Postirradiation Examination of High Burnup Metallic Fuels for Transmutation

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History of Metallic Fuels in Fast Reactors

- EBR-I (1951)
  - Unalloyed U
  - U-2Zr
  - Pu-1.25Al

- UK Dounreay Fast Reactor (1963)
  - U-0.1Cr
  - U-7Mo
  - U-9Mo

- Enrico Fermi FBR (1963)
  - U-10Mo

- EBR-II (1964)
  - U-5Fs
  - U-10Zr
  - U-20Pu-10Zr

- FFTF (1982)
  - Assembly testing of U-10Zr
  - Assembly testing of U-20Pu-10Zr
AFCI Fuels Testing in the East Flux Trap of ATR

• 4 Capsule Positions in EFT
  – Cd shrouds in 1,2,3,4
  – 6 rodlets per capsule
  – 24 rodlets irradiated simultaneously

• Rodlet & Capsule Limits
  – LHGR ≤ 500 W/cm
  – PICT ≤ 650°C
  – Rodlet pressure ≤ 1250 psi
  – Capsule pressure ≤ 975 psi
Non-Destructive Examinations

- Visual Inspection
- Neutron Radiography
- Dimensional Inspection
- Gamma Ray Spectroscopy
- Eddy Current Oxide Layer Tester
- Eddy Current Cladding Integrity Tester
Destructive Examinations

- Plenum Puncture & Gas Analysis
- Fuel Annealing Furnace
- Isotopic & Burnup Analysis
- Metallography
- Physical Properties
  - Density
  - Cladding Hydrogen Analysis
  - Mechanical Properties

→ Macroscopic Characterization
Destructive Examinations

- Microgamma Scanning/Analysis
- Scanning Electron Microscopy
- Transmission Electron Microscopy
- Physical Properties
  - Thermal Diffusivity

Microscopic Characterization