THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

8th Wernher von Braun Memorial Symposium
October 27 – 29, 2015

1954 2015 American Astronautical Society

A study of ion and electron responses to a DC electric field in a hydrocarbon flame

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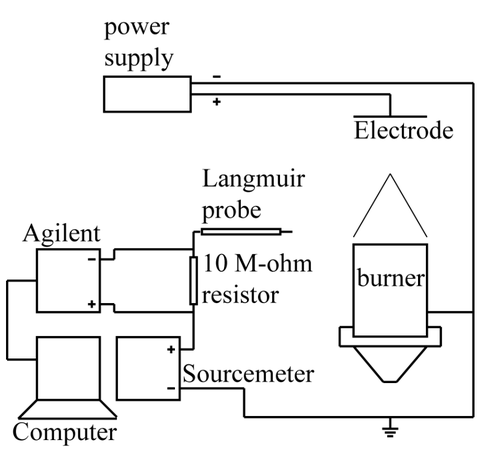
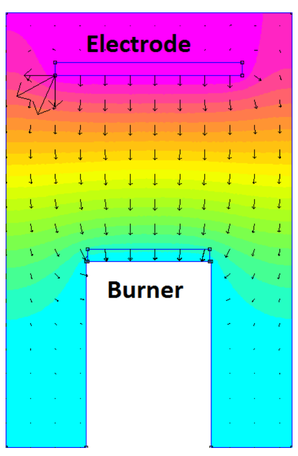
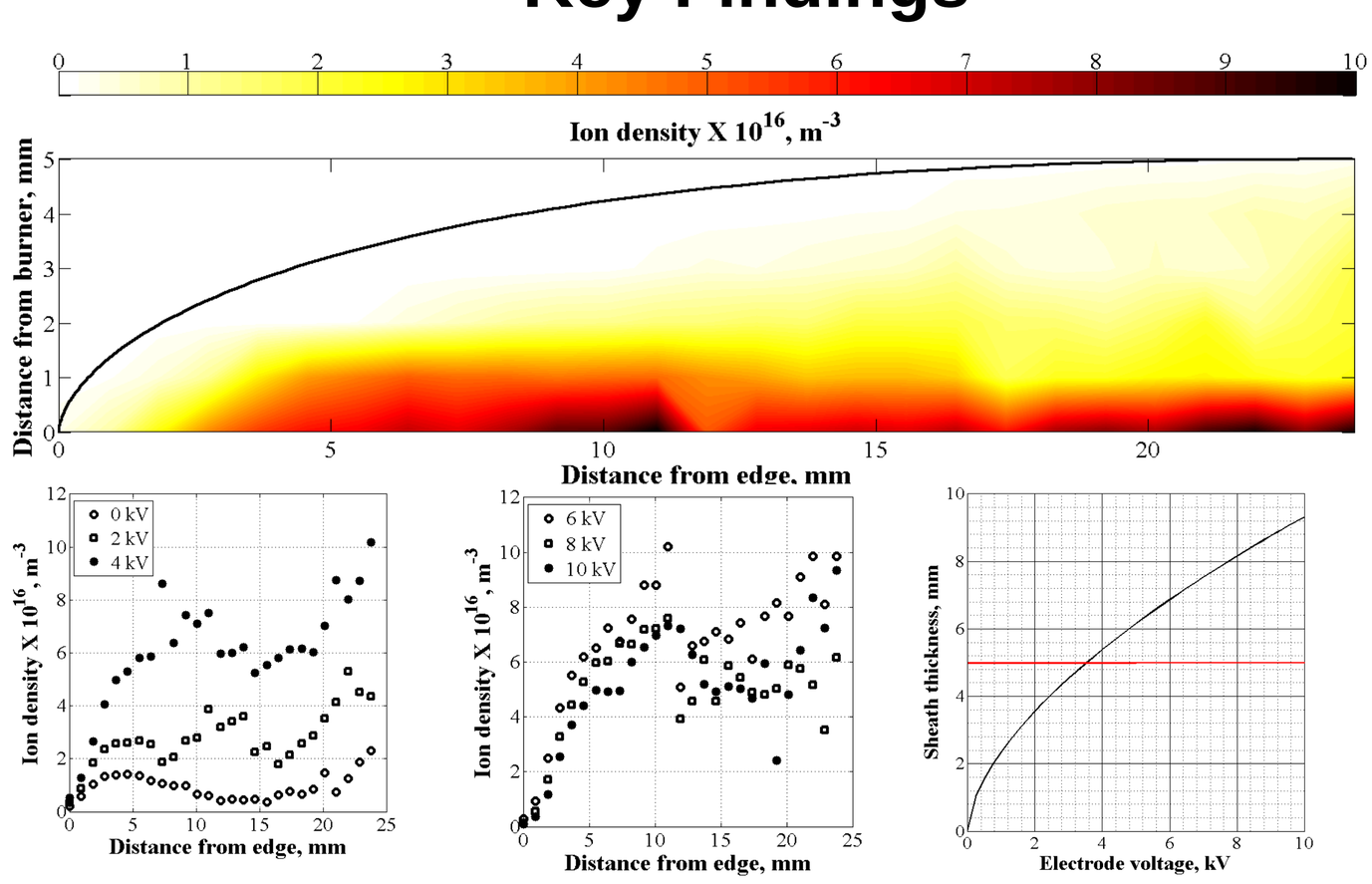
Overview

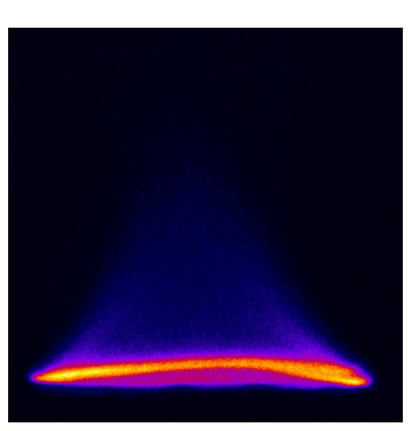
- Applying electric fields to flames known to affect flame properties and behaviors.
- This research investigates the plasma properties of hydrocarbon flames subject to a DC electric field produced by a flat grid electrode
- Used Langmuir probes to measure ion density and electron temperature, compared results to chemiluminescence images

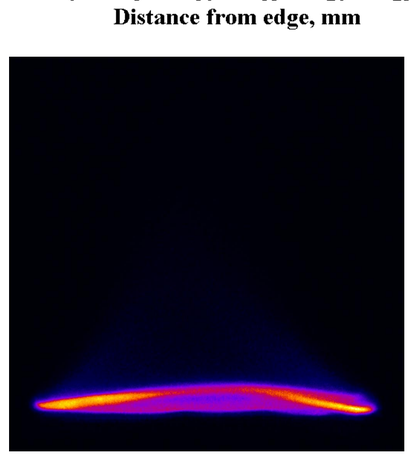


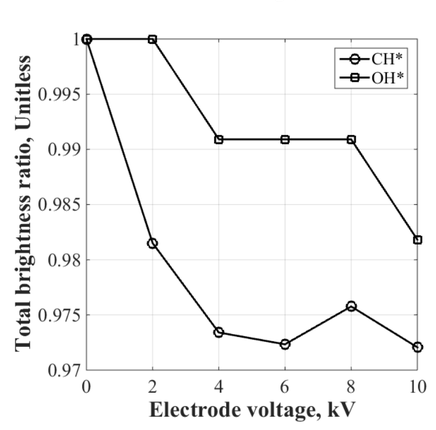


Key Findings









- Ions were pushed towards the burner surface by an electro-hydrodynamic force (ionic wind), kept in place by a growing cathode sheath.
- Combustion radicals CH* and OH* observed to decrease as electrode voltage increased
- Electron temperature observed to increase with electrode voltage, became progressively difficult to measure.

Impact

- This research investigates combustion problems from a plasma physics standpoint.
- Conducting this research will help provide a better understanding of combustion-related problems.
- Conducting this research may help explain why flames become more stable in electric fields.

Explanation

- Electric fields have been shown to suppress thermoaccoustic instabilities in flames, which damage or destroy equipment.
- This research may help with understanding why this occurs and lead to a means of actively stabilizing rocket engines.

Acknowledgements

This research was made possible with the help of Dr. Kunning Gabriel Xu. Additional assistance with data collection and analysis was provided by Dr. David Lineberry, Roberto Dextre, Zachary Pinz, and Brian Roy.

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