FIU | Applied Research Center
FLORIDA INTERNATIONAL UNIVERSITY

U.S. DEPARTMENT OF ENERGY

HIGH LEVEL WASTE/WASTE PROCESSING

PROJECT: Chemical Process Alternatives for Radioactive Waste. *Evaluation of Nonmetallic Components in the Hanford Waste Transfer System (WTS)*

CLIENT: U.S. Department of Energy (U.S. DOE)
PRINCIPAL INVESTIGATOR: Dr. Leonel Lagos
LOCATION: Miami, FL

Description:

Nonmetallic materials are used in U.S. DOE's Hanford Site Tank Farm WTS and include the inner primary hoses in the hose-in-hose transfer lines (HIHTLs), Garlock® gaskets, ethylene propylene diene monomer (EPDM) O-rings, and other nonmetallic materials. These nonmetallic materials are exposed to β and γ radiation, caustic solutions, as well as high temperatures and pressure stressors. How the nonmetallic components react to each of these stressors individually has been well established. However, simultaneous exposure of these stressors has not been evaluated and is of great concern to Hanford Site engineers. FIU-ARC engineers worked closely with key Hanford HLW personnel to develop an experimental test plan that determines how these nonmetallic components react to various simultaneous stressor exposures.

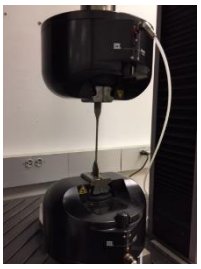
Objectives

- Provide Hanford Site with data from testing hose-in-hose transfer lines, Garlock® gaskets and EPDM O-rings used in their tank farm WTS under various combinations of simultaneous stressor exposures of caustic solutions, high temperatures and high pressure.
- Evaluate baseline materials and compare with materials conditioned with the various stressors.

Benefits:

- Assist engineers in understanding how nonmetallic components of the tank farm WTS react to simultaneous stressor exposures of caustic solutions, high temperatures and high pressure.
- Helps determine service life of WTS parts that contain nonmetallic components.
- Aid in designing new transfer systems by establishing more detailed/accurate guidelines governing the life expectancy of the transfer system parts.

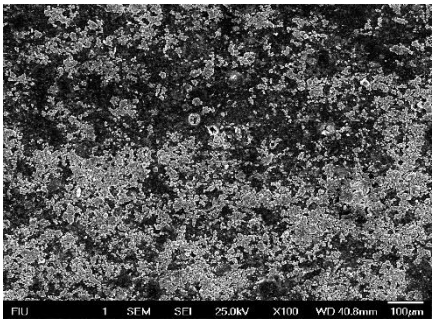
Ruptured hose



EPDM Dog bone tensile test

Accomplishments:

- Conducted baseline HIHTL blowout and material property tests on EPDM and Garlock® coupons.
- Conducted HIHTL blowout and material property tests on EPDM and Garlock® coupons aged for 6 & 12-months in both NaOH solution and water only.
- Greatest degradation in tensile strength and burst pressure occurred in specimens aged at 170°F for 12-months. The tensile strength and burst pressure degraded by 89% and 27% respectively.
- Conducted Scanning Electron Microscopy with Energy Dispersive X-Ray Analysis (SEM-EDX) on HIHTL and EPDM coupon specimens.
- The specimen surface roughness (Ra) increased by up to 203% while the porosity increased by up to 203%.



SEM scan of aged HIHTL inside surface

ABOUT

Since 1995, the Applied Research Center at Florida International University has provided critical support to the Department of Energy's Office of Environmental Management mission of accelerated risk reduction and cleanup of the environmental legacy of the nation's nuclear weapons program. ARC's research performed under the DOE-FIU Cooperative Agreement (Contract # DE-EM0005213) can be classified as fundamental/basic, proof of principle, prototyping and laboratory experimentation.

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