Seminar

Institute for Plasma Research

Title : Experimental study of near anode plasma in hollow cathode cross field discharges.

Speaker: Mr. Ramkrishna Rane
Institute for Plasma Research, Gandhinagar

Date : 7th June 2019 (Friday)

Time : 10.30 AM

Venue : Seminar Hall, IPR

Abstract :

Magnetised DC discharges in hollow cathode configuration are used in a wide variety of applications such as ion sources, basic plasma research and sputter deposition processes. Generally the anode region is studied by using auxiliary electrode and biasing it with reference to background plasma. However, considering the importance of plasma surface interaction with conducting surfaces like anode in applications such as coating devices, Hall Thruster etc., we present the experimental results of the effect of magnetic field on plasma properties near the discharge electrode itself i.e. anode. For this study, two types of magnetized DC discharges i.e. hollow cathode cylindrical magnetron (HCCM) and modified hollow cathode Penning discharge have been used. In a HCCM, the transition from positive space charge to negative space charge due to magnetic field has been experimentally demonstrated. In this configuration, discharge is not sustained in positive space charge mode beyond a critical magnetic field. It is observed that, the anode fall becomes prominent in presence of magnetic field. In addition, the plasma potential profile near the anode shows two distinct regions with potential difference of 10-15 V at the boundary of anode glow. The size of the anode glow increases with magnetic field in order to collect more electron current. The stable electron sheath near the anode transforms into an oscillating anode glow with the application of magnetic field beyond 4-5 Gauss. In another study using the modified hollow cathode Penning discharge, transition from ion sheath to electron sheath due to magnetic field is explored. The onset of anode glow at a critical applied magnetic field indicates formation of electron sheath and anode spots. The plasma potential locks to the ionization potential of argon gas when anode spot is completely formed. During the transition from ion to electron sheath, the electron temperature increases while plasma density decreases in the bulk plasma. The intensity of the spectral lines also shows a dip during the transition between two sheaths. After the formation of the anode spot, oscillations of the order of 5-20 kHz are observed in the discharge current and floating potential due to the enhanced ionization and excitation processes in the electron sheath.