Abstract Submitted
for the GEC07 Meeting of
The American Physical Society

Instability Analysis of Formation of Multiple Arc Anode Attachments GUANG YANG, JOACHIM HEBERLEIN, University of Minnesota — To understand the origin of the multiple arc-anode attachments and the origin of the restrike behavior in the anode region of high intensity arcs, linear stability analyses of a non-uniform singly-ionized argon plasma and of the arc-anode interface are performed. The short characteristic times of such anode phenomena allow significant simplification and linearization of the governing equations, from which dispersion relations of the plasma are obtained. According to the calculations, we propose that the electron overheating instability and the anode evaporation-ionization instability are responsible for the formation of these anode phenomena. The electron overheating instability, which generates an electron temperature run-away situation, is excited by small-amplitude fluctuations in the plasma with specific combination of current flow, electric field, electron temperature and electron density. The vaporation-ionization instability, which leads to current run-away in a small area, is encouraged by large electric fields accelerating electrons towards the anode. The regions of these instabilities are identified with our experimental measurements. The results show that the multiple arc-anode attachments form in the fringes of the arc, and that the restrike behavior starts from flow instabilities, which bring high electron temperature cloud to the anode surface. Observations to the anode surface confirm the analysis results.

Guang Yang
University of Minnesota

Date submitted: 11 Jun 2007 Electronic form version 1.4