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Transient Effects of Nanosecond Repetitively Pulsed Discharges on a Lean Premixed Flame[1] VICTORIEN BLANCHARD, NICOLAS MINESI, SERGEY STEPANYAN, GABI-DANIEL STANCU, CHRISTOPHE LAUX, Laboratoire EM2C, CNRS, CentraleSupelec, Universite Paris-Saclay — The thermal and chemical effects of nanosecond discharges have been thoroughly investigated in previous work at atmospheric pressure in preheated air at 1000 K. N_2 is excited by electron impact reactions, radicals and heat are produced via dissociative quenching of excited electronic states of N_2 by O_2. In this work, we extend these investigations to NRP discharges in partially burned, premixed methane-air flames. A burst of 500 discharges is applied to stabilize a 10-kW lean flame at atmospheric pressure. The shape of the flame is strongly modified by the heat and radicals produced by the discharge. We study the transient production of OH radicals and heat to identify the effects that promote flame stabilization. First, we record time-resolved OH* chemiluminescence images during the transition from a flame without plasma to the steady-state plasma-stabilized flame. Steady state is reached at the end of the burst. Then using calibrated optical emission spectroscopy, we measure the rotational temperature and the $N_2(C)$ number density evolution during the transient stabilization. Laser-Rayleigh scattering is also applied to confirm the gas temperature evolution obtained by emission spectroscopy.

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