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FLAME-WALL INTERACTION AT ENHANCED TURBULENCE INTENSITIES AS CHARACTERIZED BY ULTRAFAST 1D-CARS THERMOMETRY

A. Bohlin [2], K. El Sioufy [2], C. Jainski [3], B.D. Patterson [1], A. Dreizler [3], C.J. Kliewer [1]

[1]*Combustion Research Facility, Sandia National Laboratory, Livermore, California 94550, USA*

[2]*Faculty of Aerospace Engineering, Delft University of Technology, Delft 2629 HS, The Netherlands*

[3]*Institute of Reactive Flows and Diagnostics (RSM), Technische Universität Darmstadt, 64287 Darmstadt, Germany*

In practical combustion-based devices, such as internal combustion (IC) engines and gas turbines for power generation, there exists significant interaction between gas-phase combustion and metal surfaces. The nature of this heterogeneous interaction is complex, involving both physical and chemical effects. The metal surface is generally much cooler than impinging flames, and significant heat flux to the metal wall ensues during the flame–wall interaction (FWI). In this work, we investigate FWI in the side-wall quenching canonical configuration obtained with two-beam femtosecond/picosecond 1D-CARS thermometry. The experiments are performed using a generic burner where the turbulence intensities are significantly enhanced by the employment of a turbulence generator grid (blockage 45%). Previously, these operating conditions have only been well-characterized at quasi-stationary conditions (Re = 5000) [Bohlin, A., Jainski, C., Patterson, B.D., Dreizler, A., Kliewer, C.J.: Multiparameter spatio-thermochemical probing of flame–wall interactions advanced with coherent Raman imaging. Proc. Combust. Inst. 36, 4557–4564 (2017)]. In these new experiments, complex interplay between the laser diagnostic and the turbulent combustion in the near wall region is overcome, and data is produced, for instance, on the maximum instantaneous temperature gradients versus the position of the flame-front near the wall as determined with direct thermometry contour analysis.