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Hydrodynamic and chemical effects of hydrogen dilution on soot evolution in turbulent nonpremixed bluff body ethylene flames SILI DENG, MICHAEL E. MUELLER, Princeton University, QING N. CHAN, The University of New South Wales, NADER H. QAMAR, FCT-Combustion, BASSAM B. DALLY, ZEYAD T. ALWAHABI, GRAHAM J. NATHAN, The University of Adelaide — A turbulent nonpremixed bluff body ethylene/hydrogen (volume ratio 2:1) flame is studied and compared with the ethylene counterpart [Mueller et al. Combust. Flame, 160, 2013]. Similar to the ethylene buff body flame, a low-strain recirculation zone, a high-strain neck region, and a downstream jet-like region are observed. However, the maximum soot volume fraction in the recirculation zone of the hydrogen diluted case is significantly lower than the ethylene case. Large Eddy Simulation is used to further investigate soot evolution in the recirculation zone and to elucidate the role of hydrogen dilution. Since the central jet Reynolds numbers in both cases are the same (approximately 30,900), the jet velocity of the hydrogen diluted case is higher, resulting in a shorter and leaner recirculation zone. In addition, hydrogen dilution chemically suppresses soot formation due to the reduction of C/H ratio. Consequently, the reduction of the soot volume fraction for the hydrogen diluted ethylene flame is attributed to two major effects: hydrodynamic and chemical effects.

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