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Spatially-resolved time-evolution of rotation-vibration non-equilibrium and CH_4 concentration measured by fs/ps CARS in a nanosecond-pulsed pin-to-pin discharge[1] TIMOTHY CHEN, Princeton University, BENJAMIN GOLDBERG, CHRISTOPHER KLIEWER, Sandia National Laboratories, EGEMEN KOLEMEN, YIGUANG JU, Princeton University — To develop quantitative understanding of non-equilibrium plasmas for methane reforming, temporally and spatially resolved measurements of reactant concentration and rotation-vibration non-equilibrium are necessary. In this study, a recently developed rotational fs/ps CARS method was used to simultaneously measure rotational and vibrational temperatures of a pin-to-pin CH_4/N_2 nanosecond-pulsed discharge at 60 Torr. The CH_4 concentration was measured separately using vibrational CARS in the same experimental setup. These measurements were conducted across a 2 mm length along the electrode axis within 150 μm of the cathode and from delays of 50 ns from the voltage pulse up to 800 μs. Significant gradients in N_2 rotational and vibrational temperature and CH_4 number density were observed across the measurement length. Peak vibrational temperature exceeding 6000K was observed, 0.8 mm from the cathode and 100 μs after the voltage pulse. Majority of the CH_4 consumption occurred during the voltage pulse, but additional decrease was observed within the first 5 μs of the afterglow.

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