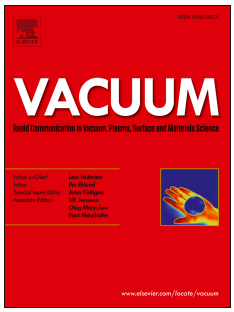

Estimation of the plasma sheath thickness and particle number density in the axial phase of plasma coaxial accelerator

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PII: S0042-207X(16)30294-9

DOI: 10.1016/j.vacuum.2017.01.027

Reference: VAC 7296

To appear in: *Vacuum*

Received Date: 22 July 2016

Revised Date: 10 December 2016

Accepted Date: 24 January 2017

Please cite this article as: Abd Al-Halim MA, Estimation of the plasma sheath thickness and particle number density in the axial phase of plasma coaxial accelerator, *Vacuum* (2017), doi: 10.1016/j.vacuum.2017.01.027.

Estimation of the Plasma Sheath Thickness and Particle Number Density in the Axial Phase of Plasma Coaxial Accelerator

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Abstract

The snow plow model and shock wave equations are used to simulate the plasma sheath motion in the axial phase of the coaxial accelerator. The model is elaborated to calculate the sheath velocity and temperature. On the other hand, the corona model helps to calculate the particle number density; therefore the sheath thickness is obtained. The United Nations University/International Centre for Theoretical Physics Plasma Focus Facility (UNU ICTP PFF) experiment parameters has been implemented. The model is examined for various gases such as, Ar, He, He, and D_2 of the same mass density in order to distinguish the physical properties of each in the plasma sheath. The results show a significant effect of the specific heat ratio on the sheath thickness in which the deuterium has a thicker sheath as compared to other gases due to the higher specific heat ratio leading to a weaker compression. On the other hand, the particle number density is affected slightly by the specific heath but affected much more by the effective charge state and the gas molecular weight. The latter is dominant, leading to lower density and higher temperature for the gas of higher molecular mass. Validation of the model equations is confirmed in comparison with experimental measurements.

Key Words: MHD; coaxial accelerator; corona model; snow plow model; sheath thickness; particle number density.