



NRIC

National Reactor
Innovation Center

INL Creep Testing Capabilities

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7/9/2024



INL Creep Testing Capabilities

Motivation – Advanced Reactors

- Developing, emerging, and nascent advanced reactor technologies involve new materials, manufacturing methods
- Extreme operating conditions
- In some cases, material service life needs to be defined or reassessed





INL Creep Testing Capabilities

Creep Testing Challenges

- Test duration
- Floorspace
- Environmental stability
- Radiological hazards

...all of the above can influence sample throughput, data generation

INL Creep Testing Capabilities

Facilities – Materials and Fuels Complex

- 3x full-size thermal creep frames
 - Housed in Research Collaboration Building (currently)
 - Non-radiological (currently)
 - Air testing to 1000°C
 - 20:1 lever ratio producing up to 10000 lbf load
 - Direct load and automated hot step load capable
- Research focus: DOE Office of Science basic science study of creep behavior in Ni-base high entropy alloys



INL Creep Testing Capabilities

Facilities – INL Research Center (REC-603)

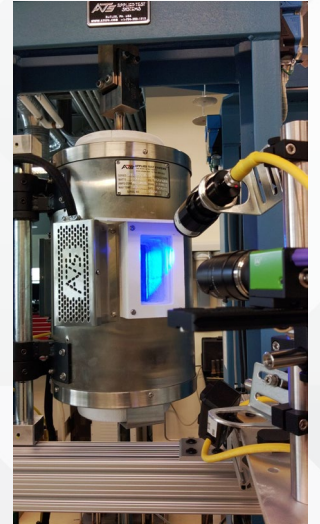
- 18x creep frames studying general creep behavior, notch strengthening under creep loading
 - Long-term tests (up to 13 years) in progress
 - Data acquisition systems being upgraded
- 2x creep frames equipped for stress relaxation measurements, 1200°C capable
- Creep rupture frames
- Research focus: ART/AMMT (gas-cooled reactors, fast reactors, microreactors), concentrated solar, fossil energy



INL Creep Testing Capabilities

Facilities – Energy Innovation Lab

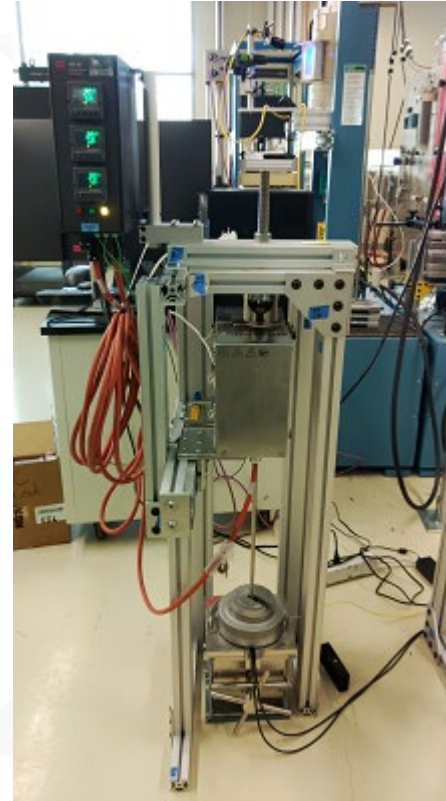
- 10x full-size thermal creep frames
 - Parallel loading capability; digital imaging correlation (DIC) analysis
- 3x subsize creep frames
 - Ongoing non-irradiated materials testing
- Research focus: ART/AMMT (gas-cooled reactors, fast reactors, microreactors), concentrated solar, fossil energy



INL Creep Testing Capabilities

Subsize Creep Frames

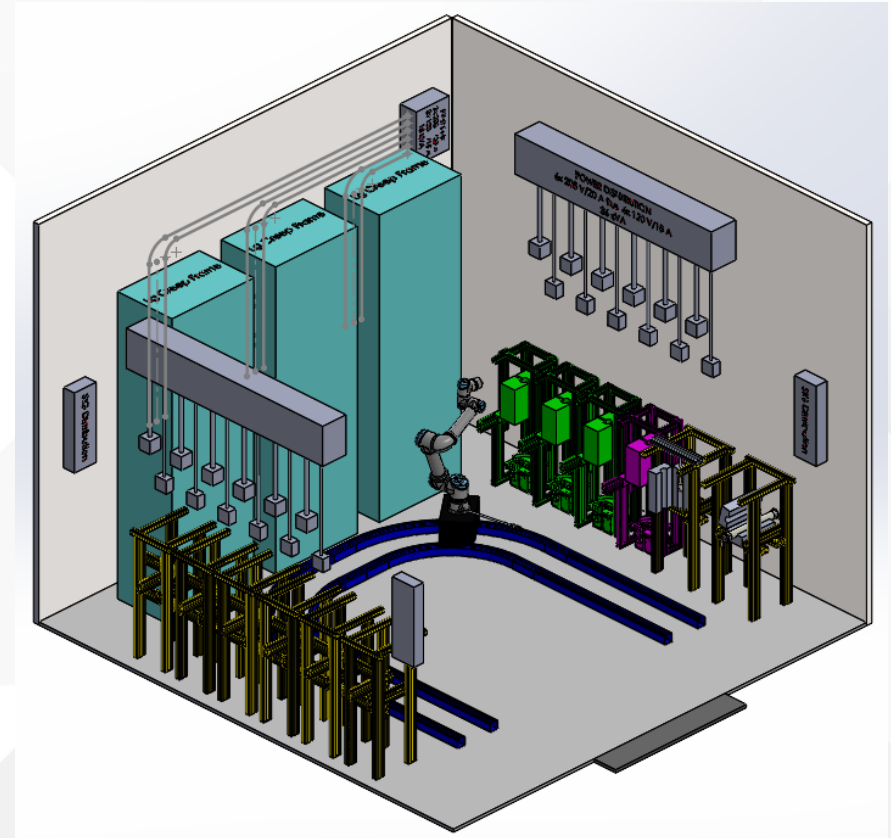
- NRIC-directed work scope
- Developed and built FY20-22
- Validation testing concluded FY22
- Focus on subsize tensile specimens (e.g., SSJ-3)
- Address several challenges for rad material testing: source term, floorspace/structural loading, replicates



INL Creep Testing Capabilities

Future Possibilities

- New facility coming online at MFC: SPL
 - Experimental Test Beds (flexible floorspace)
 - Robotic/remotized handling
 - One-stop-shop: from raw material receipt through characterization and disposition of tested specimens
- Experienced research staff and diverse engineering capabilities across the Laboratory, readiness to collaborate where possible
 - Ex. develop novel test capabilities, new test environments, revisit NFML samples





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