

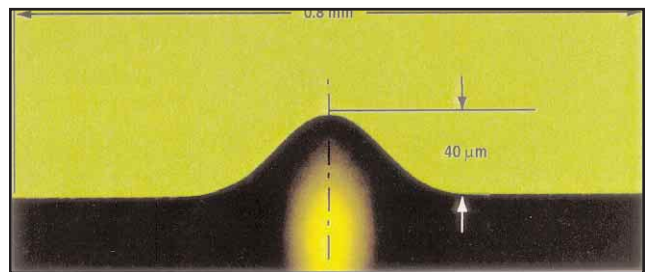
ICF Target Support Highlights

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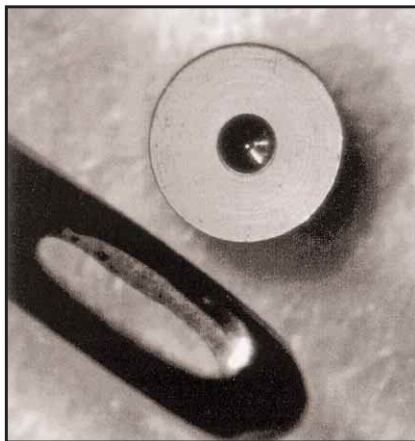
General Atomics, with our partner Schafer Corporation, serves as the ICF Target Support Contractor, providing target development and fabrication and target system engineering development to support the ICF program at five ICF Labs — LLNL, LANL, NRL, SNL, and UR/LLE. This informal newsletter contains highlights of that support for July 1997.

GA/Schafer on-site staff at LLNL, LANL, and SNL fabricated, machined, assembled and characterized about 250 targets of various kinds for experiments on Nova, Trident and PBFA-Z. We fabricated, characterized and delivered about 340 targets and target components, including 60 micromachined hohlraums, witness plates and foams to LLNL, and SNL for shots on Nova and PBFA-Z, 100 plastic and glass microballoon capsules to LLNL, LANL and UR/LLE for shots on Nova and Omega, and 180 flat foil targets of various materials and configurations to NRL and UR/LLE for shots on Nike and Omega.

To support experiments on Nova at LLNL we developed and produced five small copper disks (0.8 mm diameter — smaller than the head of a pin) with a Bessel function shaped dimple 40 μm deep in one side. These were fabricated on our Precitech diamond turning machine using a technique where the reverse of the dimple was first machined on a zinc rod; copper was electroplated onto the zinc; the copper was machined down to the desired diameter and thickness; and, then the zinc was dissolved in HC 1. (Hydrochloric acid does not affect copper.) We had produced similar dimpled disks previously, but the dimples in the disks delivered this month were considerably smaller than those produced previously, making the machining more challenging.



Zinc mandrel for electroplating a copper disk with a Bessel function dimple for LLNL



Finished copper disk with dimple next to sewing needle

GA uses several techniques to produce the glass and plastic microballoons that are the heart of ICF target capsules. Our “workhorse” technique for producing plastic capsules is the PAMS/GDP process in which we make a poly(alpha-methylstyrene) or “PAMS” shell using microencapsulation, overcoat it with glow discharge polymer (GDP) and then heat the shell to decompose the PAMS and leave a very precise GDP capsule. This process can produce shells with the good sphericity of the microencapsulation process and the uniform wall thickness of the GDP process. PAMS, however, is susceptible to inclusions of water which leave tiny voids called “vacuoles” in the shell wall as the solvents are removed from the PAMS solution. These vacuoles impart minute surface features in the critical Legendre mode 10 to 100 range to the finished GDP capsules and cause a reduction in optical clarity. Over the past several months, we have explored the addition of CaCl_2 to the exterior aqueous PVA solution, in order to make vacuole-free PAMS shells. The additive enables osmotic pressure to pull the water out of

the “green” capsule wall. This removes all the vacuoles near the outside surface of the shell, and the number of vacuoles on the inside wall (which is irrelevant for the PAMS/GDP process) is minimal. GDP shells made from PAMS mandrels processed with CaCl_2 have excellent optical clarity and the modal power spectrum as by the atomic force microscope (AFM) spheremapper also appears to be improved.

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