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Modeling of extreme density plasma by nanosecond pulsed discharge with second-stage wave heating EVRIM SOLMAZ, LAXMINARAYAN L. RAJA, University of Texas at Austin — Non-equilibrium high pressure discharges of plasma densities ~10^{14}-10^{15} cm^{-3} have been characterized well through experiments and modeling. However, the mechanisms that generate plasma densities of $>10^{19}$ cm^{-3} bordering on warm dense matter regimes are not well understood. We hypothesize that the anomalously high plasma densities in nanosecond-pulsed discharges are driven by 1) transient streamer propagation leading to extreme electric fields and 2) extreme cathode sheath electric fields causing runaway emission. In this work, we improve our existing computational fluid model for simulating these dense nanosecond-pulsed discharges at high pressures. An obstacle to predicting streamer transition to dense mode is a timestep restriction, which will be alleviated by a fully implicit time integration scheme for the electron-Poisson equation system. The lowering of ionization potentials will be addressed by modified rate coefficients for ionization reactions. The ion correlation effects, which become significant in non-ideal plasmas, will be addressed by reformulating our heavy species energy equations to account for the ion-ion Coulomb interactions. Also, corrections will be made for the enhanced charged particle collision cross sections, which will modify the transport properties.

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