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Response of a laminar M-shaped premixed flame to plasma forcing DEANNA A. LACOSTE, King Abdullah University of Science and Technology, JONAS P. MOECK, Technische Universität Berlin, MIN SUK CHA, SUK HO CHUNG, King Abdullah University of Science and Technology, DRACO COLLABORATION — We report on the response of a lean methane-air flame to non-thermal plasma forcing. The set-up consists of an axisymmetric burner, with a nozzle made of a quartz tube of 7-mm inlet diameter. The equivalence ratio is 0.9 and the flame is stabilized in an M-shape morphology over a central stainless steel rod and the quartz tube. The plasma is produced by nanosecond pulses of 10 kV maximum voltage amplitude, applied at 10 kHz. The central rod is used as a cathode, while the anode is a stainless steel ring, fixed on the outer surface of the quartz tube. The plasma forcing is produced by bursts of plasma pulses of 1 s duration. The response of the flame is investigated through the heat release rate (HRR) fluctuations. The chemiluminescence of CH* between two consecutive pulses was recorded using an intensified camera with an optical filter to estimate the HRR fluctuations. The results show that, even though the plasma is located in the combustion area, the flame is not responding to each single plasma pulse, but is affected by the discharge burst. The plasma forcing can then be considered as a step of forcing: the beginning of a positive step corresponding to the first plasma pulse, and the beginning of a negative step corresponding to the end of the last pulse of the burst. The effects of both positive and negative steps were investigated. The response of the flame is then analyzed and viable mechanisms are discussed.

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