PIE Status at Westinghouse
2026 NSUF Annual Program Review

Catou Cmar
Principal Materials Engineer
NSUF Technical Lead

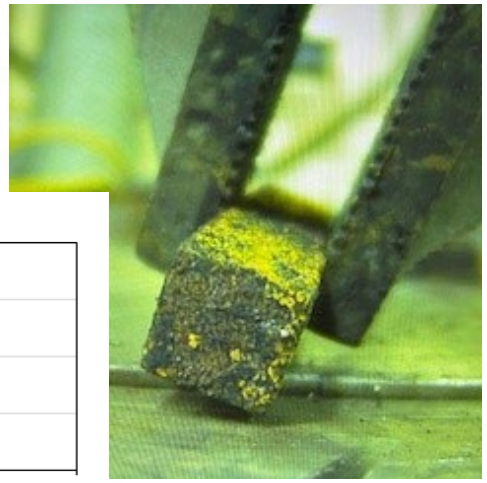
Overview

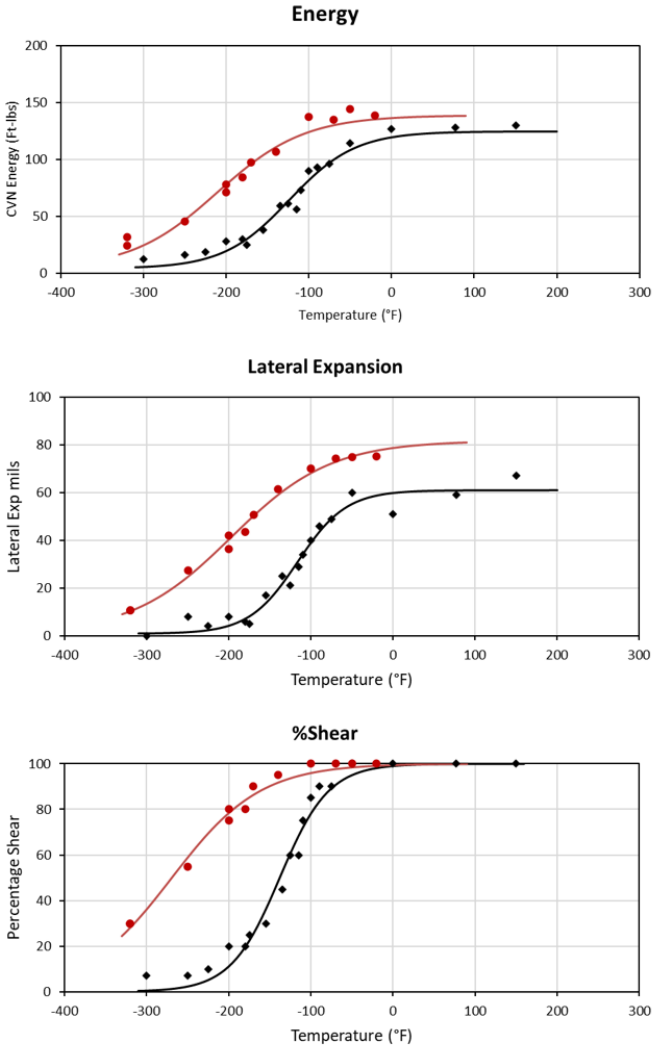
- PIE Status of NSUF Recent / Ongoing Projects at Churchill
  - CINR 19-16297 FINESSE
  - CINR 19-16547 NuScale
  - CINR 24-31388 Joe Wall
  - Super RTE 24-5069 Laser Welding
  - Super RTE 24-5016 Tim Lach
  - Super RTE 24-5082 Todd Palmer
  - RTE 24-5130 IPP PZR

CINR 19-16547 NuScale

NuScale SMR Materials Irradiation and Testing

PI: Dr. Hongqing Xu





F6NM BM Heat 1

TS1W01

- Low temperature irradiation embrittlement data for base metal, weld metal, and HAZ material from SA-508 Grade 3 Class 2 weldments and Code Case N-774 Grade F6NM
- WEC's role
  - Inventoried 216 CVN and 24 tensile specimens (HLC)
  - SA-508 corrosion removal (M cell)
    - IDs were not legible
    - Samples did not fit in CVN holder and loader
    - POR-15
    - Sample IDs: **stamped** vs laser
  - Tested SA-508 CVNs (LLC)
  - Tested both SA-508 and F6NM tensiles (LLC)
  - Testing F6NM samples in progress (LLC)
    - - 316°F
  - Final Report due in September

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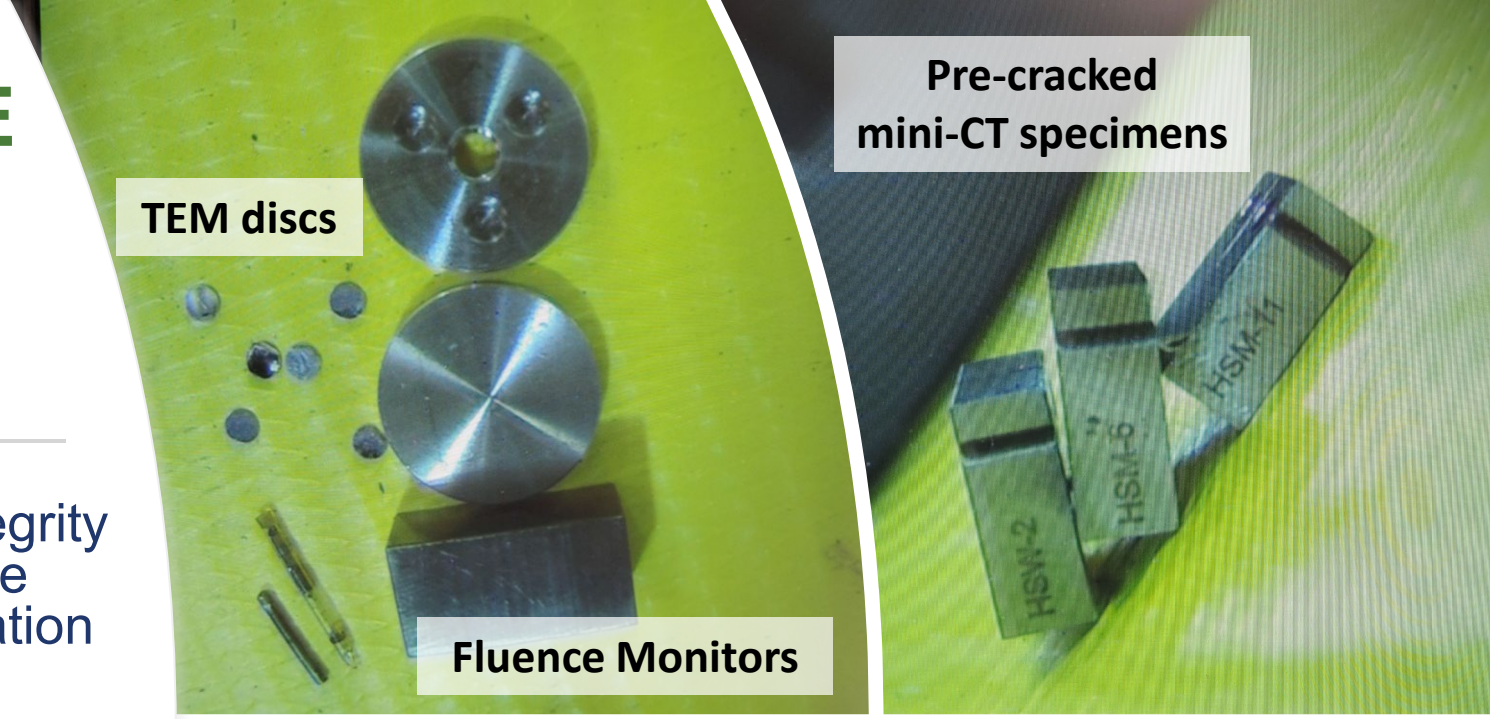
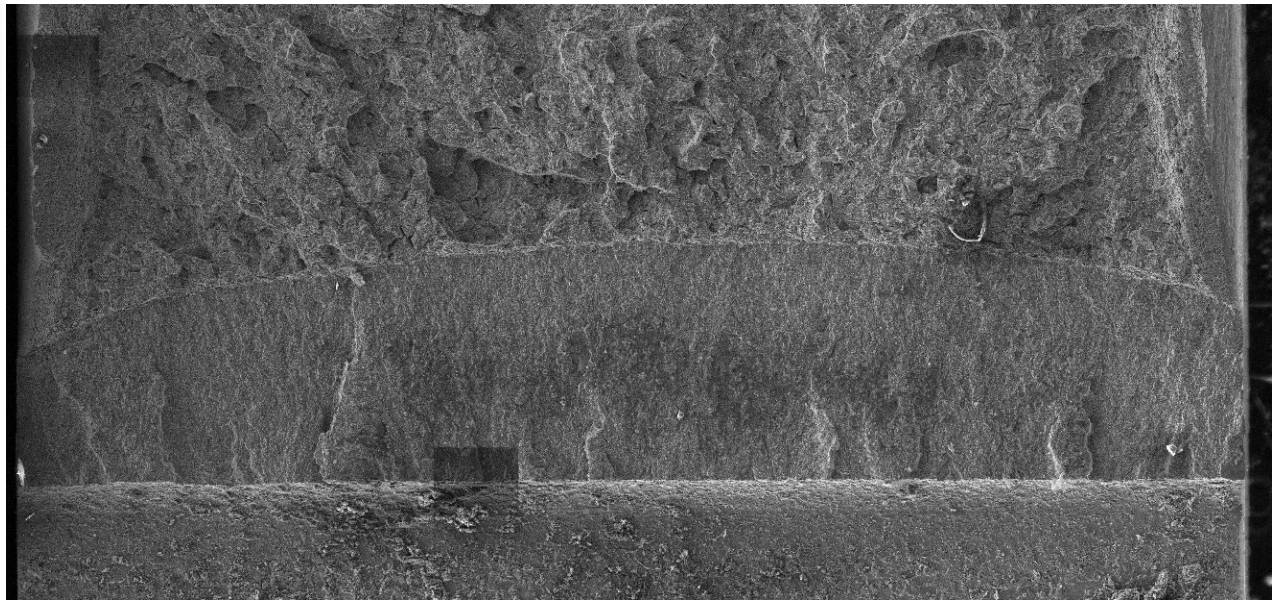
CINR 19-16297 FINESSE

Irradiation Studies on Electron Beam Welded PM-HIP Pressure Vessel Steel

PI: Dr. Janelle Wharry



- Assess the structural and mechanical integrity of electron beam welded PM-HIP pressure vessel steel under service-relevant irradiation
- WEC's role:
  - Opened and inventoried 5 capsules (HLC)
    - New capsule design
  - Tested 110 mini-CT specimens (LLC)
    - 10 different conditions
    - T0
  - Fractography of 30 tested mini-CTs (Shielded SEM)
    - Initiation sites
  - Final report for fracture toughness and fractography delivered in March
  - Shipped 2 of the 10 TEM specimens per condition
  - Shipment planned for June for fluence monitors to PNNL



HSM7 (-45°F / -43°C)

Super RTE 24-5069 Laser Welding

Influence of laser welding on deformation mechanisms in irradiated and weld-repaired Ni-Cr alloys

PI: Matthew Swenson

University of Idaho

- Understand whether the favorable mechanical and irradiation resistance properties in the Ni-Cr alloys can be maintained during the laser welding process
- WEC's role:
  - Receipt of broken tensiles and decon of alpha contamination (HLC)
  - Prep the samples to be welded (HLC)
  - Laser weld samples (A cell)
    - Unirradiated Alloy 625 stock material for weld parameterization
    - Unirradiated Forged and PM-HIP Alloy 625 for welding and follow-on proton irradiation
    - ~0.7 dpa Irradiated Forged and PM-HIP Alloy 625
  - Cross-sectioned and metallographic mounts prepared

Super RTE 24-5016

Detailed characterization of in-service IASCC in 316 and 347 stainless steel baffle-former bolts

PI: Timothy Lach

OAK RIDGE National Laboratory

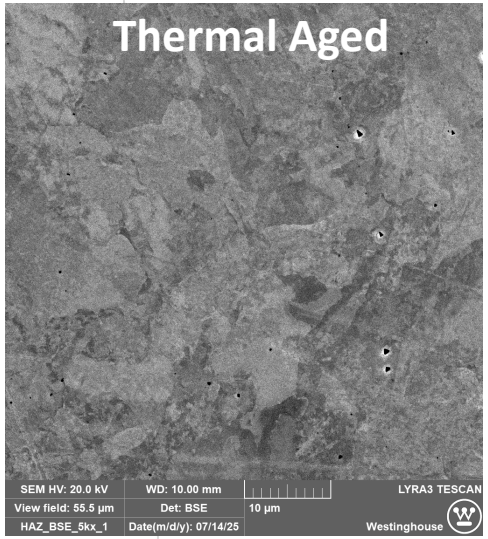
- Assess the mechanisms for initiation and development of IASCC in austenitic stainless steel internal components harvested from commercial PWRs by characterizing surface oxides
- WEC's role:
  - Retrieve samples from storage
  - Sample preparation (HLC)
    - Specific region of interest
  - Ship samples to ORNL for analysis

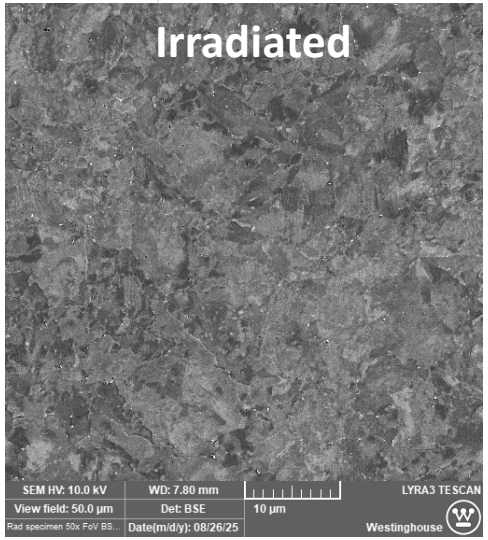
RTE 24-5130 IPP PZR

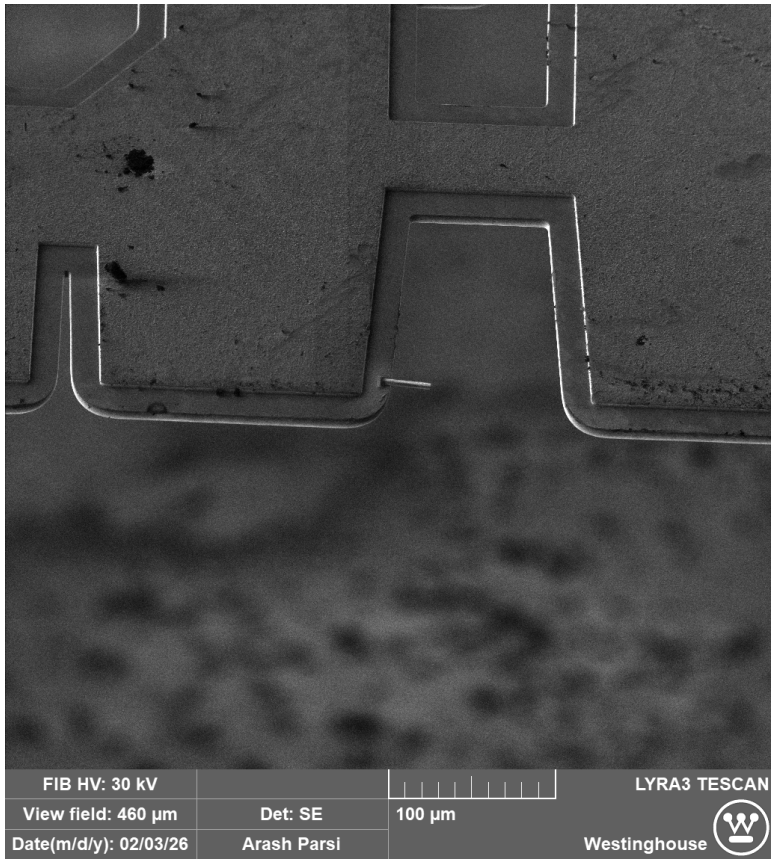
Unveiling Long-Term Irradiation and Thermal Aging Effects on Solute Segregation in Commercial Reactor Pressure Boundary Material

PI: Caleb Clement

- Determine if segregation and clustering behavior directly correlate to impurity content, grain character, and fluence, and to evaluate if the neutron-irradiated coarse grain HAZ will have the greatest extent of segregation
- WEC's role
  - Donated samples to the NFML
    - Surveillance capsule and IPP PZR material
  - Sample preparation
    - FIB lamella for APT analysis at INL







CINR 24-31388

Nondestructive Evaluation of Fracture Properties in Irradiated Light Water Reactor Pressure Vessel Steels

PI: Joe Wall

- Retrieved archive material from surveillance capsules
- Hosted vendor and EPRI and collaborated with Churchill technicians for in-cell measurements
- Ultrasonic measurements completed
- 3MA magnetic measurements in Q4

Super RTE 24-5082 Todd Palmer

Interactions between Neutron Irradiation and Oxide Based Inclusions in Additively Manufactured Austenitic Stainless Steels

PI: Todd Palmer

- Sample Preparation
  - Irradiated TEM Discs
  - Donated samples prepared to the NFML
- Performed QC of samples
- Samples to be shipped to INL for analysis

Questions?

- Thank you for your time and attention
- Catherine (Catou) Cmar
  - cmarcr@westinghouse.com
  - 412-256-1686

Backup Info

- FINESSE

Capsule – Top/Bottom	Process	Region	Heat Treat	# of CTs for fracture testing	# of CTs for fractography
1-Bottom	PM-HIP	Base	none	10	3
2-Bottom	PM-HIP	Centerline	PWHT	10	3
5-Bottom	PM-HIP	HAZ	PWHT	10	3
2-Top	PM-HIP	Base	PWHT	10	3
3-Bottom	PM-HIP	Base	SQNT	10	3
3-Top	PM-HIP	Centerline	SQNT	10	3
1-Top	PM-HIP	HAZ	SQNT	10	3
4-Top	Forging	Base	PWHT	10	3
4-Bottom	Forging	Centerline	PWHT	10	3
5-Top	Forging	HAZ	PWHT	10	3
	TOTAL			**100**	**30**