Abstract Submitted
for the GEC14 Meeting of
The American Physical Society

On cathode spot motion in magnetically driven high-pressure arcs[1] VALERIAN NEMCHINSKY, Keiser University, Fort Lauderdale, Florida USA, VLADIMIR KOLOBOV, ROBERT ARSLANBEKOV, CFD Research Corporation — High-pressure magnetically driven arcs are used in many industrial applications. In gas heaters, the arc is forced to rotate by axial magnetic fields along tubular electrodes to reduce electrode erosion. Many questions about the nature cathode and anode spot motion and electrode erosion remain unclear. We develop computational tool for simulations of electrode erosion in high pressure moving arcs. We assume that the operation of cathode spot operation in the high-pressure arc has many features of the vacuum arc (so called cold cathode mode) modified by the high pressure gas environment under high current density on the level of $10^9 A/m^2$ and temperature exceeding melting point. The gas-dynamic interaction of the cathode vapor jet with background gas defines the erosion rate. We study the arc column attachment to the cathode. The arc column motion by the Lorentz force produces a tilt near the cathode due to time lag of electrode heating processes. It is suggested that the tilt of the arc column leads to asymmetry of the cathode voltage drop: it is larger at the leading end of the cathode attachment and lower at the opposite (trailing) end. The asymmetry of the cathode voltage drop causes asymmetry of the heat transfer to the cathode: it is shifted ahead of the cathode temperature distribution. As a result, the cathode spot moves catching up running away heat flux. The proposed model allows to connecting the tilt angle of the arc column with the speed of the arc rotation and current density at the cathode.

[1]Supported by an AFOSR STTR project monitored by Dr. M.Kendra

Vladimir Kolobov
CFD Research Corporation

Date submitted: 12 Jun 2014 Electronic form version 1.4