Electrolytic Dissolving Overview and Potential Future Use in H Canyon

A Short Course on Stainless Steel Dissolution

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Overview

- Basic Principles of Operation
- Brief History of Electrolytic Dissolution at SRS
- Summarize Operating Experience
- Potential Future Use in H Canyon
Principles of Operation

- **Definition**
  - Electrode – metal that can be electrically charged
  - Anode – positively charged electrode
  - Cathode – negatively charged electrode

- **Electrolytic Dissolver**
  - Electrodes fabricated from niobium with platinum face
    - Niobium and platinum do not dissolve electrolytically
    - Electrons flow between platinum faces

- **Stainless Steel Clad Fuel in Nitric Acid Solution**
  - Oxide surface film prevents acid attack
  - Electron flow breaks down stainless steel cladding
  - Surface facing cathode dissolves

- **Fuel Core Dissolves Chemically and/or Electrolytically**
  - Metals dissolve electrolytically/chemically
  - Oxides dissolve chemically
Electrolytic Dissolution History at SRS

- **1958 – Initial Studies on Reprocessing of Power Reactor Fuels**
  - Stainless steel clad domestic and foreign research reactor fuel
  - Heavy Water Components Test Reactor (HWCTR) fuel
  - Aggressive chemical dissolution
  - Electrolytic dissolution

- **1959 – Built Small Scale Electrolytic Dissolver**
  - Dissolved stainless steel clad fuel

- **1960 – Built Full Scale Pilot Electrolytic Dissolver**

- **1965 – Built H Canyon Electrolytic Dissolver**
  - Conducted additional dissolution tests

- **1968 – Installed in H Canyon**

- **1969 – Began Processing Stainless Steel Clad Fuel**
Operating Experience

- Began Processing Stainless Steel Clad Fuel in 1969
- Processed Variety of Non-Aluminum SNF
  - Cladding
    - Stainless steel, zirconium
  - Bundles
    - Suitcase
    - Tubes
    - Attachments
  - Uranium oxide fuel
    - Cermet, powder, pellets, plates, etc.
- Operated Until 1980
- Processed 26 MT metal, 34 MTU
  - 1,213 Bundles in 182 batches
Future Use For Electrolytic Dissolver

• **Japanese Atomic Energy Agency Fast Critical Assembly Fuel**
  - Stainless steel clad plutonium plates and rods
  - Packaged in stainless steel cans
  - Storage after dissolution with future discard
  - Conceptual Design to restore electrolytic dissolver operation
  - NEPA required prior to processing

• **L Basin Non-Aluminum Spent Nuclear Fuel**
  - Cladding
    - *Stainless steel, zirconium, Hastelloy™*
  - Broad Spectrum Fuel
    - *UO₂, ThO₂, PuO₂-UO₂, U-Mo, etc.*
  - Dissolve and process for recovery of U or store for discard
  - NEPA required prior to processing
H Canyon Processing

Aluminum Clad SNF → Chemical Dissolution → HM Process → Uranium Solution Storage

Fast Critical Assembly → Electrolytic Dissolution → Storage → Waste to Tank Farm

Non-Aluminum Clad SNF