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Diagnostics of laser plasma plume dynamics within an electrically biased confining cavity

Source

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Abstract

The dynamics of laser generated plasma plumes expanding within confining surfaces display a two-phase nature. Early phase enhancement due to hydrodynamic containment results in higher temperatures, densities, and average charges states in comparison to freely expanding plasma plumes. Later phase dynamics result in rapid decay of the plasma plume due to lossy plasma-surface interactions. This paper examines laser plasma generation and expansion within rectangular aluminium cavities biased to high voltages (V(bias) = +/- 69 kV). " Hydro-electro-dynamic" confinement of the laser plasma plumes and the expansion dynamics were studied via space and time resolved visible emission spectroscopy. The charged confining cavities displayed enhanced emission, higher electron densities (N(e)) and longer emission durations compared to those of an unbiased cavity. This behavior is attributed to the influence of the electric fields in the cavity on the charged particle dynamics within the cavity volume. The degree of enhancement depended strongly on the applied polarity. (C) 2011 American Institute of Physics.