ICF Target Support Highlights

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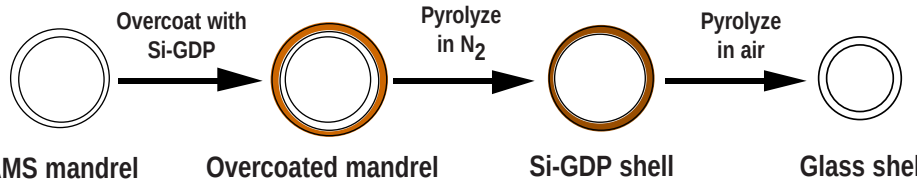
General Atomics, with our partner Schafer Corporation, serves as the ICF Target Support Contractor, providing target development and fabrication and target system engineering development to support the ICF program at five ICF Labs – LLNL, LANL, NRL, SNL, and UR/LLE. This informal newsletter contains highlights of that support for December 1998.

GA/Schafer onsite staff at LLNL, LANL, and SNL fabricated, machined, assembled and characterized about 100 targets of various kinds for experiments on Nova, Omega, Trident, and Z. We fabricated, characterized, and delivered about 450 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.



The "drop tower" method has been the standard method for making ICF glass shells for over 20 years. Glass shell diameters can be made up to 1.5 mm but with very thin walls which makes them very fragile. A new method was discovered by Martin Hoppe at GA for converting doped polymer mandrels made by the poly(α-methylstyrene)-glow discharge polymer (PAMS-GDP) process into glass shells:

The diameters from Hoppe's process are limited only by the diameter of the PAMS mandrels. We have developed the process to make strong glass shells approaching 1.5 mm diameter with 14 µm walls and excellent concentricity.

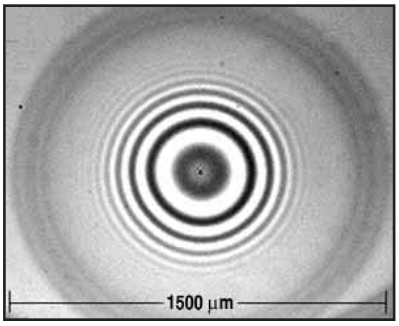


Fig. 1. 1437 µm o.d. x 14 µm wall glass shell made from 9% Si-GDP has excellent uniformity and clarity.

Experiments were conducted to manufacture glass shells from silicon-doped GDP to determine the optimal concentration of silicon. Figure 1 shows the representative appearance of the glass shells made from the 9% Si-GDP. This shell, pyrolyzed to 1000˚C in air for one hour, exhibited physical and D_2 permeability properties consistent with the formation of fully dense SiO_2.

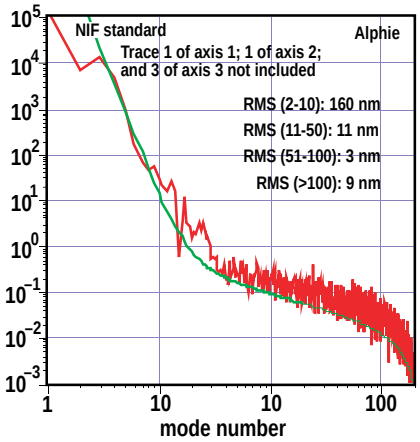


Fig. 2. The spheremapper AFM power spectrum

An AFM power spectrum of the shell was obtained after pyrolysis, shown in Fig. 2. The measurements confirm the excellent sphericity of the shell with the out-of-round measurement at mode 2 only ~1 µm. Indeed, the overall power spectrum approaches the requirements for use as a National Ignition Facility (NIF) target.

This process appears to be suitable for making large (~2 mm), high quality, thick-walled glass shells for use in cryogenic layering experiments or other potential applications. PAMS mandrels over 2 mm diameter are available. We are continuing development.

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