10th International Conference on Inertial Fusion Sciences and Applications
September 11-15, 2017 • Saint Malo, FRANCE

Laser Imprint Reduction using High-Z Coatings on a 3ω laser

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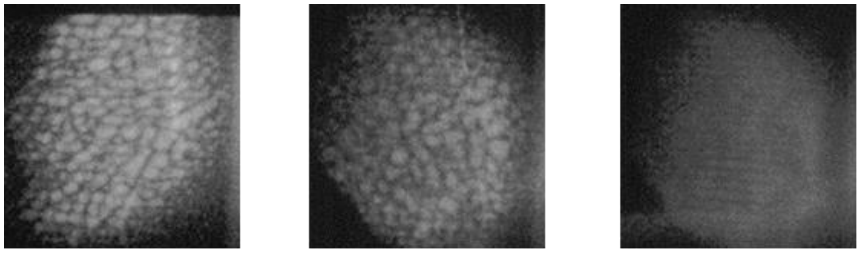
Previous experiments on Nike KrF laser (λ = 248 nm) at NRL found that a thin (400 – 800 Å) high-Z (Au or Pd) overcoat on the laser side of the target is effective in suppressing broadband imprint [1,2] and reducing ablative Richtmyer-Meshkov growth [3]. The overcoat initially absorbs the laser and emits soft x-rays that ablate the target, forming a large separation between laser absorption and ablation and driving the target at higher mass ablation rate. Implementation of this technique on the frequency-tripled Nd:glass (351 nm) NIF would enable a wider range direct-drive experiments there. To this end, we are carrying out experiments using the NIF-like beams of Omega EP. On Nike, a low-intensity, highly smooth prepulse heats and pre-expands the low thermal mass metallic coating to ~100 μm scale length. This likely improves imprint reduction for longer spatial scales because of increased distance between laser absorption and the ablation surface. The 3ω beams of Omega EP do not have this feature due to non-linear harmonic conversion. In order to improve longer spatial scale imprint reduction, we have introduced a means of pre-expanding the high-Z coating to similar length scale on Omega EP using a soft x-ray prepulse. The prepulse is generated by irradiating an auxiliary Au foil 1 cm in front of the main target tens of ns prior to the drive on the main target. Coating expansion due to the prepulse is measured using streaked side-on radiography. RT-amplified imprint is measured using face-on radiography on a framing camera. While some reduction in areal mass perturbations is measured for coated targets without pre-expansion, a dramatic reduction is seen when pre-expansion is applied. Work supported by the US Department of Energy/NNSA.



The NRL team would like to thank Laboratory for Laser Energetics Omega EP laser, target, and diagnostics teams for their support of these experiments.

References

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[2] Karasik et al, Phys. Rev. Lett. 114, 085001 (2015)
[3] http://meetings.aps.org/link/BAPS.2008.DPP.CO5.9