

Cold Spray Repair & Mitigation of Stress Corrosion Cracks in Spent Nuclear Fuel Dry Storage Canisters

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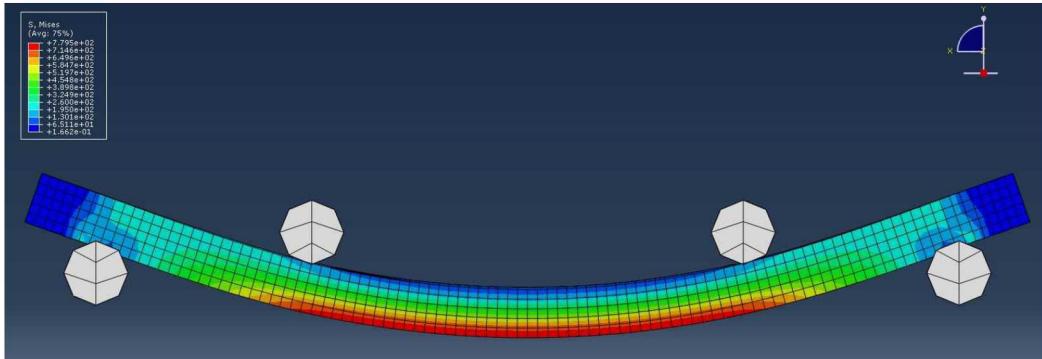
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ESCP

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4-Point Bending Test

- Test coupon dimension:
 - 4''(L) x 0.735''(W) x 0.14''(T)
- FEA & bending σ : 400 Mpa
- ASTM G-39



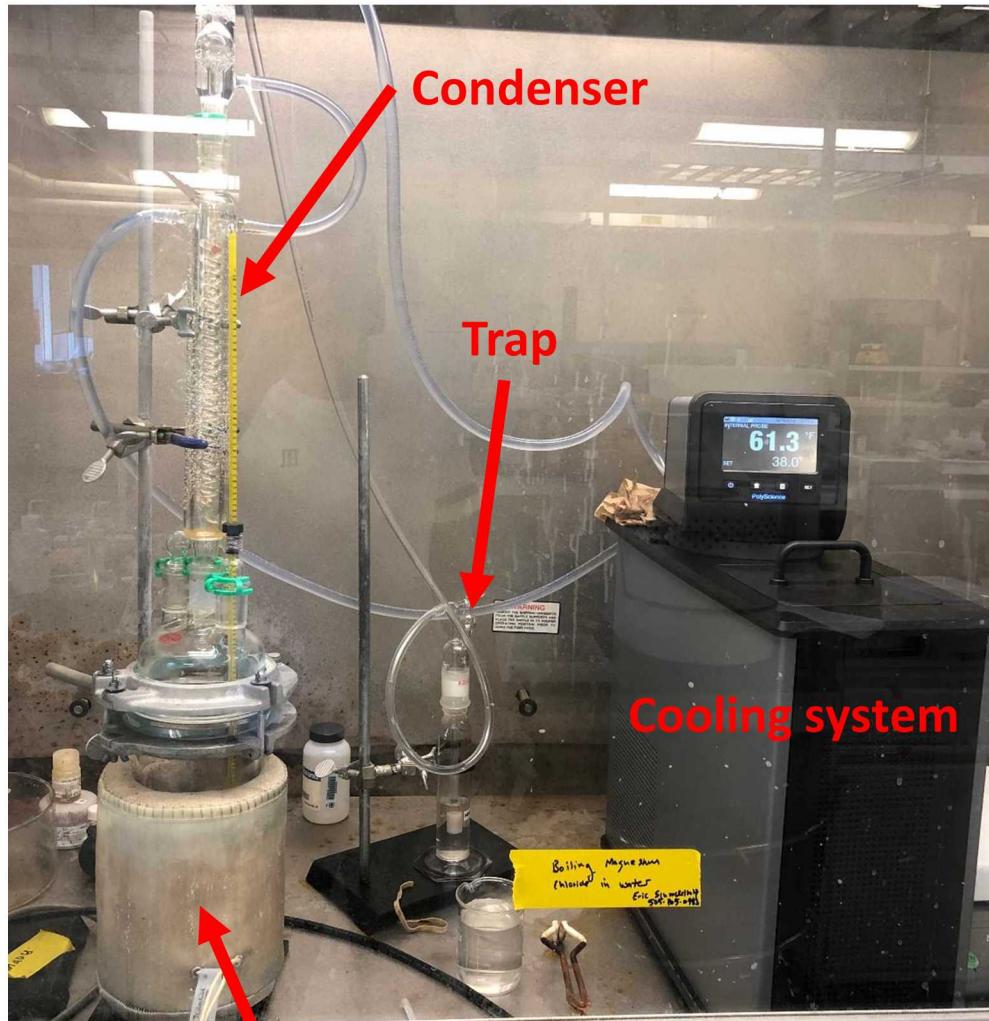
Loading bolt

Test coupon

Dial Indicator



Corrosion test



- Boiling $MgCl_2$ test
 - ASTM G-36
 - Boiling at 155 ± 3 °C
 - Crack examination 20x
- $FeCl_3$ pitting test
 - ASTM G-48
 - 22 ± 2 °C
 - 72-hour immersion

Coupons after corrosion

Boling $MgCl_2$ test



As-received coupon
(Crack after 17h)



Inconel 625 sprayed coupon
(No crack after 216h)

$FeCl_3$ pitting test



As-received coupon



Inconel 625 sprayed coupon
(Delamination happens)

Boling MgCl₂ test results

Particle material	Surface treatment	Accelerating gas	4-point fixture	Time boiled (h)	Crack
304L SS	Ground	Helium	Y	197	N
304L SS	Mill Finish	Helium	Y	24	N
Inconel 625	Ground	Nitrogen	Y	216	N
Inconel 625	Mill Finish	Nitrogen	Y	60	N
N/A	Ground	N/A	Y	17	Y
N/A	Mill Finish	N/A	Y	8	Y (ruptured)

Future plans

- Successfully crack cold-sprayed coupons
- Microstructural analysis by EM
 - Electron backscatter diffraction (EBSD)
 - Energy-dispersive x-ray spectroscopy (EDX)
- Quantitative analysis by mechanical test
 - Constant extension rate tests (CERT)