Seminar

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Institute for Plasma Research

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Title: Impact of Electron Temperature inhomogeneity on radial Plasma Properties in a cylindrical CCP discharge and a revisit on SCR method

Speaker: Dr. Avnish Kumar Pandey

Institute for Plasma Research, Gandhinagar

Date: 10th February 2023 (Friday)

Time: 11.00 AM

Venue: Join the talk Online: https://meet.google.com/dak-mbjt-rcw

Abstract

Low temperature plasmas have shown an exceptional application value in microelectronic industries, space technologies and fundamental research in laboratories. One of the important application involves etching of silicon wafer in semiconductor industries. This requires directed ion flux / energy in order to make atomic scale modifications in a controlled manner. The control can be provided by optimizing the plasma density, ion flux and ion energy with the help of an external magnetic field. The magnetized CCP (Capacitive Coupled) discharges in this regards are proven to be one of the most dominant technique that meet the above requirement, in which inhomogeneity in electron temperature is often observed.

In this talk, a cylindrical CCP discharge in presence of an axisymmetric magnetic field is theoretically investigated by considering the effect of inhomogeneity in electron temperature. The model has been developed under fluid approximation with electrons magnetized but ions un-magnetized. The spatial density profiles obtained from the model with respect to two parameters namely the magnetic field strength and gas pressure have been compared with the experiment. It is found that the effect of inhomogeneous electron temperature on plasma density profile is irrelevant at low pressure but found to tend towards the density profile obtained in un-magnetized case as the gas pressure increases. The plausible explanations are given to explain the effect.

In conjugation to the above, the SCR (Saturation Current) method, popular for finding electronegativity parameter using a cylindrical Langmuir probe, is revisited briefly to overview its limitations and proposes a method to improve its accuracy with the help of a DC hairpin resonator probe.