Reducing the Costs of Targets for Inertial Fusion Energy

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Current targets produced for current inertial confinement fusion ignition experiments are estimated to cost about $2500 each, not including the effort to fill, layer, and position them for the driver beams. Design studies of power production from Inertial Fusion Energy (IFE) have assumed the as-delivered target cost at chamber center to be about $0.25 each. While four orders of magnitude cost reduction may seem at first to be a significant challenge, there are many factors that suggest this is an achievable goal. Targets that are being fabricated now are on a one-of-a-kind or limited batch run basis, with significant and costly development required for each. In contrast, targets for a commercial IFE fusion power plant will be of a single design and will have well developed and sorted out mass production methods. Current targets require a detailed "pedigree" on each unit to support experiment analyses, IFE targets will be subject to statistical sampling and quality control. Moreover, because of the limited production runs, and their widely varying specifications, current target production methods have not been optimized for cost, and high yield. Typically the yields are about 1%. IFE target production processes will be developed for robustness and yields >99%. High-volume, mass-production methods will be developed for filling, layering, and injecting IFE targets. Well-developed industrial technologies are available in a number of fields for handling large quantities of precise materials, and these technologies will be applied to the IFE target supply system. This paper summarizes the major steps, developments, and process modifications that will be taken to economically supply targets for IFE power plant fueling.

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