Abstract Submitted
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Fuel Oxidation and Ignition in Premixed Hydrocarbon-Air Flows by Nonequilibrium Plasmas IGOR ADAMOVICH, AINAN BAO, GUOFENG LOU, MUNETAKE NISHIHARA, J.WILLIAM RICH, WALTER LEMPERT, Ohio State University — We present nonequilibrium RF plasma assisted combustion experiments in ethylene-air and methane-air flows using FTIR absorption and visible emission spectroscopy. Results show highest oxidation efficiency ($\sim$100% of ethylene and $\sim$70% of methane) under conditions which do not produce a flame (T=250-300° C). Under these conditions, oxidation occurs by plasma chemical reactions which differ from those leading to ordinary thermal combustion. These results, combined with previous measurements demonstrating very low temperature ignition, suggests the following nonequilibrium plasma ignition mechanism: (i) plasma generation of active radical species, (ii) plasma fuel oxidation with participation of these radicals, (iii) heating by net exothermal fuel oxidation, and (iv) ordinary thermal ignition and combustion. Emission spectroscopy shows that O, H, and OH emission intensities are highest in lean fuel-air mixtures, when a significant fraction of fuel is oxidized by plasma chemical reactions without producing ignition.

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