Diversity of Mineralogy in Hanford Tanks

G. A. Cooke and D. L. Herting, Washington River Protection Solutions

Why Do We Care?

Ability to predict waste behavior during operations
- Retrieval (sluicing, chemical cleaning, etc.)
- Tank Farm Pretreatment (SpinTek, SCIX, LiHT)
- WTP Pretreatment (caustic/oxidative leaching, cross flow filtration)

Ability to prepare simulants
- For "cold" testing of above-listed operations
- For Waste Feed Staging & Delivery mixing tests
- For WTP pulse jet mixer (PJM) tests
- For WTP cold commissioning

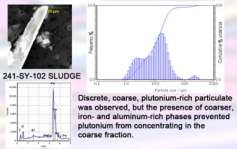
Method*	Advantages	Limitations
XRD (powder)	• definitive identification of crystalline phases	• not useful for amorphous phases • requires sample drying/mounting • can give "false positives"
SEM/EDS	• elemental composition of crystalline and amorphous phases • finer resolution than XRD or PLM	• requires sample drying and coating • may require assumptions about stoichiometry
PLM	• identification of crystalline phases by optical properties (refractive index, birefringence)	• limited use for amorphous phases • limited to particles larger than ~ 5 µm
Selective Dissolution	• may be only way to study distribution of radionuclides	• expensive • non-routine procedures • very low resolution
Other	• provide information not available by above methods	• instruments not readily available in rad zones • extensive sample prep may be involved

* Methods: XRD = x-ray diffraction; SEM/EDS = scanning electron microscopy with energy-dispersive x-ray spectroscopy; PLM = polarized light microscopy; Other = Raman microprobe, FTIR, XAFS, TEM, single-crystal XRD, etc.

What's Left to Learn?

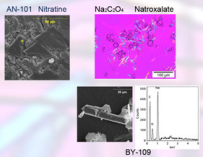
- Much more abut amorphous phases
  - size
  - composition
  - prevalence
- Gibbsite / Boehmite / NAS distribution
- Pu particulate size & prevalence
  - For criticality evaluations
- Locations of radionuclides
  - Where is the insoluble 99Tc hiding?
  - Is 90Sr found mainly with CO32-, OH-, or SO42-?
  - Is 137Cs found more with sodalite or cancrinite?
  - Is 241Am associated more with Fe or Al phases?

Distribution of Plutonium-Rich Particles

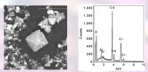


Discrete, coarse, plutonium-rich particulate was observed, but the presence of coarser, iron- and aluminum-rich phases prevented plutonium from concentrating in the coarse fraction.

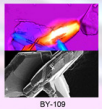
Sodium Phases



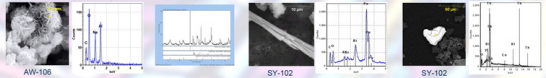
Chromium Phases



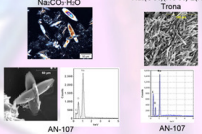
Sulfur Phases



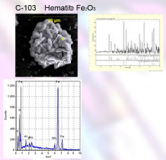
Minor Phases



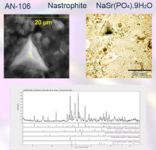
Carbonate Phases

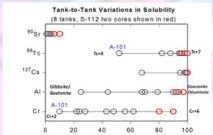


Iron Phases

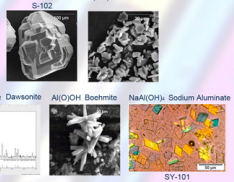


Strontium Phases

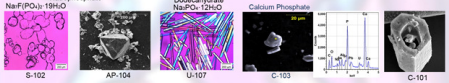




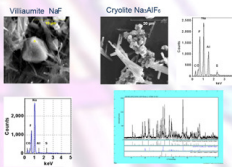
Aluminum Phases



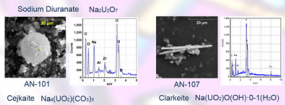
Phosphate Phases



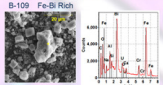
Fluoride Phases

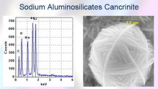


Uranium Phases



Amorphous Phases





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