Mechanical Properties on Fuel and Structural Materials

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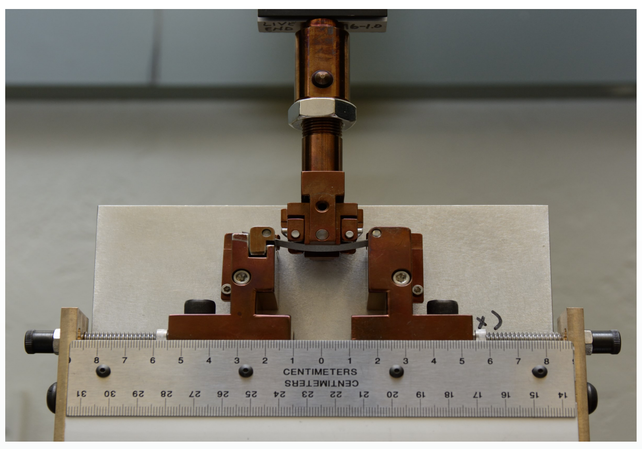
Overview

-The Materials and Fuels Complex has capabilities to perform mechanical properties tests on either pre or post-irradiated fuel and structural materials and has plans in place for continued growth of these capabilities.

Pre-Irradiation

-FASB Load Frame
  -10kN load frame (Instron 3366)
  -1200°C Furnace can be used in conjunction with the load frame
-LECO LM247AT microhardness tester
  -Load ranges from 1g to 2 kg

Experiment set up for elevated temperature tensile test on UMo alloy



New adjustable 4-point bend test fixture developed for deployment at HFEF. Currently testing irradiated UMo alloys

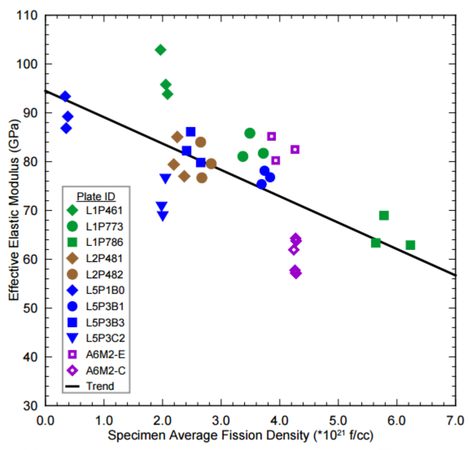


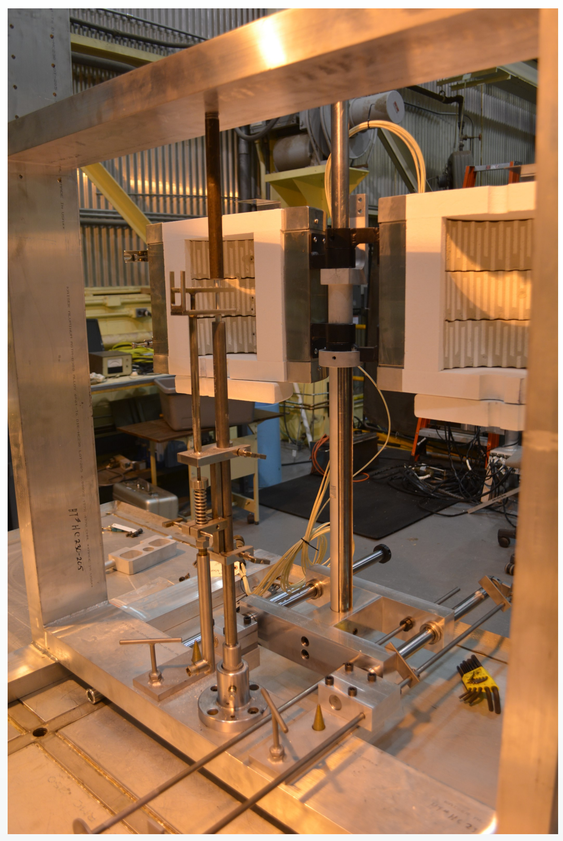
Figure 19. Individual-specimen effective elastic modulus versus average specimen FD, with group trend lines and equations shown.

Example data set of 4-point bend test on irradiated UMo alloy

Post Irradiation

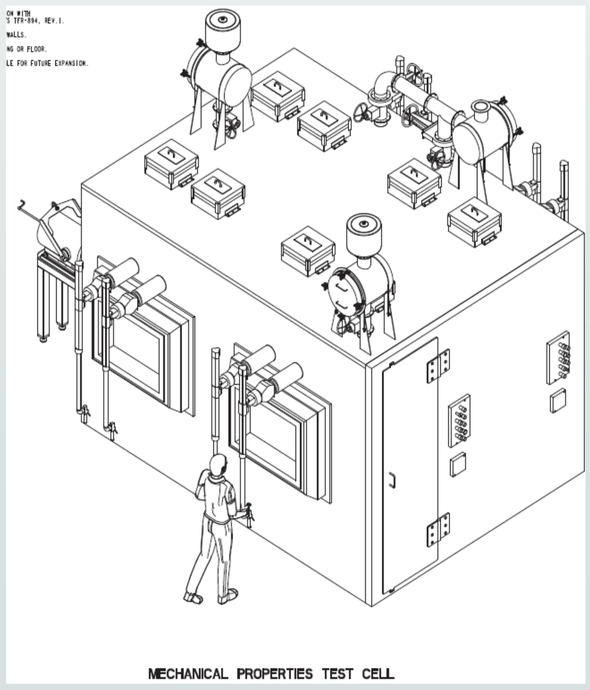
-HFEF Load Frame
  -50 kN capacity load frame (Instron 5869) remotely located in the shielded HFEF main cell
  -1200°C Furnace can be used in conjunction with the load frame
-Microhardness testing
  -LECO AMH43 microindentation hardness system in a shielded inert atmosphere alpha hot cell
  -Load ranges from 10 g to 1 kg
-Irradiation assisted stress corrosion cracking (IASCC)
  -Installed in two hot cells and includes autoclaves for simulating PWR and BWR environments
  -100 kN capacity allowing fracture toughness on full-sized 1TCT specimens
  -IASCC cells also include a small benchtop SEM for fractography of tested specimens.

IASCC Hotcells



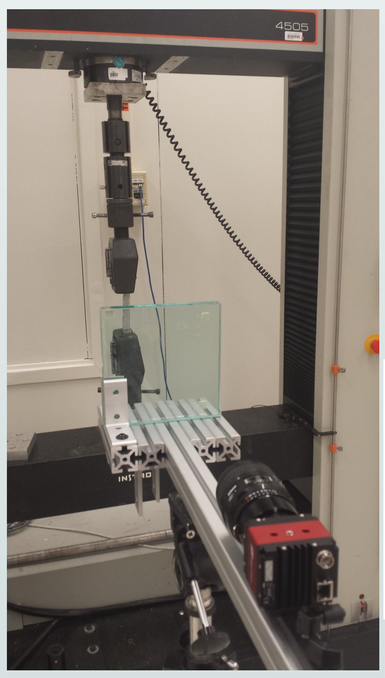
New furnace developed for deployment at HFEF

Future Capabilities



Beta-Gamma Mechanical Properties Testing Cell

-New construction to be installed in SPL
-Will contain full suite of mechanical properties testing equipment (load frame, Charpy impact, Vickers hardness, environmental chambers, annealing furnace, SEM, and optical microscope.



Digital Image Correlation at HFEF

-Developing a technique to correct image distortion through the hotcell windows, enabling deployment of DIC at HFEF and expand the mechanical testing capability to include small scale tensile testing.

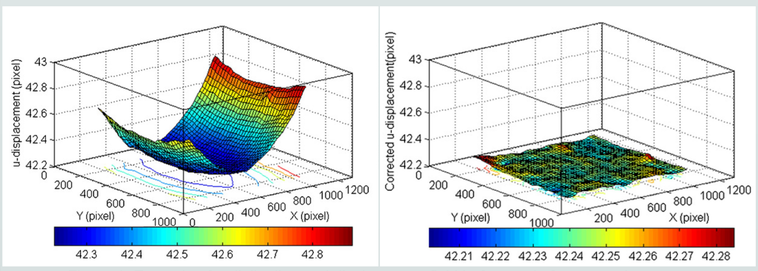


Figure 1: Example of radially distorted displacement field before and after correction.
Pan B, et al, Opt Lasers Eng 2012

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