Abstract Submitted
for the GEC14 Meeting of
The American Physical Society

OH(A,X) radicals in microwave plasma-assisted combustion of methane/air[1] WEI WU, CHE FUH, CHUJI WANG, Mississippi State University, LASER SPECTROSCOPY AND PLASMA TEAM — A novel microwave plasma-assisted combustion (PAC) system, which consists of a microwave plasma-assisted combustor, a gas flow control manifold, and a set of optical diagnostic systems, was developed as a new test platform to study plasma enhancement of combustion. Using this system, we studied the state-resolved OH(A,X) radicals in the plasma-assisted combustion and ignition of a methane/air mixture. Experimental results identified three reaction zones in the plasma-assisted combustor: the plasma zone, the hybrid plasma-flame zone, and the flame zone. The OH(A) radicals in the three distinct zones were characterized using optical emission spectroscopy (OES). Results showed a surge of OH(A) radicals in the hybrid zone compared to the plasma zone and the flame zone. The OH(X) radicals in the flame zone were measured using cavity ringdown spectroscopy (CRDS), and the absolute number density distribution of OH(X) was quantified in two-dimension. The effect of microwave argon plasma on combustion was studied with two different fuel/oxidizer injection patterns, namely the premixed methane/air injection and the nonpremixed (separate) methane/air injection. Parameters investigated included the flame geometry, the lean flammability limit, the emission spectra, and rotational temperature. State-resolved OH(A,X) radicals in the PAC of both injection patterns were also compared.

[1]This work is supported by the National Science Foundation through the grant No. CBET-1066486.

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Date submitted: 11 Jun 2014 Electronic form version 1.4