Characterization of the Primary Laser Ablation and Secondary Sputtering Plasmas Produced in a Hollow Cylindrical Target

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A laser ion source utilizing a hollow cylindrical target to confine and thermalize a laser ablation plasma was found to exhibit an asymmetric ion beam extraction[1,2]. In its operation, a focused laser strikes a spot in the interior surface of the cylinder at an oblique angle, which generates a plasma that expands rapidly in the confining space. Near-source deposition experiments revealed the existence of two significant sources of particle fluence from the target aperture – the primary ablation site and its confronting surface. This indicates the formation of a secondary plasma produced due to sputtering of the primary ablation plume. The existence of two diverging particle fluxes from the cylindrical aperture are hypothesized to be the cause of the ion beam asymmetry.

In order to better understand the cause of an asymmetric ion beam extraction, the plasma characteristics of both the primary ablation plume and secondary sputtering are being investigated. Investigations include the use of fast Langmuir Probe techniques specific for the pulsed nanosecond ablation plasmas of carbon and aluminum.

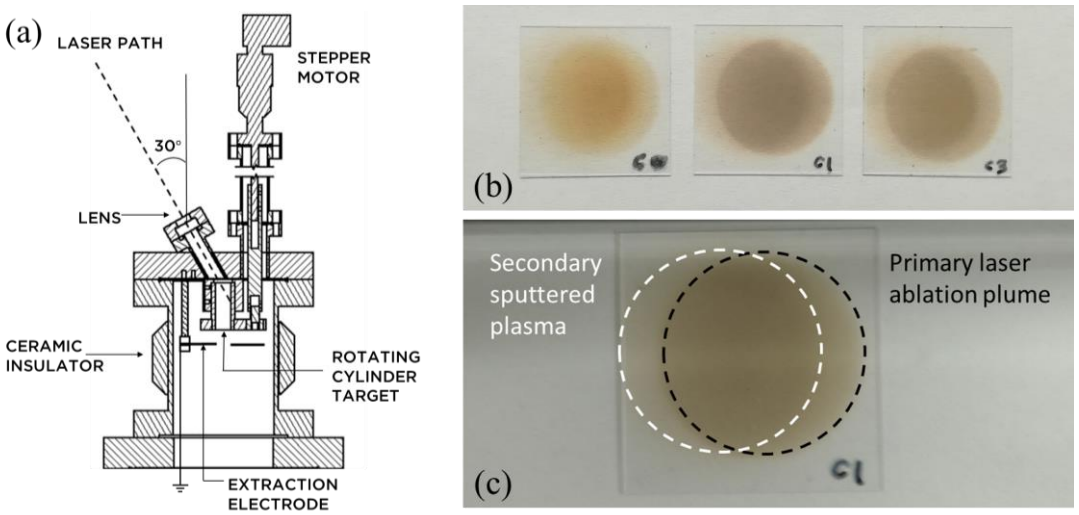

FIG. 1. (a) Schematic of the main part of the laser ion source set-up, (b) Carbon deposition patterns produced from near-source experiments at 0, 1, and 3 kV extraction, and (c) Traced outline of the two overlapping deposition layers

[1]G.Q. Saquilayan, M. Wada, AIP Conference Proceedings No. 1869, Art. No. 040003 (2017).

[2]A.T. Tanquintic, G.Q. Saquilayan, M. Wada, presented at 17th International Conference on Ion Sources, CERN-CICG, Geneva, October (2017).