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Kinetic Simulations of Dense Plasma Focus Breakdown A. SCHMIDT, D.P. HIGGINSON, S. JIANG, A. LINK, A. POVILUS, J. SEARS, Lawrence Livermore National Laboratory, N. BENNETT, National Security Technologies, D.V. ROSE, D.R. WELCH, Voss Scientific — A dense plasma focus (DPF) device is a type of plasma gun that drives current through a set of coaxial electrodes to assemble gas inside the device and then implode that gas on axis to form a Z-pinch. This implosion drives hydrodynamic and kinetic instabilities that generate strong electric fields, which produces a short intense pulse of x-rays, high-energy (>100 keV) electrons and ions, and (in deuterium gas) neutrons. A strong factor in pinch performance is the initial breakdown and ionization of the gas along the insulator surface separating the two electrodes. The smoothness and isotropy of this ionized sheath are imprinted on the current sheath that travels along the electrodes, thus making it an important portion of the DPF to both understand and optimize. Here we use kinetic simulations in the Particle-in-cell code LSP to model the breakdown. Simulations are initiated with neutral gas and the breakdown modeled self-consistently as driven by a charged capacitor system. We also investigate novel geometries for the insulator and electrodes to attempt to control the electric field profile. The initial ionization fraction of gas is explored computationally to gauge possible advantages of pre-ionization which could be created experimentally via lasers or a glow-discharge. Prepared by LLNL under Contract DE-AC52-07NA27344.

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