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Experimental Characterization of Magnetogasdynamic Phenomena in Ultra-High Velocity Pulsed Plasma Jets[1] KEITH LOEBNER, BENJAMIN WANG, MARK CAPPELLI, Stanford University — The formation and propagation of high velocity plasma jets in a pulsed, coaxial, deflagration-type discharge is examined experimentally. A sensitive, miniaturized, immersed probe array is used to map out magnetic flux density and associated radial current density as a function of time and axial position. This array is also used to probe the magnetic field gradient across the exit of the accelerator and in the jet formation region. Sensitive interferometry via a continuous-wave helium-neon laser source is used to probe the structure of the plasma jet over multiple chords and axial locations. A two dimensional plasma density gradient profile at an instant in time during jet formation is compiled via Shack-Hartmann wavefront sensor analysis. The qualitative characteristics of rarefaction and/or shock wave formation as a function of chamber back-pressure is examined via fast-framing ICCD imaging. These measurements are compared to existing resistive MHD simulations of the coaxial deflagration accelerator and the ensuing rarefaction jet that is expelled from the electrode assembly. The physical mechanisms governing the behavior of the discharge and the formation of these high energy density plasma jets are proposed and validated against both theoretical models and numerically simulated behavior.

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