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

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.

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.

Explanation

- Electric fields have been shown to suppress thermoacoustic 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.

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