ALLOY 690/52/152 THERMAL AGING: NRC PLANS AND ACTIVITIES

EPRI Alloy 690/52/152 PWSCC Research Collaboration Meeting

Nov 29 – Dec. 2, 2022

POC: Eric Focht, NRC

INTRODUCTION

- NRC Alloy 690/52/152 PWSCC CGR Testing Program
  - NRC-sponsored testing at PNNL and ANL completed in 2020
  - Expert Panel identified thermal aging as a potential PWSCC accelerator
    - Long-range ordering (LRO) or other hardening mechanism (e.g., short-range ordering, carbide precipitation)
- NRR requested plan to address thermal aging of Alloy 690/52/152
  - Literature review by PNNL
  - Plan by RES

BACKGROUND: ALLOY 690/52/152 THERMAL AGING

- Thermal aging effects detection
  - Direct: TEM, XRD
  - Indirect: hardness, resistivity
    - For example, increased hardness may be indicative of LRO => increased PWSCC susceptibility
- Potential aging mechanisms
  - LRO, SRO
  - Carbide precipitation
  - Hardening near fusion boundaries
- Hardness increases detected in commercially representative Alloy 690
  - VTT (Finland), Oregon State University, ANL
  - Very limited PWSCC CGR testing on thermally aged materials

PLAN TO ADDRESS ALLOY 690/52/152 THERMAL AGING

- PWSCC susceptibility is the primary concern
  - LRO significantly increases PWSCC susceptibility
  - Other aging mechanisms might be operating
  - Very limited PWSCC CGR testing on thermally aged materials

Cooperation	Service-aged materials	Laboratory-aged materials
DOE EPRI Universities (e.g., Ore. State U.)	Harvested components (e.g., Ringhals CRDM nozzles and SGT)	Materials aged during PWSCC initiation project Continue aging service-aged materials Materials aged by others (e.g., ANL, universities)

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- Cooperation
  - DOE, EPRI
  - Universities (e.g., Ore. State U.)
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  - Harvested components
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CURRENT ACTIVITIES

- ANL research
  - Evaluate furnace-aged Alloy 690/152/LAS weldment
  - Evaluate autoclave-aged CRDM Alloy 690 HAZ
  - Hardness, XRD
- Attempting to acquire Ringhals 2 CRDM and SGT materials
  - Service-aged materials
  - No solid plan, yet. Focusing to obtaining materials first.
- Alloy 690/52/152 PWSCC initiation testing specimen evaluations.
  - Hardness testing, FIB trenching to obtain specimens for future use.

THE END