

# **Operation of a High-Pressure Uncooled Plasma Torch with Hydrocarbon Feedstocks**

by

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## **(ABSTRACT)**

The main scope of this project was to determine if a plasma torch could operate on pure hydrocarbon feedstocks and, if so, to catalogue the torch operational characteristics. The future goal of the project is to design a plasma torch for supersonic combustion applications that operates off of the vehicle main fuel supply to simplify onboard fuel systems. Experiments were conducted with argon, methane, ethylene and propylene. Spectrographic tests and tests designed to catalogue current/voltage characteristics, plasma jet phenomena, arc stability dependencies, electrode erosion rate and torch body temperature were performed.

Spectrographic analysis of the plasma jet exhaust confirmed the presence of combustion-enhancing radicals for each hydrocarbon gas tested. Also, it was discovered that simple hydrocarbon gases, such as methane, produced smooth torch operation, while even slightly more complex gases, ethylene and propylene, caused unsteady performance. Plasma jet oscillation was found to be related to the voltage waveform of the power supplies, indicating that plasma jet length and oscillation rate could be controlled by changing the input voltage.

The plasma torch for this study was proven to have the capability of operating with pure hydrocarbon feedstocks and producing radicals that are known to reduce combustion reaction rate times. The torch was demonstrated to have potential for use in supersonic combustion applications.

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