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Ignition of Gaseous and Liquid Hydrocarbon Fuels by Repetitively Pulsed, Nanosecond Pulse Duration Plasma IGOR ADAMOVICH, AINAN BAO, YURII UTKIN, SAURABH KESHAV, Ohio State University — The paper presents results of plasma assisted combustion experiments in premixed hydrocarbon-air flows excited by a low-temperature, transverse, repetitively pulsed discharge plasma. The experiments have been conducted with methane, ethylene, methanol, and ethanol fuels in a wide range of equivalence ratios and flow velocities. The plasma was generated by high-voltage (16-18 kV), short pulse duration (20-30 nsec), high repetition rate (up to 50 kHz) pulses. The high reduced electric field during the pulse allows efficient electronic excitation and molecular dissociation. The low duty cycle of the discharge, $\sim$1/1000, greatly improves its stability and helps sustaining diffuse and volume filling plasma. In a wide range of conditions, generating the plasma in premixed air-fuel flows resulted in flow ignition and flameholding. Plasma assisted ignition occurred at a low discharge powers, $\sim$100 W ($\sim$1% of heat of reaction), and very low flow temperatures, 100-200^0 C. The reacted fuel fraction, measured by the FTIR absorption spectroscopy, is up to 85-95%. Plasma temperature was inferred from nitrogen second positive band system emission spectra and calibrated using thermocouple measurements in flows preheated by an in-line flow heater (without plasma).

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