



SNL Joining Capabilities

Sandia National Laboratories

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Joining at SNL

- **Materials Science and Engineering (1800)**
 - 1813 Joining & Coating Dept (mgr: Mike Hosking)
 - 1824 Microsystem Materials (mgr: Jon Custer)
- **Manufacturing Science and Technology Center (2400)**
 - 2430 Manufacturing Enterprise
 - 2450 Manufacturing Process Science and Technology
- **Other Centers**
 - Microsystems Science, Technology & Components (1700)
 - Responsive Neutron Generator Product Deployment (2700)
 - Energetic Components Realization (2500)
 - Includes battery, explosive components groups



Joining & Coating 1813, Mike Hosking, Mgr.
Microsystems Materials 1824, Jon Custer, Mgr.

Welding staff:

Charlie Robino
Jerry Knorovsky
Jerome Norris

Brazing/Soldering staff:

Paul Vianco (1824)
Don Susan (1813)
Brad Boyce (1824)

Technologists:

Danny MacCallum
Mark Reece
Peter Duran

Jerry Rejent (1824)
Mark Grazier (1824)



Weld Process Capabilities

- **Laser joining (weld, braze, solder)**
- **Laser thermal processing (heat treat, glaze, cut, drill)**
- **Arc welding (GTAW, PAW, GMAW, Percussive, Stud)**
- **Resistance Spot Welding**
- **Electron Beam Welding**
- **Ultrasonic Welding**
- **Friction Welding* (conventional and stir**)**
- **Upset Welding***
- **Many soldering procedures (reflow, wave, resistance, IR, manual, etc.)**
- **Exotic matls. joining (Ni, Co, Ti, Ta, Mo-base, etc.)**
- **Ceramic to metal brazing (conventional & active alloys)**



Diagnostic Capabilities

- **Varestraint weldability testing**
- **Gleeble thermal-mechanical simulator**
- **Weld calorimetry**
- **High speed, variable magnification video (record dendrites growing, cracks cracking)**
- **Data acquisition systems**
- **Laser beam diagnostic tools**
- **Digital Image Correlation full-field strain measurement**
- **Holography**
- **ESPI strain measurement capability**
- **Solderability (meniscograph, meniscometer)**
- **ASTM F19 Braze Test (strength & hermeticity)**



Ancillary Capabilities

- Complete metallography lab
- State-of-the-art electron/ion microscopy facilities
- SOTA chemical analysis capabilities
- SOTA mechanical test capabilities (nano-to-macro, very slow-to-very fast, fatigue, impact, fracture toughness, wear, hardness)
- Arc button melter (produces small amounts of specialty alloy compositions)
- Robotic, CNC stage manipulators
- SOTA thermal, structural, material modeling (massively parallel Tflop computers, MD, level sets, FEM, meshless, Lattice Boltzman, CA, etc.)
- Thermal spray of metals and ceramic coatings



Recent Projects

- **Commercialization of Gd-containing alloy for nuclear waste storage**
- **Analysis of Ta alloy weld cracking**
- **DIC measurement of dissimilar weld strain fields**
- **HS video of keyhole laser welds**
- **Calorimetry of absorbed/reflected laser energy in keyhole welds**
- **Laser scabbling of concrete**
- **Effect of process parameters on porosity in LBW**
- **Pb-free solder characterization & qualification**
- **Active braze alloy development & qualification for production**



More Projects

- **Laser Ultrasonic NDE**
- **Lead-free solders**
- **Growth of Sn whiskers**
- **Thermal fatigue of solders**
- **Welding of glass, glass-ceramic, brazed ceramic connectors**
- **Analysis of shear test results**
- **Specification of stainless steel composition for weld critical applications, glass-to-metal seals**
- **Diagnostic method for determining resistance projection weld quality**



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