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 February 1999.

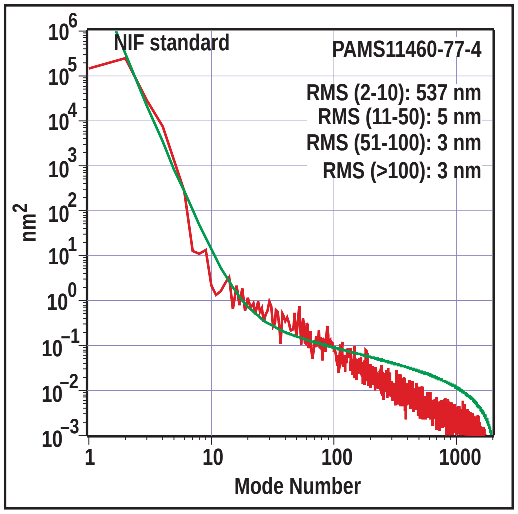

Fig. 1. One of the best AFM spheremapper power modal spectra from a 2 mm thin-walled PAMS mandrel

GA/Schafer onsite staff at LLNL, LANL, and SNL fabricated, machined, assembled and characterized about 300 targets of various kinds for experiments on Nova, Omega, Trident, and Z. We fabricated, characterized, and delivered about 650 targets and target components, including micromachined hohlraums, witness plates, and foams to LLNL, LANL, and SNL for shots on Nova, Omega, and Z, plastic and glass microballoon capsules to LLNL, LANL, and UR/LLE for shots on Nova and Omega, and flat foil targets of various materials and configurations to NRL and UR/LLE for experiments on Nike and Omega.

As the ICF program progresses toward NIF readiness, GA has begun receiving orders from LLNL and SNL for NIF scale capsules. Utilizing the combined experience of Don Czechowicz, Fred Elsner, Barry McQuillan and Masa Takagi (LLNL, onsite at GA), GA has fabricated hundreds of 2 mm thin-walled poly (α-methylstyrene) (PAMS) mandrels with surface finishes approaching NIF specifications (Fig. 1). These mandrels were obtained by carefully controlling the solution temperature and density so that the composite shells maintained neutral buoyancy throughout the curing process. In addition, the shells were agitated under conditions sufficiently strong enough to encourage shell centering but mildly enough to minimize the distorting effects of shear. Sphericity and roundness are improved when the curing and agitation time are increased by adding excess solvent to the curing solution. Similar spheremap traces have been obtained for relatively thick-walled (25-50 µm) PAMS shells, however, thin walled shells are preferable for GDP coating as discussed below.

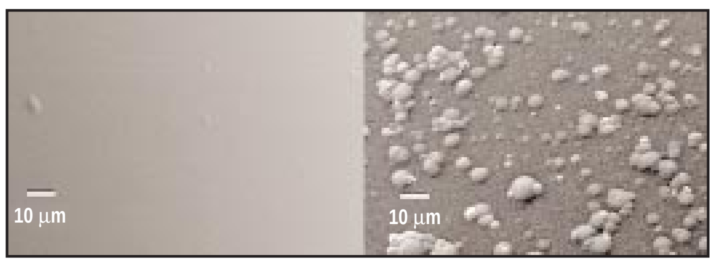

Fig. 2. A thin-wall PAMS mandrel coats to a smoother surface finish (left) than a thick-walled mandrel.

Progress, also, has been made in glow discharge polymer (GDP) coating 2 mm or larger PAMS shells by Abbas Nikroo. Coating such shells presents a special challenge. The traditional piezo bouncing of shells does not provide enough agitation for the thicker-walled (>20 µm) shells. When the agitation strength is increased to obtain uniform coatings, undesirable dome-covered coatings result which adversely affect the power spectra of the shells. We have used a spinning pan agitation scheme to roll the shells which has alleviated these problems tremendously. Proper rolling agitation has been shown to result in uniform coatings. However, when rolling very thick walled (≈50 µm) shells, dome-filled coatings can still result. Figure 2 compares the surfaces of ≈2.5 mm diameter GDP shells made from PAMS mandrels having 12 µm and 50 µm walls. This demonstrates the advantage of starting with thin-walled PAMS shells.

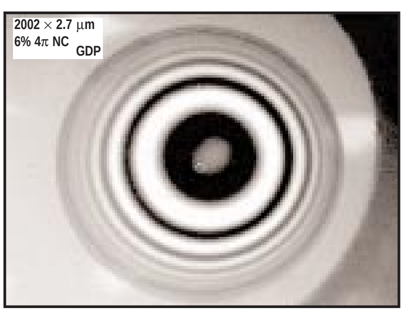

Fig. 3. Interference photomicrograph of a high aspect (2 mm x 2.7 µm) GDP shell with 6% nonconcentricity and 2 µm out-of-round (Δd)

We have also made very high aspect ratio, thin walled GDP shells at the 2 mm diameter range. Figure 3 shows an interferometric image of such a shell. These may prove useful for the direct drive effort.

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For more information, contact Ken Schultz at GA: 619-455-4304; fax: 619-455-2399; e-mail: ken.schultz@gat.com.

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