

CRYOGENIC HEATING STAGE

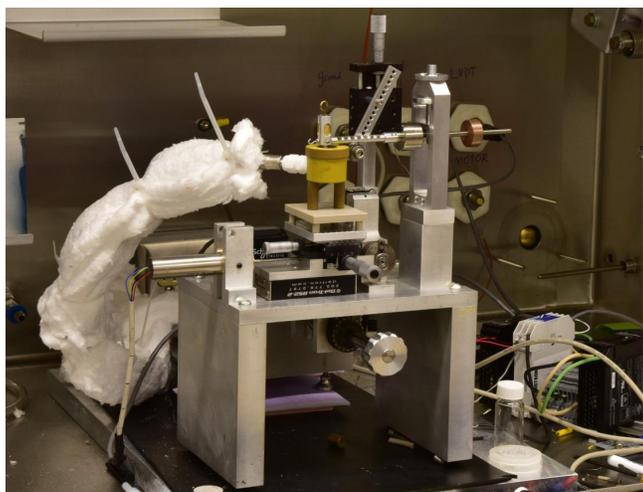
Patent Pending

Technology Readiness Level: 5

Key elements demonstrated in relevant environment

Extreme temperatures are vital to scientific and industrial processes such as cryogenics, metallurgy, tempering, and tribology. However, sciences and processes such as these are inherently dangerous. Furthermore, experimenting with extreme high and low temperatures can be difficult due to lack of accuracy and efficiency. To address these issues, engineers at Sandia have developed the In-Situ Cryogenic Moderate Temperature Controlled Rapid Aging Heater (Cryogenic Heating Stage) to incorporate extreme temperatures into experiments.

The Cryogenic Heating Stage employs a cryogenic liquid inert gas supply to heat/cool a test coupon between -200°C and 200°C without contacting the sample by directing a stream of gas onto the back of the sample. The heating stage uses commercially available tube gas heaters (totaling 1900



Sandia's Cryogenic Heating Stage

watts) controlled by a series of custom control boxes implementing advanced temperature process PID controllers with an accuracy of $\pm 0.5^{\circ}\text{C}$, and emergency over-temperature shutoff systems. The heating system connects to a custom made modular insulating coupon holder made of Torlon plastic that is mounted on a friction testing system inside a controlled atmospheric chamber. The heating stage can also be hooked up to a room temperature inert gas supply and provide temperatures up to 540°C .

The stage rests inside a sealed glove-box, allowing the user to safely run tests without contacting the sample. Our specially designed control box efficiently regulate dangerous temperatures needed for experimentation while simultaneously providing the utmost accuracy. The

control box counteracts the dangers of working with high-low temperature extremes by incorporating emergency over-temperature shutoff systems.

Sandia's Cryogenic Heating Stage provides researchers with a safe, efficient, and accurate way to incorporate extreme temperatures into their experiments and processes.

TECHNICAL BENEFITS

- Increased accuracy
- Increased efficiency
- Cost efficient (uses commercially available components/attachments)
- Provides high and low temperature extremes in a safe testing environment

INDUSTRIES & APPLICATIONS

- Experiments requiring high range temperature variations
- Cryogenics
- Tribology
- Thermal Management

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