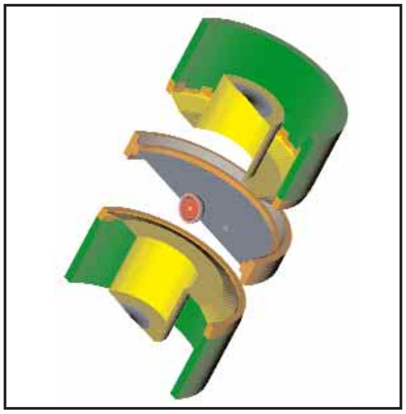
ICF Target Support Highlights

GA-C22688
June 1998

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 June 1998.

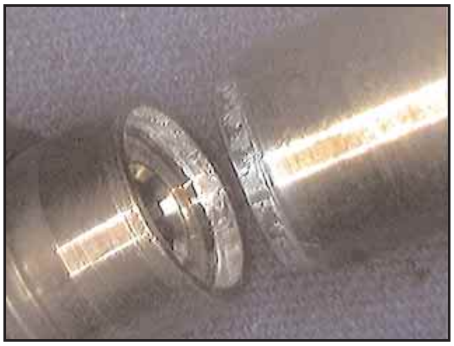
GA/Schafer onsite staff at LLNL, LANL, and SNL fabricated, machined, assembled and characterized more than 140 targets of various kinds for experiments on Nova, Omega, Trident, and Z. We fabricated, characterized, and delivered almost 400 targets and target components, including micromachined hohlraums, 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.



Hohlraum parts (yellow) being assembled onto the capsule's mounting ring by the press anvils (green) of the cryogenic assembler. The mounting ring is much larger in diameter than the hohlraum to minimize thermal perturbation during layering of the capsule.

One of the methods under consideration for fielding a cryogenic ignition target on the National Ignition Facility is to use a cryogenically assembled hohlaum. This method keeps the hohlraum away from the capsule until the capsule's DT fuel has been layered and characterized. This provides expanded access to the capsule for enhanced layering techniques and characterization. The sequence would be as follows. The target's capsule is mounted in a small ring. The ring mounted capsule is transported from the fill station cryostat, where the capsule is permeation filled with DT, to the target chamber center by the insertion cryostat. The insertion cryostat is moved into the chamber by the target positioner. The capsule is layered and characterized in the shroud of the insertion cryostat. Just before the shot, the hohlraum is quickly assembled (<10 s) onto the capsule's mounting ring, thus forming the target, and the shroud is rapidly removed exposing the target to the laser beams. A miniature cryogenic mechanism in the shroud is used to fasten the hohlraum to the mounting ring. Prior to the shot, the hohlraum of the assembled target is also filled with tamping gas, a helium and hydrogen gas mixture,. The high density (about 60 kPa at 19 K) of the gas interferes with the DT beta-layering process, so it is added just prior to the shot.

The assembled target must hold in the tamping gas while it is in the vacuum of the target chamber. This requires all the joints in the target's hohlraum to have a low leak rate. Neil Alexander at General Atomics is investigating concepts for cryogenically assembled hohlraums, and is experimenting on potential seals for the joints that will make up the target's hohlraum. In tests at room temperature, using fixtures designed to test just the joint seal, a 9° taper seal joint was found to leak helium at a rate of 2×10^{-9} STD mbar liter/s when using an assembly force of 160 N and a 50 µm indium gasket, and at 7×10^{-10} STD mbar liter/s when using an assembly force of 980 N and no gasket. The effective pressure held in by the sealed parts was at least 120 kPa and 690 kPa, respectively.



Test of a 9° taper seal with indium gasket, showing indium well bonded to both seal surfaces

The 9° taper seal joint will be assembled and tested at cryogenic temperatures. Other concepts that perform well at room temperature will also be tested cryogenically. The forces found to produce effective sealing will be input into finite element models of the cryogenically assembled hohlraums to predict the stresses and displacements produced within the target by the assembly process.

Work supported by the U.S. Department of Energy under Contract No. DE-AC03-95SF20732

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

Schafer

GENERAL ATOMICS