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Application of a Polymeric Ablator Coating to a
Ball-and-Disk Target Design by the
Physical Vapor Deposition of Polyethylene**

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**LASER-FUSION TARGET FABRICATION:
APPLICATION OF A POLYMERIC ABLATOR COATING TO A
BALL-AND-DISK TARGET DESIGN BY THE
PHYSICAL VAPOR DEPOSITION OF POLYETHYLENE**

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Gary A. Simonsic

ABSTRACT

A technique for applying polyethylene by physical vapor deposition is described. The ball-and-disk target design requires the application of a thin film of polyethylene on the front surface of the ball and substrate upon which the ball is mounted. Disk-shaped films, typically 200- μm -diam by 1- μm -thick, are successfully applied by this method.

INTRODUCTION

Thin-film technology is being widely used in the fabrication of targets for laser-initiated fusion. The fabrication of laser-fusion targets, which are made individually, requires that thin films be applied to various microsize substrates. A prime area of interest is organic thin films, which are used in various target designs. Because of the size and nature of laser-fusion targets, unique techniques for the deposition of organic coatings from the vapor state had to be developed and evaluated.

This report describes a technique developed for the ball-and-disk target design, which is shown in Fig. 1. This design consists of a nominal 50- μm -diam glass microballoon containing 50-100 atm of DT gas. The microballoon is mounted on a 1000- $\text{\AA}$ -thick polymeric film. A 1- μm -thick polyethylene coating is applied to the front surface of the microballoon and to the polymeric substrate for a radial distance of about 100 μm from the center of the microballoon.

**PHYSICAL VAPOR DEPOSITION OF THE
POLYETHYLENE DISK**

The physical vapor deposition (PVD) of polyethylene is somewhat analogous to the PVD of

metal; the main difference is the relatively low vaporization temperature ($<500^\circ\text{C}$) of the polyethylene. The coating is applied in a vacuum-evaporator station under an operating pressure of $<1 \times 10^{-5}$ mm Hg. A small, weighed charge of polyethylene* is vaporized from an alumina crucible, which is heated by a wrapping of nichrome, resistance heating wire, as shown in Fig. 2. The polyethylene is maintained at $\sim 425^\circ\text{C}$ during vaporization. Splattering of the polyethylene from the crucible is prevented by placing boiling stones in the crucible and a 30-mesh stainless steel screen over the mouth of the crucible. The shape of the polyethylene film is produced by placing a mask with a 200- μm -diam hole over the ball and film mount. The source-to-substrate distance established for this process was 50 mm. Eleven milligrams of polyethylene completely vaporized with the above conditions will yield a 1- μm -thick disk. Figure 3 is a photomicrograph of a ball-and-disk laser-fusion target.

*Alathon 4275, E. I. Du Pont de Nemours and Company, Wilmington, DE.

Fig. 1.
Ball-and-disk target design.

Fig. 2.
Vaporization crucible.

Fig. 3.
Photomicrograph of a ball-and-disk laser-fusion target.