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TODAY'S INERTIAL FUSION IGNITION TARGETS – SYNERGISM WITH TOMORROW'S INERTIAL FUSION ENERGY TARGETS*

T.P. Bernat and D.T. Goodin
General Atomics, P.O. Box 85608, San Diego, California 92186-5608 USA
Contact: Dan.goodin@gat.com

For several decades research and development supporting single-shot ignition and burn has been conducted by the Inertial Confinement Fusion (ICF) program at major facilities including the 1.8 MJ National Ignition Facility (NIF) under construction at Lawrence Livermore National Laboratory, the 30 kJ OMEGA laser at the University of Rochester, the 2 MJ Z x-ray pulse-power facility at Sandia National Laboratories, and the 5 kJ NIKE laser at the Naval Research Laboratory. Much of the resulting ICF science and technology is highly synergistic with target development for future Inertial Fusion Energy (IFE) power plants. Relevant subjects from ICF that are key to IFE include driver symmetry, target physics and hydrodynamic stability, energy absorption by the target, target uniformity and characterization, and target fabrication methodologies.

The laser IFE target fabrication, injection, and tracking programs – while leveraging information from the ICF work – are directed towards methods that will scale to mass production [approximately 500,000 "ignition-quality" targets per day are needed for a 1000 MW(e) power plant]. We are working closely with target designers, and other power plant systems specialists, to make specification and material selections that will satisfy a wide range of required and economically desirable target characteristics. One-of-a-kind targets produced for today's ICF experiments are estimated to cost from a few thousand to a few tens of thousands of dollars each. Design studies of cost-effective power production from laser IFE have suggested a cost goal of about $0.25–0.30 for each injected target (corresponding to ~10% of the "electricity value" in a target). To achieve such cost reduction, simplification of design, improvement in target manufacturing yield, increases in batch sizes, and rapid characterization methods will need to be achieved. Methods dedicated to the production of targets with fixed specifications (as opposed to the changing needs of current day experiments) will aid in this cost reduction. In this paper, we focus on the synergisms between the ICF and IFE target fabrication programs that are relevant to a future mass-production target supply for laser fusion. Collaboration between the ICF and IFE target programs is essential to maximize this synergism.

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