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Anode Temperature Measurement in a Vacuum Arc with a Black Body Electrode Assembly

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In a Vacuum Arc with a Black Body Assembly (VABBA), cathode material is emitted into a closed chamber formed by the end surface of a water-cooled cylindrical cathode and a cup shaped refractory anode that is heated by the arc. Material is eroded from the cathode spots as plasma and MPs. They impinge on the hot anode and are re-evaporated from it, forming a dense high-pressure plasma within the chamber. The closed chamber operates as a black body for the macroparticles (MPs) while the plasma can be emitted through either a single small anode apertures or a “shower head” array of holes.

In the present study, the Cu cathode was a 30 mm diameter and the anode was 50 mm outer diameter and 40 mm inner diameter, and constructed from Ta. The arc plasma was ejected through an array of 250 holes of 0.6 mm diameter in the anode. The arc currents were $I=175$, 200 and 225 A and the arc duration was 160 s. The anode temperature was measured using high-temperature thermocouples in the top and side of the anode body. The observed anode temperature increased sharply during a transient time of ~70-90 s and then it slightly increased with time up to 160 s, reaching 1650 K ($I=175$ A) and 1850K ($I=225$ A) on the top, and 150-200 K lower on the side.

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Experiments and Diagnostics

Author: BEILIS, Itzhak (Electrical Discharge and Plasma Laboratory, School of Electrical Engineering, Faculty of Engineering, Tel Aviv University)

Co-authors: Prof. BOXMAN, Raymond L. (Electrical Discharge and Plasma Laboratory, School of Electrical Engineering, Faculty of Engineering, Tel Aviv University); KOULIK, y (Electrical Discharge and Plasma Laboratory, School of Electrical Engineering, Faculty of Engineering, Tel Aviv University)

Presenter: BEILIS, Itzhak (Electrical Discharge and Plasma Laboratory, School of Electrical Engineering, Faculty of Engineering, Tel Aviv University)

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