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Analytical model of the short argon arc[1] ALEXANDER KHRABRY, IGOR KAGANOVICH, Princeton Plasma Physics Laboratory, Princeton, NJ, VALERIAN NEMCHINSKY, Keiser University, Fort Lauderdale, FL, ANDREI KHODAK, Princeton Plasma Physics Laboratory, Princeton, NJ — In a short atmospheric-pressure arc (with several millimeters between electrodes) near-electrode non-equilibrium regions may occupy major part of the inter-electrode gap or even overlap. Therefore non-equilibrium effects in plasma such as thermal, ionization non-equilibrium, electron diffusion, thermal diffusion and effects of space-charge sheaths are important for understanding of the arc physics. An analytical model of argon arc comprising of models for near-electrode regions, arc column and a model of heat transfer in cylindrical electrodes has been developed. The model predicts arc voltages, plasma density and temperature profiles and heat fluxes to the electrodes. Parametric studies of the arc have been performed for a range of the arc current density and pressure. Analytical solutions have been compared with simulation results performed making use of non-equilibrium one-dimensional arc model. The model was validated against experimental data and verified by comparison with Ref. [1]. Good agreement between the analytical model and simulations and reasonable agreement with experimental data were obtained. [1] N. Almeida et.al, 2008, J. Phys. D: Appl. Phys. 41.

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