機械工学セミナー
Mechanical Engineering Seminar

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主催: 慶應義塾大学理工学部機械工学科
Department of Mechanical Engineering, Keio University

日 時 (Date):
2019年7月24日（水）(July 24, 2019 (Wed.)) 13:30~15:00

場 所 (Venue):
ディスカッションルーム 6 (Discussion Room 6) (14-216)

講演題目 (Title):

Chemical Kinetics Studies at Texas A&M University: CH Absorption in a Shock Tube and Flame Speed Measurements Using High-Speed Chemiluminescence

講演者(Speaker):

Eric L. Petersen, Professor
Director of the TEES Turbomachinery Laboratory, and
Nelson-Jackson Professor in J. Mike Walker '66 Department of Mechanical Engineering,
Texas A&M University

Abstract:
Over the past few years, the Petersen Group has been active in the study of combustion chemistry using a combination of flame and shock-tube experiments. Recent laminar flame experiments include CH_4-O_2-CO_2 mixtures at 1 atm. A high-speed chemiluminescence imaging diagnostic was employed in place of the traditional schlieren technique. Laminar flame speed was measured from OH* emission at 306 nm for a full range of equivalence ratios. Additionally, images of OH* chemiluminescence of turbulent CH_4-O_2-CO_2 flames and of quiescent, 5-atm CH_4-O_2-CO_2 flames at stoichiometric concentration are also presented. These experiments provide useful data for validation of chemical kinetics models for oxy-methane combustion in a CO_2 diluent, which can be applied to the modeling of oxy-methane combustion for supercritical CO_2 power cycles. For the shock tube, recent work has been related to the improvement of NOx kinetics at engine conditions. In particular, data on CH formation at realistic combustion conditions are needed for further refinement of the prompt-NOx chemistry. To this end, a series of shock-tube experiments to obtain CH concentration time histories at elevated temperatures was performed behind reflected shock waves using a tuneable laser at 854 nm doubled down to 426.9 nm. The resulting light was used in a differential absorption setup to measure CH time histories. New measurements in CH_4-C_2H_6-O_2 mixtures highly diluted in argon were performed at temperatures between 1890 K and 2719 K. These new data are compared to several modern, detailed chemical kinetics mechanisms with updated NOx sub-mechanisms to elucidate the current state of affairs in CH prediction by the literature models and its effect on NOx production, particularly through the prompt mechanism.

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