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 October 1998.

GA/Schafer onsite staff at LLNL, LANL, and SNL fabricated, machined, assembled and characterized more than 110 targets of various kinds for experiments on Nova, Omega, Trident, and Z. We fabricated, characterized, and delivered about 190 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.

Chuck Hendricks and his team at Schafer Corporation have been developing production techniques to make planar targets for Andrew Mostovych's Equation of State experiments on the Nike laser at NRL. Figure 1 shows a schematic diagram of the aluminum plates. The base plate (the lower plate) is mounted on the surface of a 13 micron thick layer of Kapton stretched over a conical CryoTarget Mount. To produce the target parts, aluminum discs were machined on the diamond turning machine, holes were drilled through the disc and then the parts were cut from the disc. To drill the holes (about 75 microns diameter) and to cut the parts from the disc, we devised a very small, inexpensive electrical discharge machining (EDM) device.

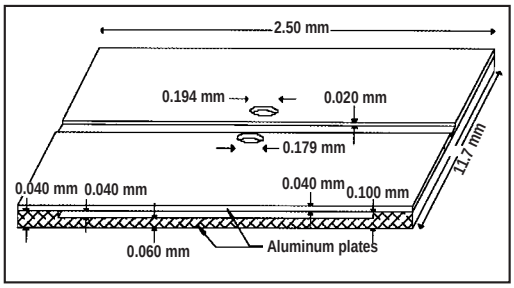

Fig. 1: Equation of state target plates.

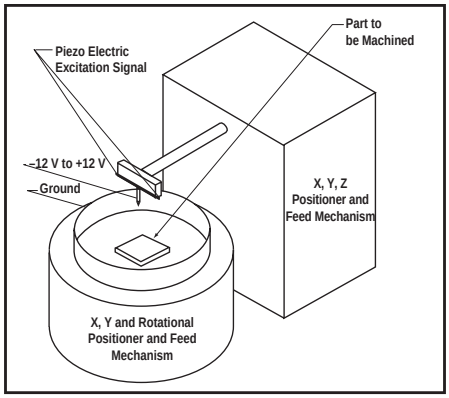

Fig. 2: Schematic diagram of Schafer micro-EDM apparatus.

Conventional mechanical micro-drilling and milling techniques tend to leave defects at hole edges that are extremely difficult to remove without inducing distortion or altering the grain structure. To minimize burrs and deformation, we developed a small EDM apparatus (Fig. 2) for producing the diagnostic holes. A current is made to flow between an oscillating electrically conducting tool and the conducting material to be machined, which is immersed in a dielectric liquid. The voltage between the tool and the material ranges from –12 volts to +12 volts. Excitation frequencies range from 200 hertz to 1.5 kilohertz. The cutting tips are made from tungsten wire. We have produced holes as small as a few tens of microns diameter. The wire, and thus the hole, can be of arbitrary shape. Using the same techniques with lateral rather than vertical motion of the EDM cutting tip, we are able to make narrow slots and/or cut out sections of metal target material and leave the parts with burr-free edges (Fig. 3). Planar parts can be made in arbitrary shapes – the cuts do not have to be straight lines. Micro EDM end milling is performed with our machine to remove material from the lower plates of the EOS targets to produce the four integral spacers at the corners of the plate on which the upper plate rests and is cemented.

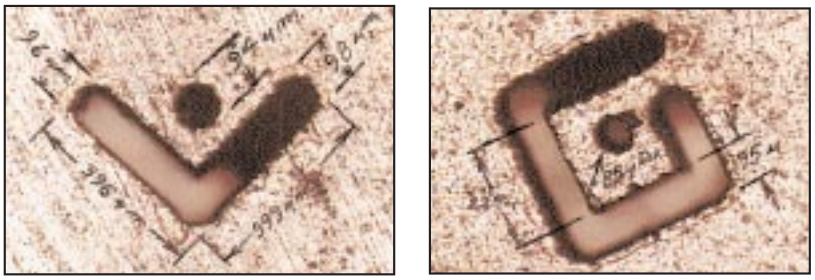

Fig. 3: Micrographs of slots and holes made with micro-EDM.

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