



DEPARTMENT OF MECHANICAL ENGINEERING Purdue School of Engineering and Technology

FALL 2003 SEMINAR SERIES

Date: **Thursday, October 30, 2003**

Time: **11:00 am - 12:00 pm**

Room: **SL 165**

**Reception at 10:45 am (cookies and refreshments served)
Everyone is invited**

Sooting Behavior of Spherical Microgravity Diffusion Flames

Dr. Peter Sunderland

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Abstract. This seminar summarizes observations and analyses of the sooting behavior of a new class of flames. These flames are spherical diffusion flames obtained in microgravity using the 2.2-second drop tower at NASA Glenn. The flames involve ethylene fuel at atmospheric pressure. The flames are one-dimensional, strain-free, and quasi-steady, thus eliminating many of the complications inherent in normal-gravity flames. These flames yield to simple models and allow a high level of control over flow direction at the flame sheet.

This work evaluates the impacts on soot formation arising from flame structure (fuel versus oxidizer dilution) and convection direction (normal versus inverse flames). Sooting limits of the present flames were found to be highly affected by flame structure and independent of convection direction. Sooting limits were successfully correlated by a linear relationship between stoichiometric mixture fraction and adiabatic flame temperature, in agreement with a simple model. The results have important implications for combustors that incorporate fuel dilution and/or oxygen enrichment.

About the Speaker. Peter Sunderland is a Staff Scientist at the National Center for Microgravity Research at the NASA Glenn Research Center in Cleveland Ohio. He earned a baccalaureate in Mechanical Engineering at Cornell (1983), an M.S. in Mechanical Engineering at the University of Massachusetts (1986), and a Ph.D. in Aerospace Engineering at the University of Michigan (1995). Dr. Sunderland's research interests are in thermal science with an emphasis on combustion, soot formation, and microgravity. He has been awarded two best-paper awards and seven NASA awards, including the 1999 Mentor of the Year.

He has been involved in collaborative research with Dr. Krishnan for the past one year and has mentored Mr. Jason Abshire, ME graduate student during his research internship at NASA Glenn during Summer 2003.