Detailed measurement and assessment of laminar hydrogen jet diffusion flames

鄭藏勝,吳志勇,陳志鵬,李約亨,趙怡欽,袁曉峰,呂宗行
Mechanical Engineering
Engineering
tscheng@chu.edu.tw

Abstract

Time-averaged, spatially resolved point measurements of temperature, major species concentrations (O_2, N_2, H_2O, H_2), and hydroxyl radical concentration (OH) in laminar hydrogen jet diffusion flames (Re = 30 and 330) are performed using non-intrusive UV Raman scattering coupled with laser-induced predissociative fluorescence (LIPF) technique for assessment of combustion models. Effects of thermal diffusion and chemical kinetics on the flame structure are investigated by comparing computed results with experimental data. Comparisons of the computed temperature and species concentration profiles with experimental measurements are in good agreement for both flames. The numerical simulations, using Miller and Bowman mechanism, indicate that thermal diffusion affects the flame structure for the Re = 330 flame, whereas its influence becomes minor for the Re = 30 flame. Effects of chemical kinetics on the flame structure are investigated in the Re = 30 flame using five different H_2/air reaction mechanisms. Comparisons of the measured and calculated data reveal that this low stretched flame is not very sensitive to the

mechanisms used
and it may not be suitable for examining the effects of chemical kinetics on the flame
structure. Effects of burner wall and co-flow boundary conditions on the computed
flame structures are also examined in detailed to clarify the importance of boundary
conditions in simulating these flames.

Keyword：Laminar hydrogen flames; Raman scattering; LIPF; thermal diffusion;
reaction mechanisms