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Advanced Additive Manufacturing of Foams for High-Power Laser Interactions at ELI Beamlines

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Additive manufacturing (AM) foam targets have gained significant attention in the realm of high-power laser–matter interaction. These two-photon polymerization 3D printed targets offer a controlled environment for laser interactions, enabling exceptional versatility in terms of average density, spatial structure, and material composition. Such attributes hold immense potential for diverse applications, ranging from inertial confinement fusion to the generation of intense X-rays and gamma rays. In this contribution, we present an approach for the design and fabrication of AM foams tailored specifically for laser–plasma interaction experiments. Key aspects covered include the selection of optimal cellular structures, the utilization of finite element analysis to enhance mechanical properties, and the successful printing of foams onto dielectric and conducting substrates. Additionally, we explore the integration of high repetition rate targetry systems for synchronizing with high repetition rate lasers. The future prospects of AM foams in advancing laser-driven applications are also discussed, highlighting the transformative impact they hold for cutting-edge research and technological innovation.

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