Abstract Submitted
for the GEC05 Meeting of
The American Physical Society

An Experimental Study of Cold Helium Arc-Jet Flowing along Diverging Magnetic Field HIROSHI AKATSUKA, TOSHIAKI KANUMA, HARUAKI MATSUURA, MITSUO MATSUZAKI, Tokyo Tech. — We experimentally examined plasma parameters of a supersonic cold helium arc jet accelerated along diverging magnetic field from a uniform magnetic channel, particularly relationship between plasma potential and ion Mach number. The atmospheric pressure arc plasma is generated and ejected into a rarefied gas wind tunnel with a uniform longitudinal magnetic field of 0.16 T. The strength of the magnetic field decreases to 0.01 T at 20 cm down from the end of the coils. The longitudinal velocity of the plasma jet was measured by Mach probes. At the maximum gradient of the magnetic field, the peak of the Mach number 3.1 of the flow velocity was observed. We found lowering of the plasma potential at the exit of the nozzle from 2.5 to 0.4 V. The radial measurement shows that the lowest plasma potential was situated along the centerline of the plasma jet. It is well explained that he acceleration was caused by the change in the plasma potential rather than fluid dynamic effect. It is also found that the MHD effect like Hall acceleration ($j_\theta B_r$) or pumping force ($j_\theta B_z$) is insignificant. In addition, the swirl acceleration due to the conservation of the magnetic moment $\mu_{\rm m} = mv_\perp^2/(2B)$ is also less significant than the electrostatic acceleration.

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Date submitted: 10 Jun 2005 Electronic form version 1.4