Abstract Submitted
for the GEC08 Meeting of
The American Physical Society

Comparative simulation studies of a magnetically rotating arc MARGARITA BAEVA, DIRK UHRLANDT, INP Greifswald, Felix-Hausdorff-Str. 2, 17489 Greifswald, Germany — Magnetically rotating arcs have been increasingly adopted in DC arc plasma devices for diagnostics and material processing, modern circuit breakers, etc. The need to study arc behavior has motivated modeling activities based on computational fluid dynamics coupled with electromagnetics. A three-dimensional model of a DC plasma torch at atmospheric pressure has been developed based on the customized CFD-ACE+ commercial package. It is applied to study the behavior of a magnetically rotating arc in argon. The simulation studies are performed comparatively in terms of 1) two- temperature description (different electron T_e and heavy particle (T) temperatures) and 2) local thermal equilibrium (LTE) ($T_e = T$). Temperature discrepancies between electron and heavy particles are found in the arc fringes and near the gas inlet. In the presence of axial magnetic field, the gas temperature gets lower in the arc core. The electron temperature profile is wider than the gas temperature one. Apart from the differences between 2-T and LTE model results, both models yield the same qualitative arc behavior. With increasing external axial magnetic field, the high temperature plasma region constrains in axial direction and expands in radial direction.

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Date submitted: 12 Jun 2008 Electronic form version 1.4