

Review of ATW Chemistry

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Problems of UREX

- Removing I from offgas efficiently
- High S.F. Np from U
- Sepn. Tc from U
- Good removal Tc from Pu, Pd
- Avoid incr. in waste vol. and have high efficiency of Pu reduction for solv. extr.

Problems of TRUEX

- Improve TRU sepn.
- Minimize secondary wastes
- Possible sepn. of TRU and RE
- Solidification of TRU stream
- Tc extr. process

Problems of EM

- Prod. of non-TRU uranium stream
- Sepn. Tc from zinc alloy cladding
- Sepn. and recov. of I
- Scale up to plant operation

Problems in ATW Fuel Fabrication

- Preparation of I⁻ and Tc targets
- Containment of Am during fuel prep.

Problems: ATW Fuel Process

- Calc. indicate Cl volatility process viable, no experience with Zr based fuel
- Electrowinning and other pyro processes only at bench-pilot scale demo.
- Iodine sepn. in molten salt systems only bench scale demo.

Technical Barriers of Cl Volatility

- Development of full scale iodine sepn.
- Acceptability of process residues by waste forms

Technical Barriers of Cl Volatility

- Uncertainty on chopping/grinding at high throughput
- Optimization of off-gas/Cl⁻ volat.
- Chem. and metallurg. behavior TRU's and Tc in Cl⁻ volat. System
- Behavior Am, Cm, Tc in TRU electrowin. system

Technical Barriers of EM Alternative

- Electrorefining of Zr based fuel
- Chemical behavior of TRU and Tc in (a)
- Development of waste forms for F⁻ salts
- Development of full scale process

R&D Needs for Cl Volatility Process

- Verification of high throughput and reliability for fuel chopping
- Est. iodine and chlorine chemistry
- Est. TRU, technetium, and fission product chemistry and metallurgy
- Verification of the TRU, technetium, and fission product behavior

R&D Needs for Cl Volatility Process

- Electrowinning cell system design optimization
- Waste minimization/waste form compatibility

R&D Needs for EM Alternative

- Adaptation of Zr electrorefining to spent fuels
- Est. behavior of TRUs and fission products in the process
- Waste minimization/waste form compatibility studies
- Molten salt solvent system optimization
- Optimum iodine from the molten salt

Waste Forms

- Aqueous processes → borosilicate glass
- EM processes → ceramic (FP + Actin), metal (Zr, U, noble metals)

Schedule

● UREX/EM:	Complete
Baseline Process Pilot Plant Tests	2010
Pilot Scale Recovery LWR TRU's	2019
LWR Fuel Process Demo Opns.	2020
● Molten Salt Chloride Volatility	2006
EM Alternative	2006
Pyrochem. Process Pilot Plant Opns.	2020
ATW Fuel Opns.	2020

Schedule

- Waste Form Development 2006
- Pilot Scale Waste Form Prep 2013
- Waste Form Demo Opns. 2020