

1D PIC/DSMC computer modeling of near-cathode plasma layers and expansion of cathode plasma flare of vacuum arc cathode spot

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A 1D PIC/DSMC model was developed to simulate the near-cathode layer of plasma with the parameters typical for plasma of vacuum arc cathode spot. The model takes into account the main types of inelastic and elastic collisions (including the coulomb one) of particles in the plasma as well as evaporation and thermofield electron emission from the cathode.

A wide range of characteristics of the quasistationary plasma layer was calculated with the help of the model. It was obtained that the cathode spot can operate in two modes: quasistationary mode with radius ~ 100 microns and current density $\sim 10^6$ A/cm², and nonstationary mode with radius ~ 1 microns and current density $>10^7$ A/cm².

The simulation of the expansion of cathode spot plasma flare, which appears at the vacuum breakdown, was performed with the help of the same model. It is obtained that the plasma flare is a dense high ionized plasma cloud expanding to vacuum with velocity of about 2×10^6 cm/s, that is in good agreement with the known experimental results.

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