# Simulation Studies of the Interaction of Laser Radiation with Additively Manufactured Foams*

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In indirect drive inertial confinement fusion, a high-*Z* enclosure (or "hohlraum") surrounds a low-Z capsule containing DT fuel. Laser beams irradiate the interior of the hohlraum, which creates an x-ray radiation bath compressing the fuel to ignition conditions. The irradiated hohlraum wall motion leads to dynamic drive symmetry swings that degrade the implosion. To mitigate this wall motion, hohlraums are typically filled with helium gas. A side effect is that for moderately high fill densities (> 0.6 mg/cc) experiments have shown a substantial amount of backscattered light, while for low densities the wall motion increases. Modern hohlraum designs are beginning to use foams in two ways. First, high-*Z* metallic foams may be effective in reducing wall motion without compromising capsule drive. Second, low-density mid-*Z* foams can be used as a substitute for higher density gas fills with the added advantage of possibly using embedded dopants to potentially mitigate backscatter losses. The interaction of laser radiation with foams of various porosity sizes and average densities has been the subject of several numerical and experimental studies [1]. In all cases, modelling foams using standard radiation-hydrodynamics codes have shown considerably disagreement with experimental measurements. These discrepancies have been attributed in large part to the inability of rad-hydro codes to faithfully represent the statistical nature of foams (solid ligaments of full density material and large vacuum pore sizes ~ 1-10 μm), typically modelled as a uniform gas of equivalent density. This deficiency may benefit from modern computer architectures (many processors) and newly developed equation of state models. In this work we use the rad-hydro code HYDRA and a simple foam statistical representation to show that this configuration goes a long way to bridge the modelling disparities. Further ease on modelling requirements can be leveraged from the use of structured foams. Recent developments in additive manufacturing (AM) allow for the fabrication of structured foams of specified average density. Currently, strands with ~ 500 nm diameter and pore sizes as small as several microns can be laid down in a structured pattern, but the technology is quickly evolving. We use HYDRA to survey a variety of AM foam configurations to find an optimal design for hohlraum experiments.

[1] S.Y. Gus'kov *et al.*, Quantum Electron., **24** 696 (1997); S.Y. Gus'kov *et al.*, Phys. of Plasmas **18**, 103114 (2011); Ph. Nicolai *et al*., Phys. of Plasmas **19**, 113105 (2012).

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