Seminar

Institute for Plasma Research

Title : Study of laser produced plasma plume and its dynamics in nickel thin film

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Date : 09th October 2019 (Wednesday)

Time : 03.00 PM

Venue : Seminar Hall, IPR

Abstract:

Plasma plume formation from a nickel thin film in rear ablation geometry, its propagation and interaction with ambient gas using lasers of different pulse widths and wavelengths have been studied in a range of background pressures. The plasma plume dynamics is studied using fast imaging, Langmuir probe and spectroscopic diagnostics. Stark broadening of neutral nickel lines is studied in correlation with H-alpha line broadening and t Stark broadening parameters of nickel lines are estimated. In the rear ablation geometry, the evolution of plasma plume, directionality, splitting and expansion are found to depend on parameters like laser pulse width, wavelength,fluence, film thickness and background pressure with which the plume interacts.

The experimental results show that the background pressure confines the plasma plume and thus helps increase electron density.The plasma plume dynamics shows a large dependence on the laser pulse width used for ablation. The dependence of wavelength and laser fluence on plume formation is also investigated. It is observed that the dynamics of constituent species in plasma plume say, neutrals and ions exhibit distinct behavior which can be seen from optical emission spectroscopy (OES) and fast imaging. The TOF spectra for the neutral and ionic species of the plasma plume show multiple distributions, probably exhibit the signature of their origin. The experimental results also give some information about the combined effect of laser pulse width and thickness of the thin film used for generation of plasma plume in rear ablation geometry. The results show a significant acceleration for the ionic and neutral species . The acceleration mechanism appears to be of double-layer nature, however, the field estimated from the observed enhancement of velocity of ionic components shows significantly large values suggesting further extensive study in the rear ablation geometry taken in the present work. In this work we also observed significant asymmetry in spectral shape for one neutral Ni line (712 nm) even for extended delay time as well as at moderate distances indicating the probability of presence of micro-electric field for an extended duration, which may again result in continuous acceleration of the ionic species.