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Coupling discharge and gas dynamics in streamer-less spark formation[1] ASHUTOSH AGNIHOTRI, CWI Amsterdam, WILLEM HUNDSDORFER, CWI Amsterdam and Radboud University, Nijmegen, UTE EBERT, CWI Amsterdam and Eindhoven University of Technology, Eindhoven — We present simulations of streamer-less spark formation with a new 2D cylindrically symmetric model. The model incorporates the coupling between the electric discharge (described by a reaction-drift-diffusion model on the timescale of ion motion and Poisson's equation) and the gas (described by Euler equations and an energy balance equation for the heat generated). The model is employed to study electrical breakdown in supercritical N2 between planar electrodes under the application of pulsed voltages. We present the modeling results of gas heating by the electrical discharge and the back coupling of the thermally driven gas expansion on the discharge. Our model captures space-charge effects, thermal shocks and induced pressure waves. Because of secondary-electrode emission, we observe a cycle of electrons being released from the cathode, heating the gas, the gas affecting the discharge and the electrons being absorbed at the anode. This cycle might either lead to spark formation or to discharge decay.

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