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Sandia National Laboratories' Dynamic Integrated Compression Experimental (DICE) Target Fabrication Capabilities and Techniques

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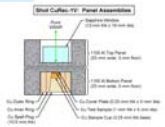
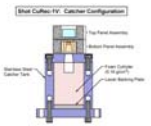
Sample Recovery

A multi-component assembly is used to achieve soft recovery of a specimen subjected to electromagnetically driven ramp-wave compression. The sample(s) and a thin cover plate are mounted in a tapered cup, which is backed by a tapered spall plug. The cup and spall plug are, in turn, mounted in a pair of concentric rings that provide lateral confinement. Due diligence is exercised to ensure minimal bond thicknesses between all mating components.





Capabilities

The Dynamic Integrated Compression Experimental (DICE) target fabrication lab provides precision targets and shot hardware that support experiments on a variety of test platforms including the VELOCE pulsed electromagnetic driver, a 3" intermediate velocity gas gun and the Z machine.

NIKON NEXIV MEASURING SYSTEM

•An ideal general purpose 3D coordinate measuring system with dimensional accuracies of ±3microns

• Features an 8-segment LED illumination system and through-the-lens laser auto-focus, allowing for ultra-accurate detection of measurement points..

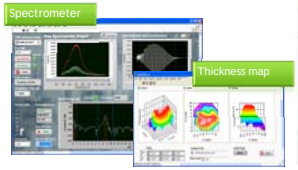
NIKON MEASURING MICROSCOPE

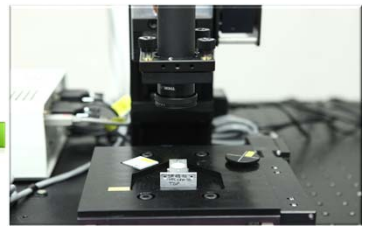
•Optical specifications facilitate exacting measurements.

• Paired with the Digital Sight DS-U1 camera the MM-40 provides detailed images and automatic measurements utilizing pixel dimensions.

NSTec GAP MEASURING SYSTEM (GMS)

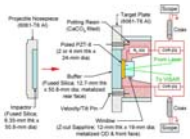
•A low-coherence spectrometer measures a modulated spectrum to infer glue-thickness

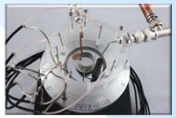




Electromechanical Shots

Simultaneous dynamic measurements of the coupled mechanical and electrical response of a ferroelectric sample, such as lead zirconate titanate (PZT), is accomplished by potting the sample and its attached impact buffer and VISAR window, along with output leads from the front and back PZT electrodes, in a $CaCO_3$-loaded resin. Care must be taken to maintain separation of the leads from other conductive elements so as to avoid shorting as high voltages are generated during sample compression.





PVDF Gauge Assembly

Assembly of the Poly Vinylidene Fluoride (PVDF) shock compression gauge package for explosives applications consists of one or more PVDF sensors, a coaxial cable, FEP Teflon Film, a two-part Hysol epoxy resin and a 5-minute epoxy. The Hysol epoxy along with the 0.001" Teflon film not only Provides protection for the gauge and the soldered connection, but also allows flexibility for molding to a variety of form factors.

Cryogenic & Pre-Heat

Specially designed cells for preparing cryogenically liquefied samples of various gases have been Developed and are utilized over a wide range of temperatures on Z.

The resultant liquid samples are shock compressed to obtain principal Hugoniot data for each material.

Sample pre-heating allows control of the initial state of a material in order to facilitate investigations of phase transitions induced by dynamic compression, such as the gamma-beta phase boundary in explosive samples.

The system requires specialized assembly procedures since most glues won't perform properly at elevated temperatures. Consequently, a system utilizing Macor ceramic clamps and compression springs was devised to support the samples.

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