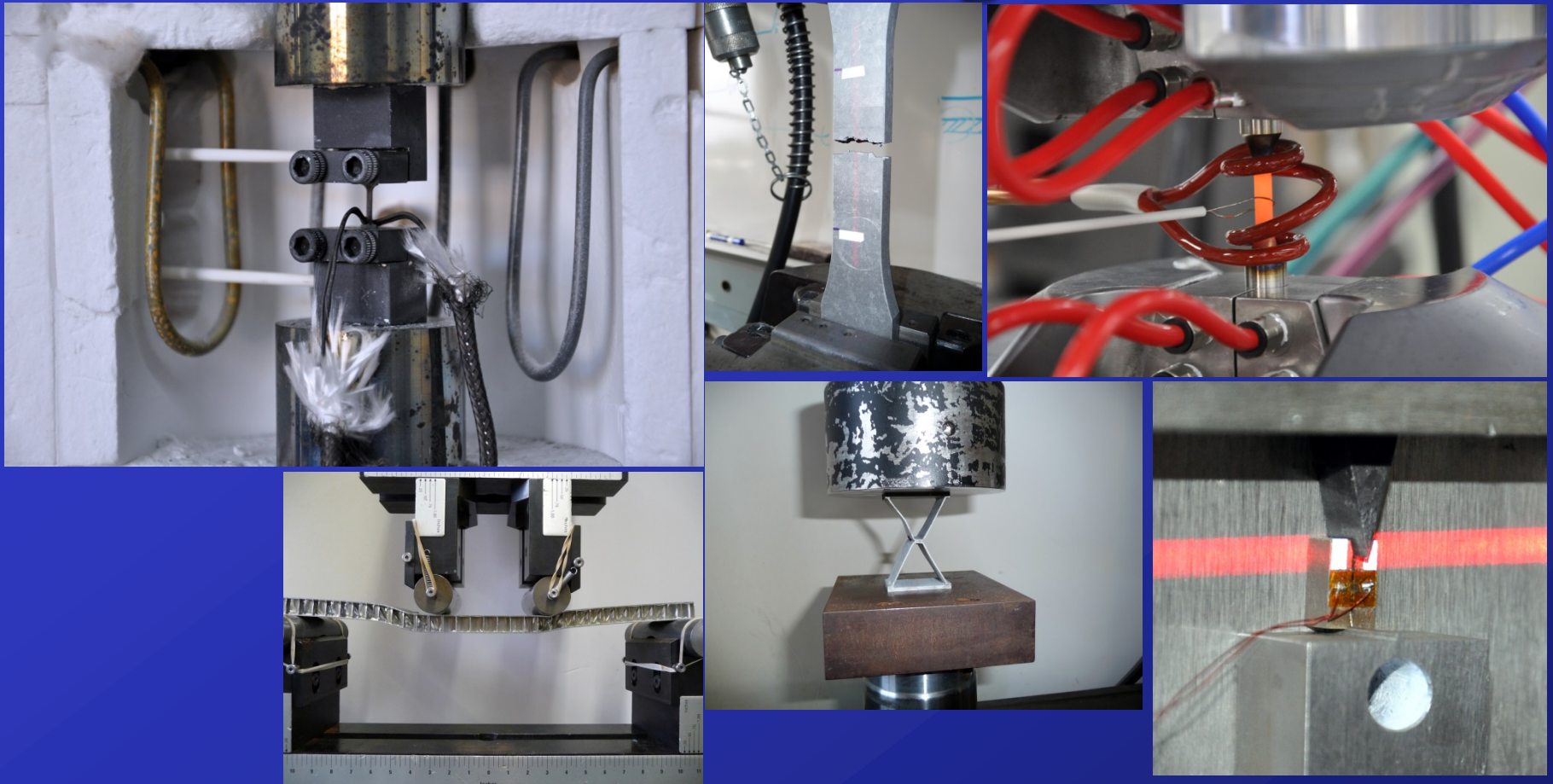


Mechanical Testing at UCSB



Mechanical Test Lab Mission

The Mechanical Testing Laboratory is a campus-wide testing resource providing users from many departments access to physical test equipment to characterize materials, components and entire structures. The lab supports research groups from Mechanical Engineering, Materials, Chemical Engineering, Physics, Chemistry, Marine Science, and the Materials Research Lab as well as undergraduate testing under the ME 189 / ME 153 Design Program. The equipment available includes universal test machines capable of tension, compression, bending and shear, with the capability for fatigue testing in all loading modes. Several high temperature furnaces allow testing at elevated temperatures. Hardness and microhardness testers accomplish non-destructive testing. A wide array of sensing systems is available to measure displacements, strains and stresses as well as microscopy for optical observation during testing. The lab is maintained by a Senior Development Engineer who keeps the equipment in good working order, upgrades hardware and software as necessary, and provides training and consultation on test techniques and test fixtures.

Examples of services performed:

- High temperature testing of ceramic matrix composites
- Fracture toughness testing of nuclear pressure vessel steels
- Tension testing of polymers
- Compression testing of foams
- Fatigue testing of metal matrix composites
- Damage tolerance of polymer matrix composites
- High temperature cyclic loading of nickel superalloys
- Shear testing of metals and composites

- Thermo-mechanical fatigue of composites
- Stiffness testing of heart tissue
- Indentation and flexure testing of bone
- Weld testing of steel tubes
- Tension testing of braze joints
- Strain mapping of sandwich structures
- Ceramic fiber bundle tensile testing
- Piezo-electric compression and flexure testing

MTS 55-kip Universal Test Machine

- 50,000 lbs (220kN) Axial
- +/- 5.0 in (127 mm) Axial Displacement
- 8 Channel Computer Data Acq. & Control System
- Static: Tension, Compression, Flexure, Shear
- Fatigue: Tension, Compression, Flexure, Shear
- High Temp., Air (~600C): Tension, Creep, Fatigue, Thermo-Mech. Fatigue
- High Temp., Air (~1600C): Tension, Compression, Creep, Cyclic Loading
- 1600C MTS Air Furnace (3-in. zone)
- 5.0 kW Induction Heater (SiC susceptor)



MTS 22-kip Universal Test Machine

- 20,000 lbs (100kN) Axial
- +/- 5.0 in (127 mm) Axial Displacement
- 8 Channel Computer Data Acq. & Control System
- Static: Tension, Compression, Flexure, Shear
- Fatigue: Tension, Compression, Flexure, Shear
- High Temp.: Quartz Lamp Radiant Heater ~ 1100C, 3D Digital Image Correlation



Instron 8562 Universal Test Machine

- 22,000 lbs (100 kN) Axial
- +/- 2.0 in (50 mm) Axial Displacement
- 8 Channel Computer Data Acq. & Control System
- High Stiffness Frame
- Static: Tension, Compression, Flexure, Shear



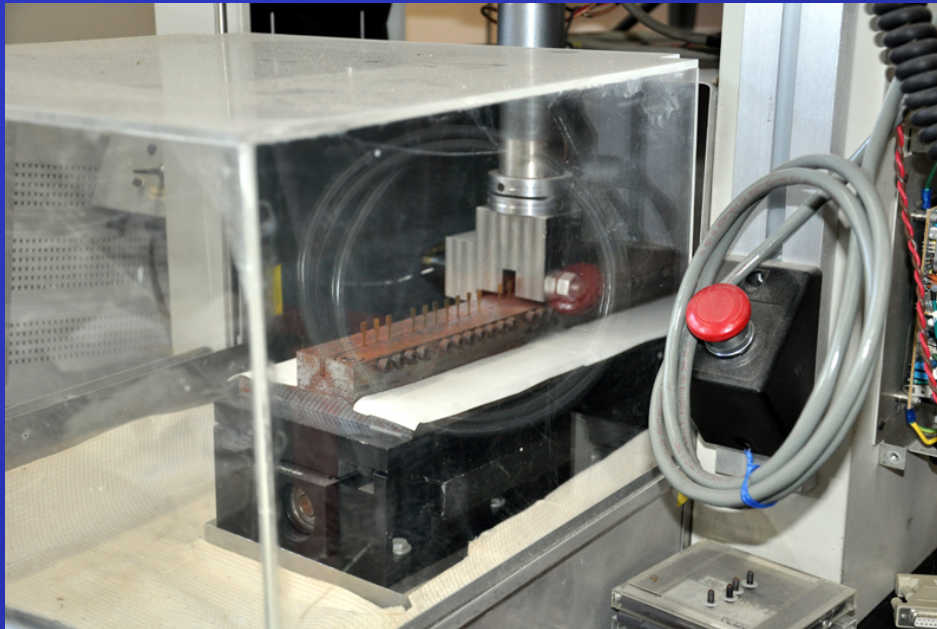
UCSB High-Strain Test Machine

- Load Ranges: 2 N, 5N, 10N, 20N, 50N
- Displacement Rate: < 0.5 mm/min to 500 mm/min
- Micro-stepper motor controlled
- Full computer control with custom UCSB-developed software
- Full Travel: 450 mm
- Allowance for thermal chamber, laser extensometry, photo-elasticity and digital image correlation



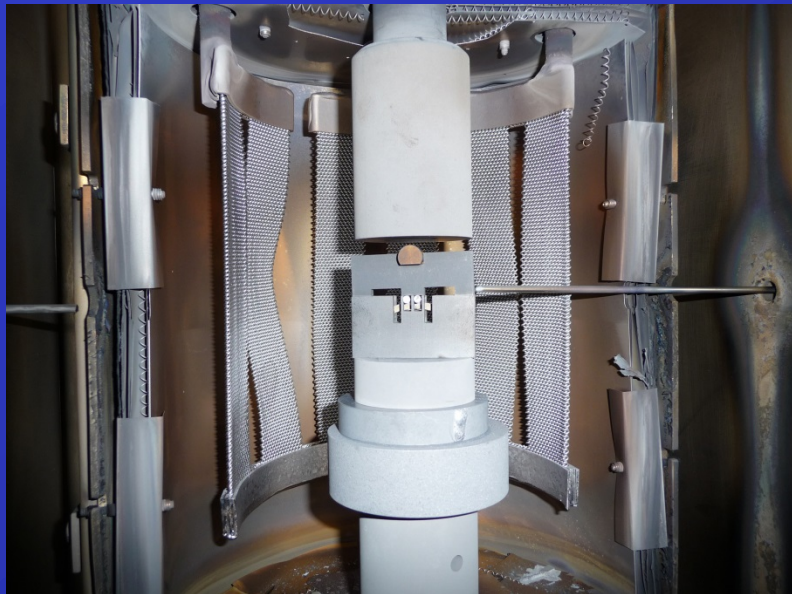
Instron 4422 Universal Test Machine

- 1000 lbs (22 kN) Axial
- 48 in (1.5 m) Axial Displacement
- 8 Channel Computer Data Acq. & Control System
- Static: Tension, Compression, Flexure, Shear
- Automated Tensile Testing



Centorr Hot Press

- 2000C High Vacuum / Inert Environment
- 750 lbs. (3.3 kN) Axial Load (Non-sensing)
- 6 in. (150 mm) Dia. X 8 in. (200 mm) long Hot Zone
- Optional instrumentation (load, displacement)
- One quartz window (1/4" dia.)



Fiber / Fiber Bundle Tester

- Load Ranges: 2 N, 5N, 10N, 20N, 50N
- Displacement Rate: < 0.5 mm/min to 500 mm/min
- Micro-stepper motor controlled
- Full computer control with custom UCSB-developed software
- Full Travel: 127 mm
- Allowance for thermal chamber, laser extensometry, photo-elasticity and digital image correlation



In-Situ Microscopy Tensile Stage

- 1000 lbs (4500 N) Axial
- 0.5 in (12.7 mm) Axial Displacement
- 2 Channel Computer Data Acq. & Control System
- Static: Tension



MTS 22-kip S.H. Load Frame

- 20,000 lbs (100 kN) Axial
- +/- 5.0 in (127 mm) Axial Displacement
- 8 Channel Computer Data Acq. & Control System
- High Rate Capability
- Static: Tension, Compression, Flexure, Shear
- Fatigue: Tension, Compression, Flexure, Shear
- High Temp., Air: ~1000C
- Thermo-Mechanical Fatigue



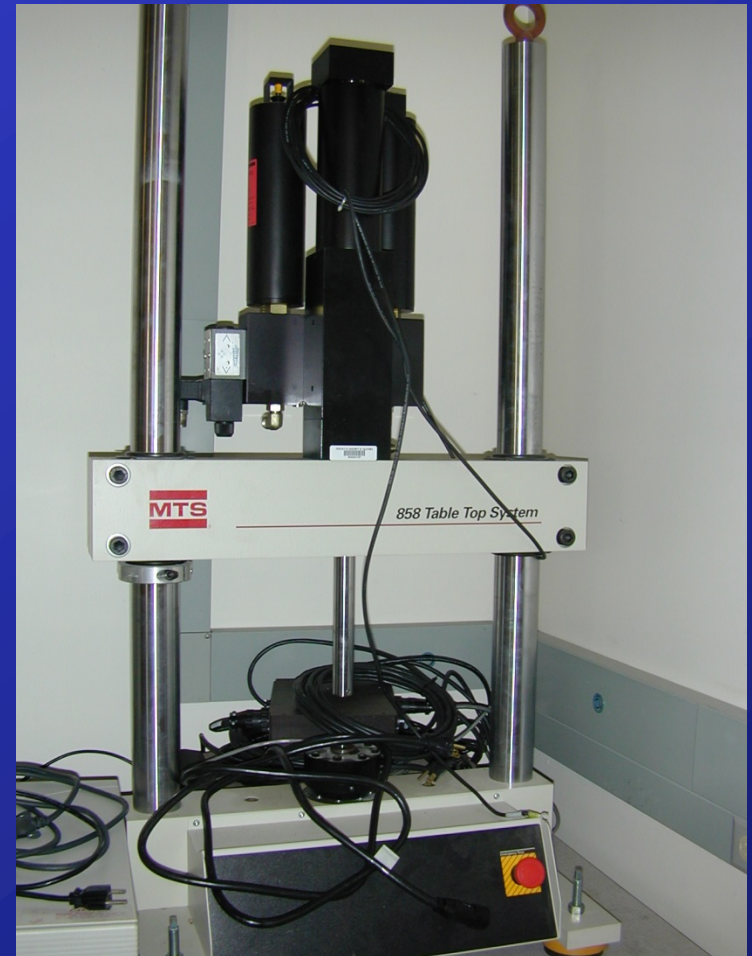
MTS 22-kip S.H. Load Frame

- 20,000 lbs (100 kN) Axial
- +/- 5.0 in (127 mm) Axial Displacement
- 8 Channel Computer Data Acq. & Control System
- Static: Tension, Compression, Flexure, Shear
- Fatigue: Tension, Compression, Flexure, Shear
- Fracture (SEB, CT, DCT, etc.), Low Temp. (-196C)
- Irradiated Materials Work



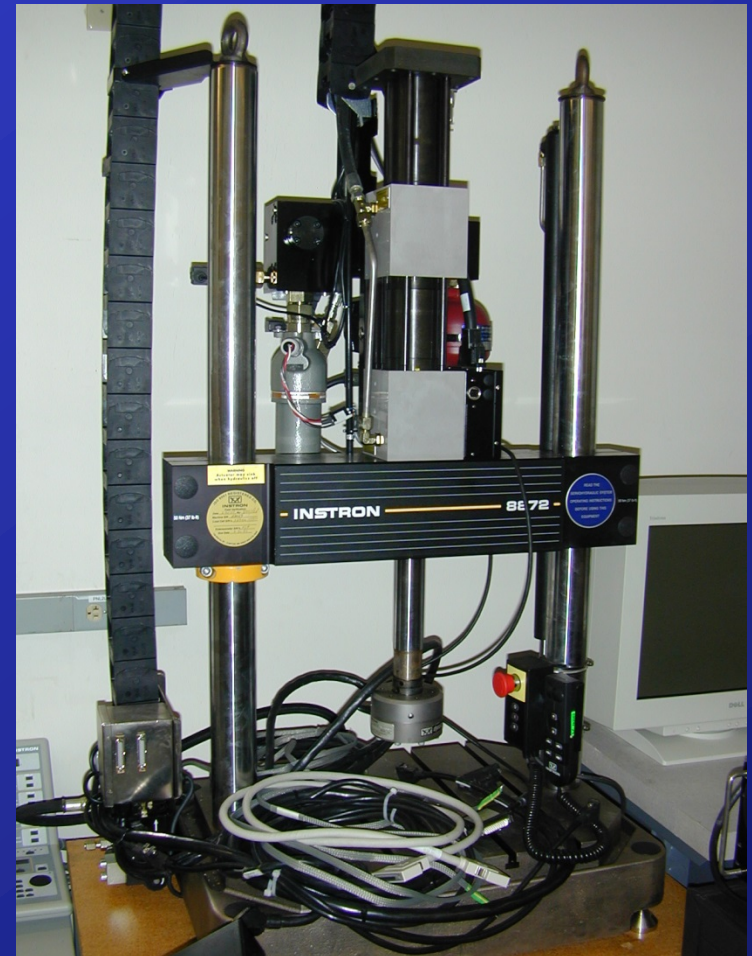
MTS 858 S.H. Test Frame

- 5000 lbs (22 kN) Axial
- +/- 4.0 in (100 mm) Axial Displacement
- No Computer Data Acq. / Control System
- High Frequencies ~100 – 250 Hz
- Static: Tension, Compression, Flexure, Shear
- Fatigue: Tension, Compression, Flexure, Shear
- No computer data acq. & control system



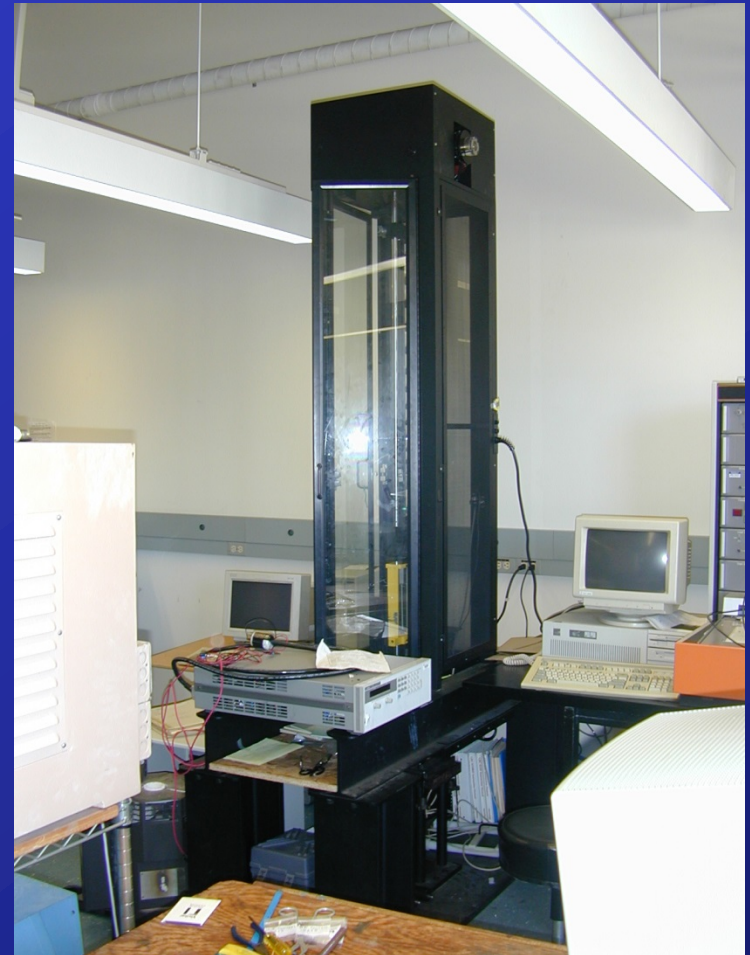
Instron 8872 S.H. Test Frame

- 5000 lbs (22 kN) Axial
- +/- 4.0 in (100 mm) Axial Displacement
- No Computer Data Acq. & Control System
- T-slotted Table for Fixturing / Accessories
- Static: Tension, Compression, Flexure, Shear
- Fatigue: Tension, Compression, Flexure, Shear



Dynatup 8210 Instrumented Drop Tower

- 50 lbs. (200 N) Max. Drop Weight
- 36 in. (1.0 m) Max. Drop Height
- 2 Channel Computer Data Acq. & Control System
- Dynamic: Fixturing limited to flat panels and some flexure



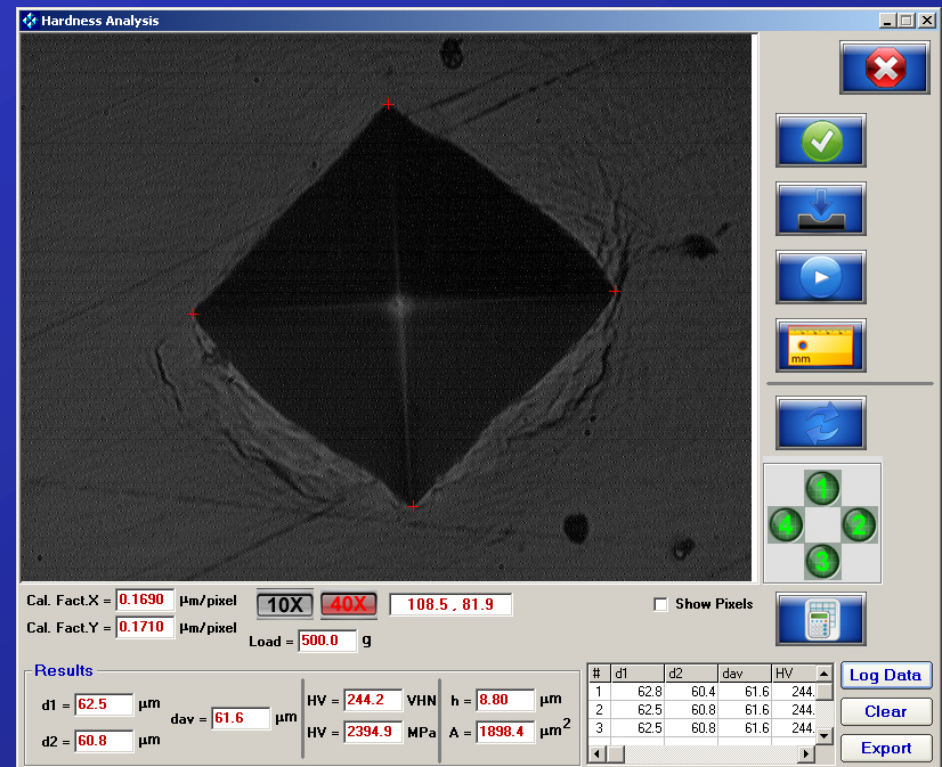
UCSB Instrumented Drop Tower

- 220 lbs. (1000 N) Max. Drop Weight
- 60 in. (1.7 m) Max. Drop Height
- 2 Channel Computer Data Acq. & Control System
- Dynamic: Fixturing limited to Charpy-type impact specimens

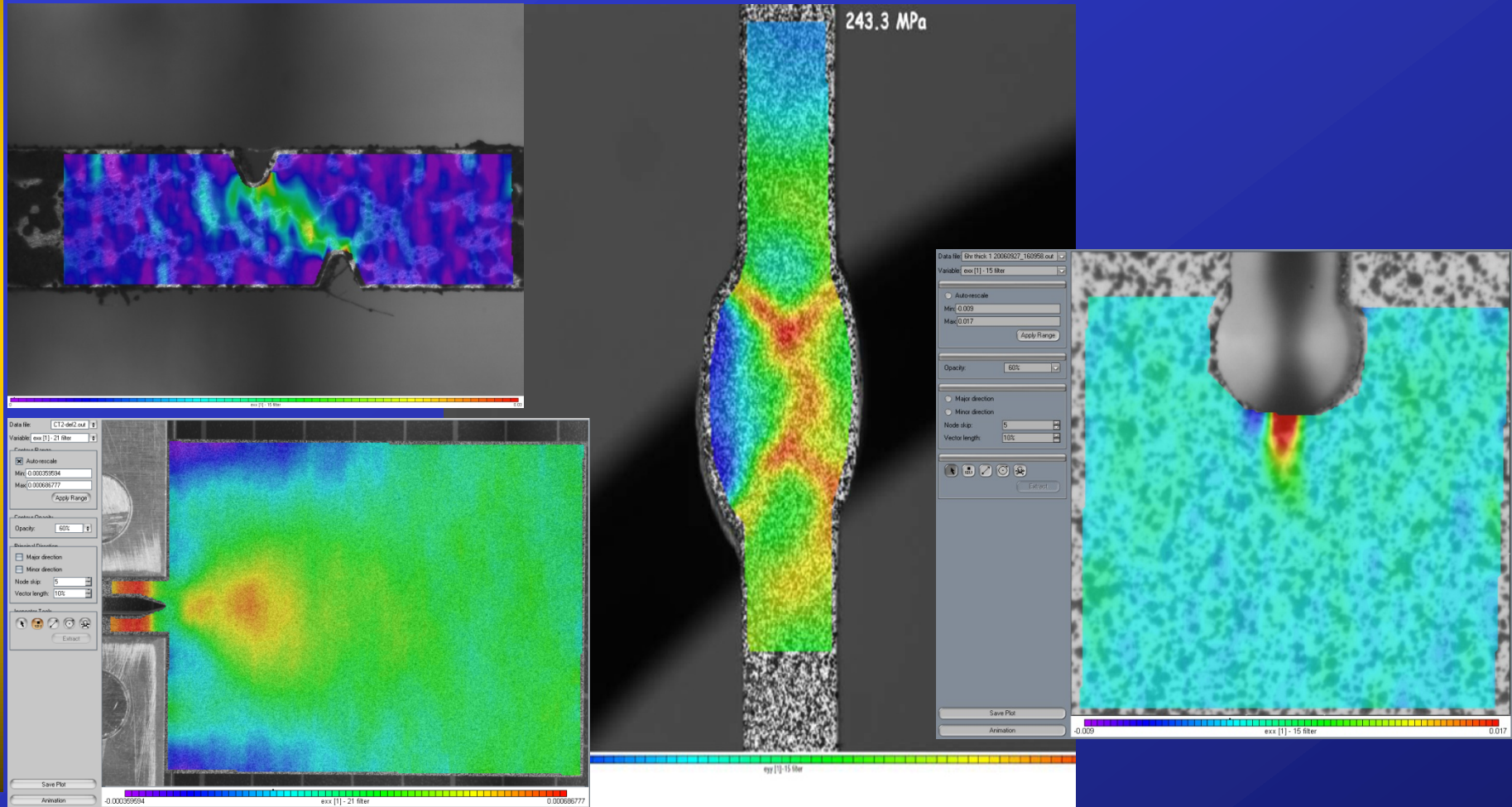


Micro-Hardness Testers

- **Zwick 3212**
 - 200 grams – 20 kg Load
 - Integrated Positioning Stages
 - Vickers and Knoop Hardness, Flaw Initiation
- **Leco**
 - 50 – 1000 grams Load
 - Fully Automated Positioning and Indentation
 - Computer Imaging and Positioning System
 - Vickers and Knoop Hardness
 - Irradiated Materials Work

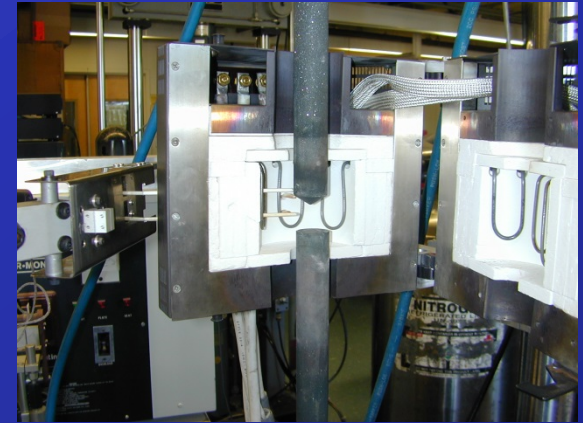


2D & 3D Dig. Image Correlation Systems



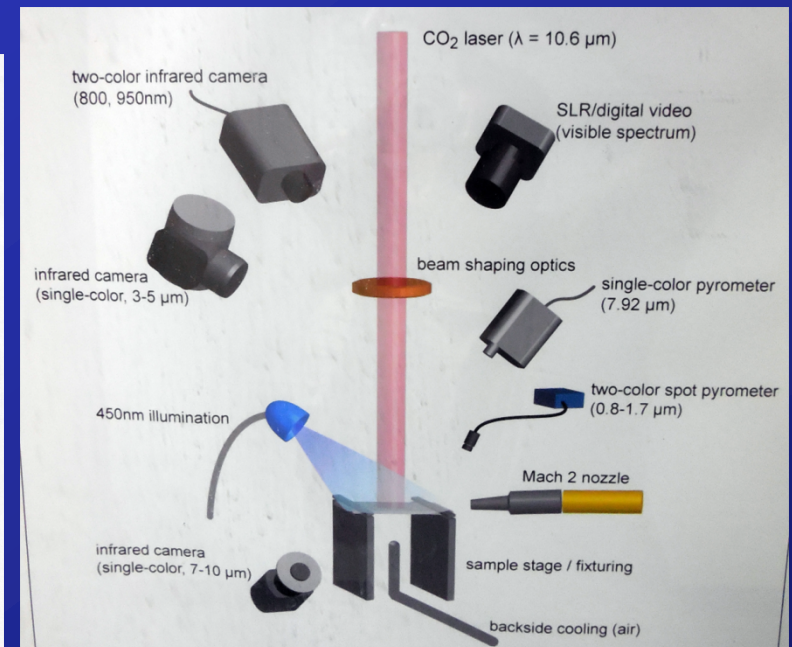
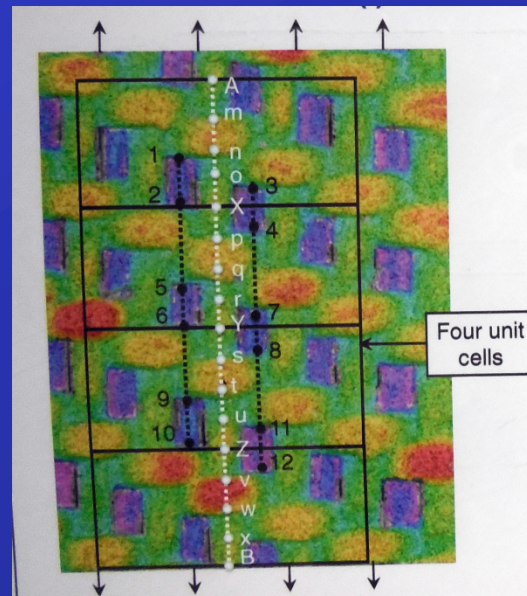
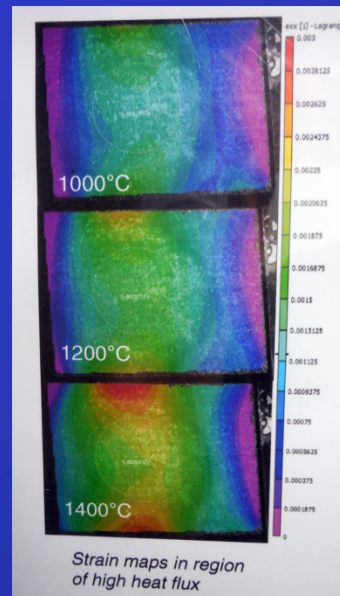
Auxiliary Equipment

- Hydraulic Wedge Grips (22-kip and 5-kip)
- Bend Fixturing (25 mm to 300 mm spans)
- Iosopescu Shear Fixture
- Shear Punch Fixture
- Wedge Fracture Fixture
- Load Cells down to 5 N
- Contacting Extensometers and COD Gages
- Laser Extensometers
- Contacting Deflection Gages
- Strain Gage Amplifiers
- Crack Detection (Gage) System
- Acoustic Emission System
- Binocular and Compound Microscopes
- CCD Cameras and Lenses
- Questar Long-Distance Microscope with 3-Axis Positioning System
- MTS High-Temperature Extensometers
- High Voltage (10-20 kV) Amplifiers



High-Power Laser Thermal Loading

- 2.0 kW CO₂ Laser with Shaping Optics
- High Heat Flux Loading for CMC's
- Flexure and Biaxial Flexure Loading
- Mach 2 Gas Nozzle for Erosion Testing
- High Temperature DIC using UCSB-developed imaging



Hysitron Triboindenter

- Loads to 10 mN Z
- Loads to 10 mN X and Z (Scratch, Wear, Friction)
- Loads to 1 N (Fiber Push-out)
- 2 nN Noise Floor
- SPM Imaging
- Hot and Cold Stage
- Acoustic Emission Tip Assembly
- Fully Automated
- Hardness and Reduced Modulus Mapping



UCSB Ballistics Lab

- Dynamic Loading of Materials and Structures
- “Small” Light Gas Gun
 - 1.75” Bore
 - 16-foot Barrel
 - Double-Diaphragm Breech
 - 1000 m/sec with Aluminum Foam Projectiles
 - 600 m/sec with Aluminum and Nylon Projectiles
- “Big” Light Gas Gun
 - Two-Stage Design
 - 0.200” Diameter Projectiles
 - 20 mm Sabot
 - 4.0 km/sec
 - Vacuum Catch Chamber
- High Speed Imaging
 - Imacon 200 (200 M-Frames/sec) Framing Camera
 - Phantom H.S. Video Camera

