FLAME*
  Wang, H., Xu, R., Wang, K., Bowman, C. T., Hanson, R. K., Davidson, D. F., Brezinsky, K., Egolfopoulos, F. N.
  2018; 193: 502–19
- **An experimental and kinetic modeling study of n-dodecane pyrolysis and oxidation** *COMBUSTION AND FLAME*
  Banerjee, S., Tangko, R., Sheen, D. A., Wang, H., Bowman, C. T.
  2016; 163: 12-30
- **Shock Tube Measurements of the Rate Constant for the Reaction Ethanol + OH.** *journal of physical chemistry. A*
  Stranic, I., Pang, G. A., Hanson, R. K., Golden, D. M., Bowman, C. T.
  2014; 118 (5): 822-828
- **Shock Tube Measurements of the Rate Constant for the Reaction Ethanol plus OH** *JOURNAL OF PHYSICAL CHEMISTRY A*
  Stranic, I., Pang, G. A., Hanson, R. K., Golden, D. M., Bowmant, C. T.
  2014; 118 (5): 822-828
- **Shock Tube Measurements of the tert-Butanol + OH Reaction Rate and the tert-C4H8OH Radical ß-Scission Branching Ratio Using Isotopic Labeling.** *journal of physical chemistry. A*
  Stranic, I., Pang, G. A., Hanson, R. K., Golden, D. M., Bowman, C. T.
  2013; 117 (23): 4777-4784
- **CFD simulation of a confined axisymmetric laminar methane-air diffusion flame** *8th Mediterranean Combustion Symposium*
  Fletcher, D. F., Bowman, C. T., Haynes, B. S.
  2013
- **Experimental Determination of the High-Temperature Rate Constant for the Reaction of OH with sec-Butanol** *JOURNAL OF PHYSICAL CHEMISTRY A*
  Pang, G. A., Hanson, R. K., Golden, D. M., Bowman, C. T.
  2012; 116 (39): 9607-9613
- **High-Temperature Rate Constant Determination for the Reaction of OH with iso-Butanol** *JOURNAL OF PHYSICAL CHEMISTRY A*
  Pang, G. A., Hanson, R. K., Golden, D. M., Bowman, C. T.
  2012; 116 (19): 4720-4725
- **Rate Constant Measurements for the Overall Reaction of OH+1-Butanol -> Products from 900 to 1200 K** *JOURNAL OF PHYSICAL CHEMISTRY A*
  Pang, G. A., Hanson, R. K., Golden, D. M., Bowman, C. T.
  2012; 116 (10): 2475-2483
- **High-Temperature Measurements of the Rate Constants for Reactions of OH with a Series of Large Normal Alkanes: n-Pentane, n-Heptane, and n-Nonane** *ZEITSCHRIFT FUR PHYSIKALISCHE CHEMIE-INTERNATIONAL JOURNAL OF RESEARCH IN PHYSICAL CHEMISTRY & CHEMICAL PHYSICS*
  Pang, G. A., Hanson, R. K., Golden, D. M., Bowman, C. T.
  2011; 225 (11-12): 1157-1178
- **Vitiated ethane oxidation in a high-pressure flow reactor** *COMBUSTION AND FLAME*
  Walters, K. M., Bowman, C. T.
  2009; 156 (10): 1886-1897
- **High-temperature shock tube study of the reactions CH3+OH -> products and CH3OH+Ar -> products** *INTERNATIONAL JOURNAL OF CHEMICAL KINETICS*
  Vasudevan, V., Cook, R. D., Hanson, R. K., Bowman, C. T., Golden, D. M.
  2008; 40 (8): 488-495
- **Shock tube study of the reaction of CH with N-2: Overall rate and branching ratio** *JOURNAL OF PHYSICAL CHEMISTRY A*
  Vasudevan, V., Hanson, R. K., Bowman, C. T., Golden, D. M., Davidson, D. F.
  2007; 111 (46): 11818-11830
- **Effects of pressure on performance of mesoscale burner arrays for gas-turbine applications** *JOURNAL OF PROPULSION AND POWER*
  Bardos, A., Walters, K. M., Boutross, M. G., Lee, S., Edwards, C. F., Bowman, C. T.
  2007; 23 (4): 884-886

- **High-temperature shock tube measurements of methyl radical decomposition** *JOURNAL OF PHYSICAL CHEMISTRY A*
  Vasudevan, V., Hanson, R. K., Golden, D. M., Bowman, C. T., Davidson, D. F.
  2007; 111 (19): 4062-4072

- **High-temperature measurements of the rates of the reactions CH2O+Ar -> Products and CH2O+O-2 -> Products** *PROCEEDINGS OF THE COMBUSTION INSTITUTE*
  Vasudevan, V., Davidson, D. F., Hanson, R. K., Bowman, C. T., Golden, D. M.
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- **Mesoscale burner Arrays for gas-turbine reheat applications** *JOURNAL OF PROPULSION AND POWER*
  Lee, S., Svrcek, M., Edwards, C. F., Bowman, C. T.
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- **Experimental study of confined, swirling, nonpremixed gas flame for validation of simulations** *JOURNAL OF PROPULSION AND POWER*
  Tribbett, E. J., Sipperley, C. M., Huh, J. Y., Edwards, C. F., Bowman, C. T.
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- **The reaction of CH3+O-2: experimental determination of the rate coefficients for the product channels at high temperatures** *30th International Symposium on Combustion*
  Herbon, J. T., Hanson, R. K., Bowman, C. T., GOLDEN, D. M.
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- **Evaluated kinetic data for combustion modeling: Supplement II** *JOURNAL OF PHYSICAL AND CHEMICAL REFERENCE DATA*
  Baulch, D. L., Bowman, C. T., Cobos, C. J., Cox, R. A., Just, T., Kerr, J. A., Pilling, M. J., Stocker, D., Troe, J., Tsang, W., Walker, R. W., Warnatz, J.
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- **A shock tube study of the reaction NH2+CH4 -> NH3+CH3 and comparison with transition state theory** *INTERNATIONAL JOURNAL OF CHEMICAL KINETICS*
  Song, S. H., Golden, D. M., Hanson, R. K., Bowman, C. T., Senosiain, J. P., Musgrave, C. B., Friedrichs, G.
  2003; 35 (7): 304-309

- **A shock tube study of the product branching ratio of the NH2+NO reaction at high temperatures** *JOURNAL OF PHYSICAL CHEMISTRY A*
  Song, S. H., Hanson, R. K., Bowman, C. T., GOLDEN, D. M.
  2002; 106 (40): 9233-9235

- **A shock tube study of benzylamine decomposition: Overall rate coefficient and heat of formation of the benzyl radical** *JOURNAL OF PHYSICAL CHEMISTRY A*
  Song, S., GOLDEN, D. M., Hanson, R. K., Bowman, C. T.
  2002; 106 (25): 6094-6098

- **A shock tube study of the enthalpy of formation of OH** *29th International Combustion Symposium*
  Herbon, J. T., Hanson, R. K., GOLDEN, D. M., Bowman, C. T.
  ELSEVIER SCIENCE INC.2002: 1201–1208

- **A shock tube study of the NH2+NO2 reaction** *29th International Combustion Symposium*
  Song, S., GOLDEN, D. M., Hanson, R. K., Bowman, C. T.
  ELSEVIER SCIENCE INC.2002: 2163–2170

- **Shock tube determination of the overall rate of NH2+NO -> products in the Thermal De-NOx temperature window** *INTERNATIONAL JOURNAL OF CHEMICAL KINETICS*
  Song, S., Hanson, R. K., Bowman, C. T., GOLDEN, D. M.
  2001; 33 (11): 715-721

- **Flow reactor study of the effect of pressure on the thermal De-NOx process** *COMBUSTION AND FLAME*
  Schmidt, C. C., Bowman, C. T.
  2001; 127 (1-2): 1958-1970

- **Experimental study and modeling of the reaction H+O-2+M -> HO2+M (M = Ar, N-2, H2O) at elevated pressures and temperatures between 1050 and 1250 K** *International Discussion Meeting of the Deutsche-Bunsen-Gesellschaft-fur-Physikalische-Chemie*
  Bates, R. W., GOLDEN, D. M., Hanson, R. K., Bowman, C. T.

ROYAL SOC CHEMISTRY.2001: 2337–42

- **Gas-phase reaction mechanisms for nitrogen oxide formation and removal in combustion** *Conference of the NATO-Advanced-Study-Institute on Pollutants from Combustion Formation and Impact on Atmospheric Chemistry*
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- **Shock tube determination of the overall rate of NH2+NO -> products at high temperatures** *28th International Symposium on Combustion*
  Song, S., Hanson, R. K., Bowman, C. T., GOLDEN, D. M.
  ELSEVIER SCIENCE INC.2000: 2403–2409

- **A shock tube study of the product branching ratio for the reaction NH2+NO using frequency-modulation detection of NH2** *JOURNAL OF PHYSICAL CHEMISTRY A*
  Votsmeier, M., Song, S., Hanson, R. K., Bowman, C. T.
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- **CH-radical concentration measurements in fuel-rich CH4/O-2/Ar and CH4/O-2/NO/Ar mixtures behind shock waves** *COMBUSTION AND FLAME*
  Woiki, D., Votsmeier, M., Davidson, D. F., Hanson, R. K., Bowman, C. T.
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- **An experimental investigation of the effects of compressibility on a turbulent reacting mixing layer** *JOURNAL OF FLUID MECHANICS*
  Miller, M. F., Bowman, C. T., Mungal, M. G.
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- **Measurement of the rate coefficient of the reaction CH+O-2->products in the temperature range 2200 to 2600 K** *INTERNATIONAL JOURNAL OF CHEMICAL KINETICS*
  Rohrig, M., Petersen, E. L., Davidson, D. F., Hanson, R. K., Bowman, C. T.
  1997; 29 (10): 781-789

- **Argon broadening of the R(48), R(50) and R(52) lines of CO2 in the (00 degrees 1)<-(00 degrees 0) band** *JOURNAL OF QUANTITATIVE SPECTROSCOPY & RADIATIVE TRANSFER*
  Wooldridge, M. S., Hanson, R. K., Bowman, C. T.
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- **Mechanisms and Modeling of Gas-Phase Aftertreatment Methods for NO Removal from Combustion Products** *Physical and Chemical Aspects of Combustion*
  Bowman, C., T.
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- **Argon Broadening of the R (48), R (50) and R (52) Lines of CO2 in the (00°1) ¬ (00°0) Band** *Journal of Quantitative Spectroscopy and Radiative Transfer*
  Wooldridge, M. S., Hanson, R. K., Bowman, C. T.
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- **A shock tube study of CO+OH->CO2+H and HNCO+OH->products via simultaneous laser adsorption measurements of OH and CO2** *INTERNATIONAL JOURNAL OF CHEMICAL KINETICS*
  Wooldridge, M. S., Hanson, R. K., Bowman, C. T.
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- **On-line adaptive optimal combustor control** *IEEE TRANSACTIONS ON CONTROL SYSTEMS TECHNOLOGY*
  PADMANABHAN, K. T., Bowman, C. T., Powell, J. D.
  1996; 4 (3): 217-229

- **A shock tube study of reactions of CN with HCN, OH, and H-2 using CN and OH laser absorption** *INTERNATIONAL JOURNAL OF CHEMICAL KINETICS*
  WOOLDRIDGE, S. T., Hanson, R. K., Bowman, C. T.
  1996; 28 (4): 245-258

- **Real-time adaptive feedback control of combustion instability** *26th International Symposium on Combustion*
  Kemal, A., Bowman, C. T.
  COMBUSTION INSTITUTE.1996: 2803–2809

- **Measurement of the rate coefficient of H+O-2+M -> HO2+M for M = Ar and N-2 at high pressures** *26th International Symposium on Combustion*
  Davidson, D. F., Petersen, E. L., Rohrig, M., Hanson, R. K., Bowman, C. T.
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- **High-pressure methane oxidation behind reflected shock waves** *26th International Symposium on Combustion*
  Petersen, E. L., Rohrig, M., Davidson, D. F., Hanson, R. K., Bowman, C. T.
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- **A SHOCK-TUBE STUDY OF METHYL-METHYL REACTIONS BETWEEN 1200 AND 2400 K** *INTERNATIONAL JOURNAL OF CHEMICAL KINETICS*
  Davidson, D. F., DIROSA, M. D., Chang, E. J., Hanson, R. K., Bowman, C. T.
  1995; 27 (12): 1179-1196
- **SIMULTANEOUS LASER-ABSORPTION MEASUREMENTS OF CN AND OH IN A SHOCK-TUBE STUDY OF HCN +OH-]PRODUCTS** *INTERNATIONAL JOURNAL OF CHEMICAL KINETICS*
  WOOLDRIDGE, S. T., Hanson, R. K., Bowman, C. T.
  1995; 27 (11): 1075-1087
- **MEASUREMENTS OF ARGON COLLISION BROADENING IN THE CN B-2-SIGMA(+)[-X(2)SIGMA(+)(0,0) SPECTRUM** *JOURNAL OF QUANTITATIVE SPECTROSCOPY & RADIATIVE TRANSFER*
  WOOLDRIDGE, S. T., Hanson, R. K., Bowman, C. T.
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  PADMANABHAN, K. T., Bowman, C. T., Powell, J. D.
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  PADMANABHAN, K. T., Bowman, C. T., Powell, J. D.
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- **Revised Values for the Rate Coefficients of Ethane and Methane Decomposition** *International Journal of Chemical Kinetics*
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  Padmanabhan, K. T., Bowman, C. T., Powell, J. D.
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- **A Shock Tube Study of Nitric Acid Decomposition** *Shock Waves @ Marseille II (Springer-Verlag)*
  Wooldridge, M. S., Hanson, R. K., Bowman, C. T.
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  Kemal, A., Bowman, C. T.
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- **A SHOCK-TUBE STUDY OF THE OH+OH-]H2O+O REACTION** *INTERNATIONAL JOURNAL OF CHEMICAL KINETICS*
  Wooldridge, M. S., Hanson, R. K., Bowman, C. T.
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- **Reexamination of Shock-Tube Measurements of the Rate Coefficient of H + O2 -> OH + O** *Journal of Physical Chemistry*
  Yu, C. L., Frenklach, M., Masten, D. A., Hanson, R. K., Bowman, C. T.
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- **An Experimental Investigation of Supersonic Reacting Mixing Layers** *32nd Aerospace Sciences Meeting and Exhibit*
  Miller, M. F., Island, T. C., Seitzman, J. M., Bowman, C. T., Mungal, M. G., Hanson, R. K.

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- **A STUDY OF ETHANE DECOMPOSITION IN A SHOCK-TUBE USING LASER-ABSORPTION OF CH3** *INTERNATIONAL JOURNAL OF CHEMICAL KINETICS*
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- **DEVELOPMENT OF A CW LASER-ABSORPTION DIAGNOSTIC FOR MEASUREMENT OF CN IN SHOCK-TUBE EXPERIMENTS** *JOURNAL OF QUANTITATIVE SPECTROSCOPY & RADIATIVE TRANSFER*
  WOOLDRIDGE, S. T., Hanson, R. K., Bowman, C. T.
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  Miller, M. F., Island, T. C., Seitzman, J. M., Bowman, C. T., Mungal, M. G., Hanson, R. K.
  1993
- **An Experimental Study of the Structure of a Compressible, Reacting Mixing Layer** *31st Aerospace Sciences Meeting*
  Miller, M. F., Island, T. C., Yip, B., Bowman, C. T., Mungal, M. G., Hanson, R. K.
  1993
- **A SHOCK-TUBE STUDY OF REACTIONS OF ATOMIC OXYGEN WITH ISOCYANIC ACID** *INTERNATIONAL JOURNAL OF CHEMICAL KINETICS*
  Mertens, J. D., Chang, A. Y., Hanson, R. K., Bowman, C. T.
  1992; 24 (3): 279-295
- **Control of Combustion-Generated Nitrogen Oxide Emissions: Technology Driven by Regulation** *Twenty-Fourth Symposium (International) on Combustion*
  Bowman, C. T.
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- **A SHOCK-TUBE STUDY OF H + HNCO -] NH2 + CO** *INTERNATIONAL JOURNAL OF CHEMICAL KINETICS*
  Mertens, J. D., KOHSEHOINGHAUS, K., Hanson, R. K., Bowman, C. T.
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- **A SHOCK-TUBE STUDY OF REACTIONS OF C ATOMS AND CH WITH NO INCLUDING PRODUCT CHANNEL MEASUREMENTS** *JOURNAL OF PHYSICAL CHEMISTRY*
  Dean, A. J., Hanson, R. K., Bowman, C. T.
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- **KINETIC MODELING OF THE REDUCTION OF NITRIC-OXIDE IN COMBUSTION PRODUCTS BY ISOCYANIC ACID** *INTERNATIONAL JOURNAL OF CHEMICAL KINETICS*
  Miller, J. A., Bowman, C. T.
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- **A SHOCK-TUBE STUDY OF THE REACTIONS OF NH WITH NO, O2, AND O** *INTERNATIONAL JOURNAL OF CHEMICAL KINETICS*
  Mertens, J. D., Chang, A. Y., Hanson, R. K., Bowman, C. T.
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- **Chemistry of Gaseous Pollutant Formation and Destruction** *Fossil Fuel Combustion: A Source Book*
  Bowman, C., T.
  edited by Bartok, W., Sarofim, A., F.
  John Wiley.1991: 215–260
- **COMBUSTOR PERFORMANCE ENHANCEMENT THROUGH DIRECT SHEAR-LAYER EXCITATION** *COMBUSTION AND FLAME*
  McManus, K. R., Vandsburger, U., Bowman, C. T.
  1990; 82 (1): 75-92
- **SHOCK-TUBE STUDY OF THE REACTION H + O2-]OH + O USING OH LASER-ABSORPTION** *JOURNAL OF PHYSICAL CHEMISTRY*
  Masten, D. A., Hanson, R. K., Bowman, C. T.
  1990; 94 (18): 7119-7128
- **Effects of Controlling Vortex Dynamics on the Performance of a Dump Combustor** *Twenty-Third Symposium (International) on Combustion*
  McManus, K. R., Bowman, C. T.

1990

- **REACTION-KINETICS OF NH IN THE SHOCK-TUBE PYROLYSIS OF HNCO** *INTERNATIONAL JOURNAL OF CHEMICAL KINETICS*
  Mertens, J. D., Chang, A. Y., Hanson, R. K., Bowman, C. T.
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  Miller, J. A., Bowman, C. T.
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- **Effect of fuel spray vaporization on the stability characteristics of a dump combustor** *25th Joint Propulsion Conference*
  Vandsburger, U., McManus, K. R., Bowman, C. T.
  1989
- **An Investigation of the Structure of a Laminar Non-Premixed Flame in an Unsteady Vortical Flow** *Twenty-Second Symposium (International) on Combustion*
  Lewis, G. S., Cantwell, B. J., Bowman, C. T.
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- **CHEMICAL-KINETICS MODELS FOR COMPLEX REACTING FLOWS** *BERICHTE DER BUNSEN-GESELLSCHAFT-PHYSICAL CHEMISTRY CHEMICAL PHYSICS*
  Bowman, C. T.
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- **Soot Production in Axisymmetric Laminar Diffusion Flames at Pressure from One to Ten Atmospheres** *Twenty-First Symposium (International) on Combustion*
  Flower, W. L., Bowman, C. T.
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- **Shock Tube Study of the Reaction between Hydrogen Cyanide and Atomic Oxygen** *Twentieth Symposium (International) on Combustion*
  Hanson, R. K., Bowman, C. T.
  1985: 647–54
- **Measurements of the Structure of Sooting Laminar Diffusion Flames at Elevated Pressure** *Twentieth Symposium (International) on Combustion*
  Flower, W. L., Bowman, C. T.
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- **Combustion of Monodisperse Droplet Clouds in a Reactive Environment** *Twentieth Symposium (International) on Combustion*
  Koshland, C. P., Bowman, C. T.
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- **SHOCK-TUBE STUDY OF THE THERMAL-DECOMPOSITION OF CYANOGEN** *JOURNAL OF CHEMICAL PHYSICS*
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