Abstract Submitted
for the GEC13 Meeting of
The American Physical Society

Microwave plasma jet assisted combustion of premixed methane-air: Roles of OH(A) and OH(X) radicals[1] CHUJI WANG, WEI WU, Mississippi State University — Plasma assisted combustion (PAC) technology can enhance combustion performance by pre-heating combustion fuels, shortening ignition delay time, enhancing flame holding, or increasing flame volume and flame speed. PAC can also increase fuel efficiency by extending fuel lean flammability limit (LFL) and help reduce combustion pollutant emissions. Experiment results have shown that microwave plasma could modify flame structure, increase flame volume, flame speed, flame temperature, and flame stability, and could also extend the fuel lean flammability limit. We report on a novel microwave PAC system that allows us to study PAC using complicated yet well-controlled combinations of operating parameters, such as fuel equivalence ratio (φ), fuel mixture flow rate, plasma gas flow rate, plasma gases, plasma jet configurations, symmetric or asymmetric fuel-oxidant injection patterns, etc. We have investigated the roles of the stated-resolved OH(A, X) radicals in plasma assisted ignition and combustion of premixed methane-air fuel mixtures. Results suggest that that both the electronically excited state OH(A) and the electronic ground state OH(X) enhance the methane-air ignition process, i.e. extending the fuel LFL, but the flame stabilization and flame holding is primarily determined by the electronic ground state OH(X) as compared to the role of the OH(A). E-mail: cw175@msstate.edu.

[1]Supported by National Science Foundation through the grant of "A quantitative survey of combustion intermediates toward understanding of plasma-assisted combustion mechanism" (CBET-1066486).

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Date submitted: 14 Jun 2013 Electronic form version 1.4