Seminar

Institute for Plasma Research

Title : Inferring the magnetization effects on a CCRF plasma discharge – An Electrical Approach

Speaker: Mr. Jay K Joshi
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Date : 14th October 2019 (Monday)

Time : 03.00 PM

Venue : Seminar Hall, IPR

Abstract:

The past few decades have witnessed significant advancements in the field of Capacitively Coupled Radio-Frequency (CCRF) discharges due to wide range of applications in plasma processing industries, particularly in reactive ion etching. The process engineers are constantly envisioning various ways to tailor the performance of commercial CCRF sources and ways to externally control/quantify the plasma properties in these plasma reactors. The role of an external magnetic field to control the plasma properties is relatively a new concept; and is yet to be adequately explored. Additionally robust non-invasive diagnostic techniques are relentlessly researched and developed to efficiently monitor the plasma processes. These techniques are meant to not only monitor/control the plasma processing but are also driven towards reducing the plasma processing costs. The thesis is primarily motivated towards investigating the effect of external magnetic field on the performance of CCRF discharges; and inferring its characteristics by means of non-invasive electrical measurements that are external to the plasma environment.

Two important aspects that has emerged from this study is the phenomena of electron series resonance in magnetized plasma and magnetically enhanced power mode transitions which apparently causes a shift from ion heating in the sheaths to the electron heating in the bulk. These phenomena have been observed through detail analysis of calibrated RF power measurements in the devices. Additionally the role of ion mass on the nature of sheaths at the RF driven electrodes has been studied. The above results have been comprehended in two representative systems by direct measurements of plasma properties inside the bulk plasma with the help of a newly developed hybrid probe system comprising of an emissive and a double probe. This talk will present the outline of the thesis work and briefly discuss the important results obtained from this research work.