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3D PIC Modeling of Microcavity Discharge[1] MATTHEW HOPKINS, RONALD MANGINELL, CHRISTOPHER MOORE, BENJAMIN YEE, MATTHEW MOORMAN, Sandia National Laboratories — We present a number of techniques and challenges in simulating the transient behavior of a microcavity discharge. Our microcavities are typically cylindrical with diameters approximately 50 - 100 μm, heights of 50 - 200 μm, pressure near atmospheric, and operate at a few hundred volts. We employ a fully kinetic simulation methodology, the Particle-in-Cell (PIC) method, with interparticle collisions handled via methods based on direct simulation Monte Carlo (DSMC). In particular, we explicitly include kinetic electrons. Some of the challenges we encounter include variations in number densities, external circuit coupling, and time step resolution constraints. By employing dynamic particle weighting (particle weights vary over time by species and location) we can mitigate some of the challenges modeling systems with 10^7 variations in number densities. Smoothing mechanisms have been used to attempt to mitigate external circuit response. We perform our simulations on hundreds or thousands of processing cores to accommodate the computational work inherent in using relatively small time step sizes (e.g., 50 fs for a 100 ns calculation). In addition, particle weighting issues inherent to three-dimensional low temperature plasma systems will be mentioned.

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