Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Effects of pressure on syngas/air turbulent nonpremixed flames
BOK JIK LEE, HONG G. IM, King Abdullah University of Science and Technology, PIETRO PAOLO CIOTTOLI, MAURO VALORANI, Sapienza University of Rome
— Large eddy simulations (LES) of turbulent non-premixed jet flames were conducted to investigate the effects of pressure on the syngas/air flame behavior. The software to solve the reactive Navier-Stokes equations was developed based on the OpenFOAM framework, using the YSLFM library for the flamelet-based chemical closure. The flamelet tabulation is obtained by means of an in-house code designed to solve unsteady flamelets of both ideal and real fluid mixtures. The validation of the numerical setup is attained by comparison of the numerical results with the Sandia/ETH-Zurich experimental database of the $CO/H_2/N_2$ non-premixed, unconfined, turbulent jet flame, referred to as Flame A. Two additional simulations, at pressure conditions of 2 and 5 atm, are compared and analyzed to unravel computational and scientific challenges in characterizing turbulent flames at high pressures. A set of flamelet solutions, representative of the jet flames under review, are analyzed following a CSP approach. In particular, the Tangential Stretching Rate (TSR), representing the reciprocal of the most energetic time scale associated with the chemical source term, and its extension to reaction-diffusion systems (extended TSR), are adopted.

Bok Jik Lee
King Abdullah University of Science and Technology

Date submitted: 31 Jul 2016 Electronic form version 1.4