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(POS-38) Laser Induced Fluorescence (LIF) investigations of inductively coupled plasma used for plasma immersion ion implantation (PIII)

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Plasma Immersion Ion Implantation (PIII) is a widely used technique in materials science and semiconductor manufacturing to modify surface properties through ion implantation. This process involves immersing a target in plasma and applying negative high-voltage pulses (NHVP) to accelerate ions onto the surface of the material. A key aspect of PIII is the dynamics of the plasma sheath expansion during the implantation pulse; this governs the implantation dose rate, as well as other aspects such as surface charge accumulation.

This research focuses on investigating sheath dynamics in a low-temperature inductively coupled plasma ICP-PIII system at the University of Saskatchewan Plasma Physics Lab (USask PPL). Laser-Induced Fluorescence (LIF) diagnostics is employed to spatially resolve the ion velocity distribution function (IVDF) and ion temperature, providing critical insights into plasma-surface interactions. Initial results were obtained using time-integrated LIF spectroscopy, which captured steady-state ion dynamics during the NHVP application. However, to fully characterize the high-voltage sheath evolution throughout the pulse duration, time-resolved LIF measurements are required. Future experiments will focus on advancing time-resolved LIF diagnostics to achieve a more detailed understanding of transient sheath behaviour, which is crucial for optimizing ion implantation efficiency and enhancing surface modification properties.

Keyword-1

Sheath expansion

Keyword-2

Laser Induced fluorescence

Keyword-3

Plasma diagnostics

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