Time evolution of the laser ablation plume composition for a metal alloy target

Wayne C. McGinnis[1*], Alexandru Hening[1], Kathryn M. Liotta[1], and Anthony Gasbarro[2]

[1] Naval Information Warfare Center Pacific, 53560 Hull St., San Diego, CA 92152, USA
[2] Naval Information Warfare Center Pacific, Pearl City, HI 96782, USA
[*]Corresponding author email: wayne.c.mcginnis2.civ@us.navy.mil

Pulsed laser deposition is said to maintain the stoichiometry of the ablation target in the laser ablation plume as well as in the deposited film. Exceptions to this conventional belief occur, however, for materials that contain elements with large differences in volatility (for example, Bi and Fe in Bi-Fe oxides). The relative effect of various pulsed laser deposition processes on the multi-element plume composition and the resulting film stoichiometry as a function of time (or the number of laser pulses) has been examined using an interactive spreadsheet-based model, [1-2] as well as experimentally by measuring the plume composition via optical emission spectroscopy. The adjustable parameters within the spreadsheet include target composition, target element ablation yield, ablation plume spread, background gas pressure, ablated target atom kinetic energy, and ablated element sticking coefficient on the substrate. Using a simple Nb-Ta model material system, the calculated and experimental evolution of the laser plume are compared.

Acknowledgements: The authors gratefully acknowledge the programmatic and financial support of the Naval Innovative Science and Engineering (NISE) program at Naval Information Warfare Center (NIWC) Pacific.

References:
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