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INL Creep Testing Capabilities

January 2025

Ryan Alexander Bouffioux

Changing the World's Energy Future

Idaho National Laboratory

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Idaho National Laboratory
Idaho Falls, Idaho 83415

http://www.inl.gov

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NRIC National Reactor Innovation Center

INL Creep Testing Capabilities

Ryan Bouffioux, Materials Engineer, BEA/INL

1/2/2025

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

Faculties – 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

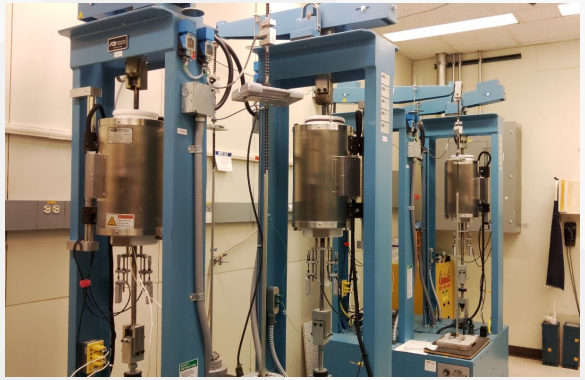
- Research focus: DOE Office of Science basic science study of creep behavior in Ni-base high entropy alloys

INL Creep Testing Capabilities

Faculties – 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

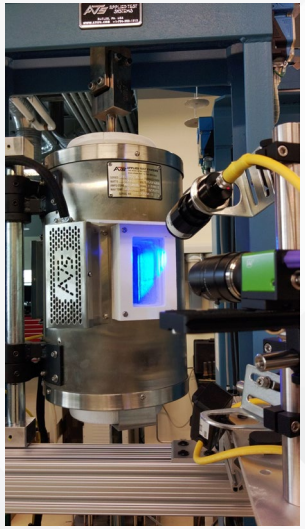


INL Creep Testing Capabilities

Faculties – 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

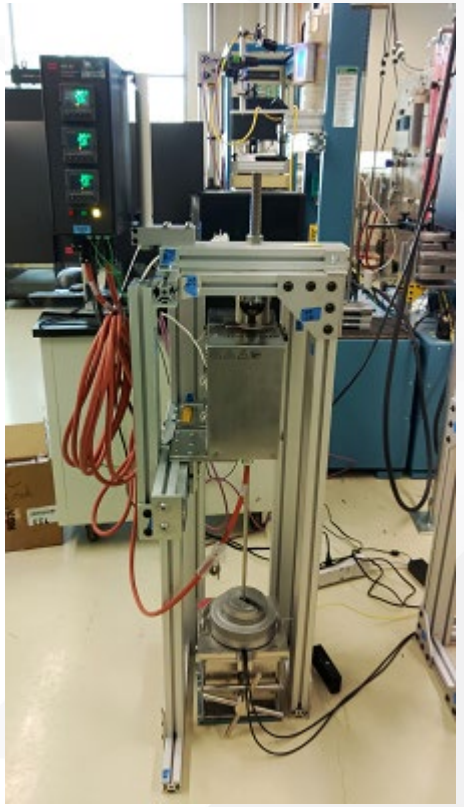
- Research focus: ART/AMMT (gas-cooled reactors, fast reactors, microreactors), concentrated solar, fossil energy

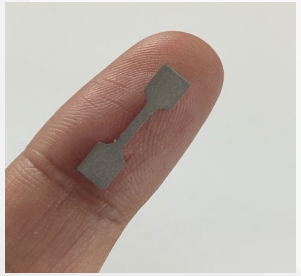


INL Creep Testing Capabilities

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

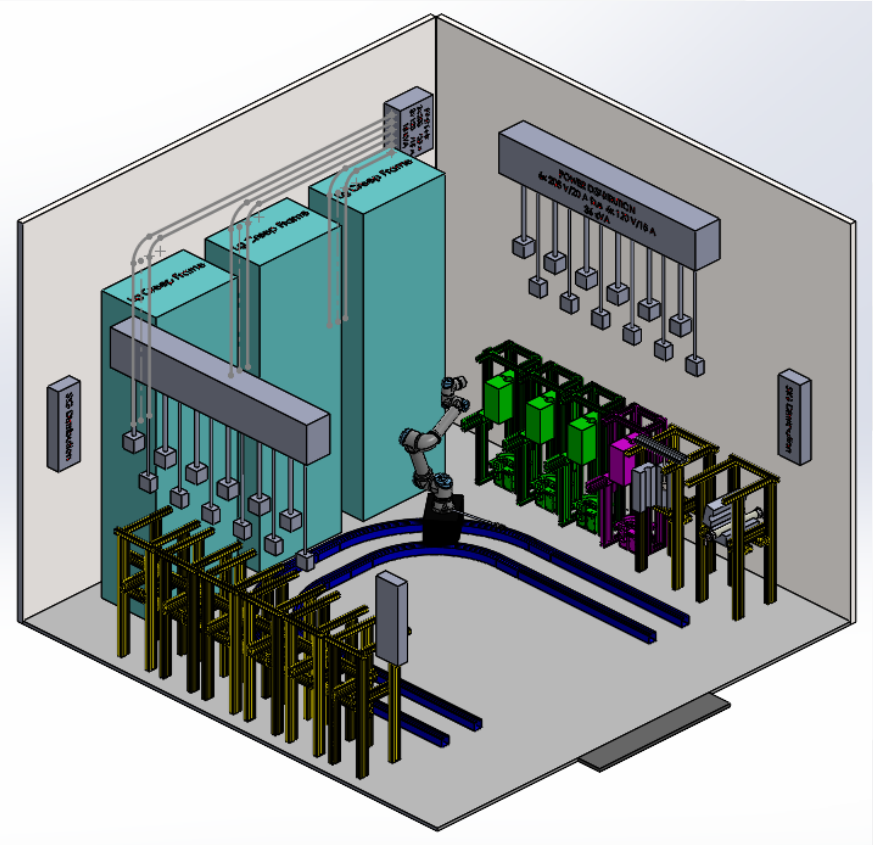




INL Creep Testing Capabilities

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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