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Ignition of Hydrocarbon Fuels by a Low Temperature Repetitively Pulsed Nanosecond Discharge Plasma SIVARAM GOGINENI, ISSI, AINAN BAO, GUOFENG LOU, SAURABH KESHAV, MUNETAKE NISHIHARA, IGOR ADAMOVICH, The Ohio State University — The results of nonequilibrium RF plasma ignition experiments demonstrate that the highest fuel conversion efficiency is achieved in lean air-fuel mixtures, including conditions when there is no flame generated in the test section. In the latter case, fuel oxidation occurs in plasma chemical reactions, which are not related to combustion. Since the net fuel oxidation process is exothermic, heat release during the plasma chemical reactions results in achieving thermal ignition, as the equivalence ratio is increased. The RF plasma also stabilizes the flame, without using flameholders. The results demonstrated the use of nonequilibrium, high-voltage (15-20 kV), short pulse duration (20-30 nsec), high repetition rate (40 kHz) pulsed discharge for ignition. Lean premixed ethylene-air flows at P=0.1 atm are ignited by the uniform and stable repetitively pulsed discharge. The plasma temperature before adding the fuel is rather low, about 200^0 C. Ignition of hydrocarbon fuels by using volume filling, high voltage, high repetition rate nanosecond pulsed discharge plasma has been achieved for the first time. This demonstrates that this type of nonequilibrium discharge can be used as a large volume, energy efficient ignition source and flame stabilizer in lean fuel-air mixtures, at conditions when conventional ignition sources are ineffective.

Sivaram Gogineni
ISSI

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