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Foams for Inertial Confinement Fusion

Mattia CIPRIANI [(1)]

(1) Laboratory of Inertial Fusion, Plasmas and Interdisciplinary Experiments - NUC-PLAS-FIPI Division of Plasma Studies and DTT, NUClear Department, ENEA - Centro Ricerche Frascati Frascati (Rome), Italy

High-power laser interaction with porous materials, or foams, have been studied from early nineties as potential ablators for ICF studies [1]. Foams are nowadays attracting considerable attention because of their peculiar features under irradiation of high-power lasers and of their applications to several fields, like inertial confinement fusion (ICF). In this context, foams have been employed as pressure amplifiers for the study of equations of state [2], of crucial importance for designing an efficient fusion target. In Indirect Drive, they have been suggested as hohlraum liners [3] to reduce motion of the inner walls and as hohlraum filling materials to replace the gas fill [4]. More recently, applications to the Direct Drive scheme became important and research efforts directed to reproducing, in a controlled environment, the conditions of the corona of an irradiated capsule in the Shock Ignition scheme [5] and to realize a full ICF target for the dynamic shell formation concept [6].

In this talk, experimental and theoretical aspects of the interaction of a high-power laser beam with foam targets will be discussed, starting from the earlier works and then focusing on the several recent results. The discussion of the experimental results will also include manufacturing technologies, up to the potential of modern additive manufacturing. The overview of modeling activities will detail the efforts towards a proper incorporation of the physics of the laser interaction with foams in the simulations, both with sub-grid models and with direct reproduction of the foam structure in radiation-hydrodynamic codes.

References

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