ELECTRICAL DISCHARGE PROPAGATING ALONG A LIQUID FUEL JET

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As traditional ignition schemes reach their efficiency limits or are found not to be optimal for alternative fuels, new techniques may expand these limits. Electrical discharge through a liquid fuel jet is one such technique being investigated. The fuel flows out of a needle charged to ~20-30 kV across a 1-3 cm gap through a grounded conducting ring. The jet facilitates the electrical discharge, reducing the breakdown voltage for a given distance[1,2]. The fluid undergoes electrospinning and transition to electrospraying as the applied voltage increases. This transforms the fuel jet into a fuel spray as the needle approaches the breakdown voltage. The electric potential thus both atomizes the fuel and provides an ignition source. Images taken of jet and spray provide measurements of the decreasing length of the jet, as well as a means of characterizing its shape. As the conductivity of the fluid increases, spinning and spraying occur at lower voltages. Experiments thus far have used line capacitance to provide the discharge energy of 1.5 mJ. This is lower than typical minimum spark ignition energies of ~3-5 mJ across shorter interelectrode distances[3]. The electrical discharge occurs over a timescale of only a few tens of nanoseconds. High speed imaging was used to determine the characteristics of the flame kernel.

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