Seminar

Institute for Plasma Research

Title : Magnetic field effects on Cold Hollow Cathode DC Discharge – An Experimental and Modeling Study

Speaker: Mr. Montu Prafulbhai Bhuva
Institute for Plasma Research, Gandhinagar

Date : 22nd February 2021 (Monday)

Time : 10:30 AM

Venue : Online - Join the talk:
https://meet.ipr.res.in/Montu_Bhuva_Ph.D._Thesis_defence

Abstract :

An experimental and modeling study of a magnetized cold hollow cathode DC discharge is presented. In particular, two distinct plasma sources having electrode configurations; (1): a cylindrical hollow cathode with an axially placed constricted anode and (2): a cone-shaped hollow cathode with a constricted anode at its minor end has been designed and investigated. It is found that the magnetic field has a phenomenal effect on the gross discharge performance of these plasma devices as well as it also impacts the radial properties of the plasma column resulting from each hollow cathode source. A detailed characterization of the plasma column has been performed using a single Langmuir probe, which provides key insight into the role of primary electrons in the sustenance of the magnetized plasma column. It is demonstrated that the secondary electron yield can be enhanced by providing an oblique cathode surface w.r.t magnetic field lines instead of applying it tangential to the cathode. The current closure through the plasma column to the opposing electrode by the primary electrons has been depicted through an equivalent electrical analogy of the discharge. Based on electrical discharge parameters, a phenomenological model has been formulated for explaining the formation of an elongated plasma column under the application of an axial magnetic field in a linear device. Moreover, an in-depth analysis of Langmuir probe characteristics to extract the information of the hot and bulk electron population has been recommended for the case where probe reference electrode is partially conducting to the ground. A significant part of the work is focussed on the development of phenomenological models to validate the experiments in both the above plasma devices. From the engineering perspective, the above experimental and modeling study provides a key insight into the design and optimization of the plasma sources based on the concept of magnetized hollow cathode discharges.