

Japanese R & D on Reprocessing of Spent Nuclear Fuels

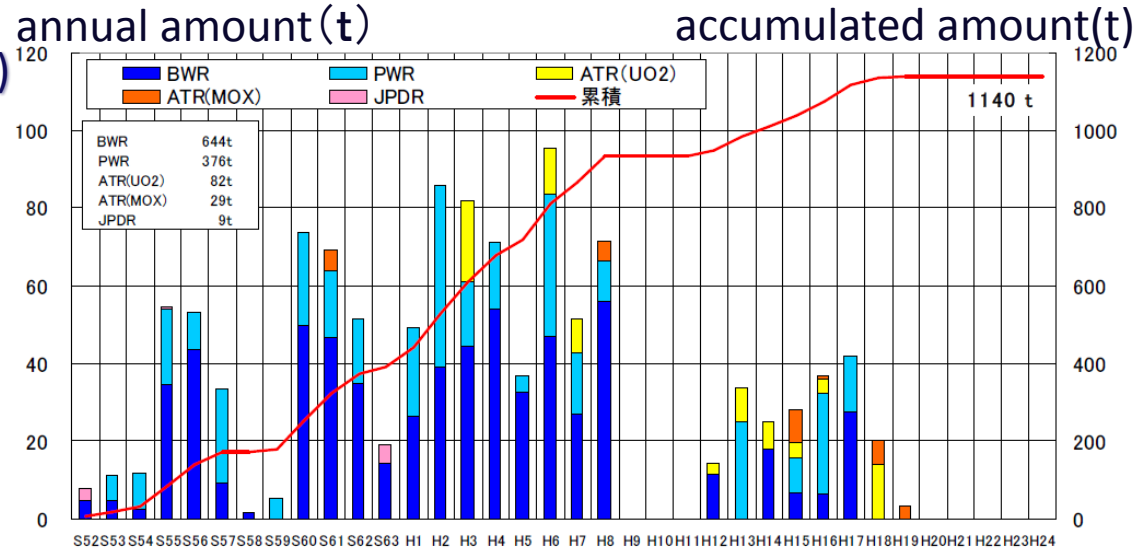
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R & D for Conventional Reprocessing Technology

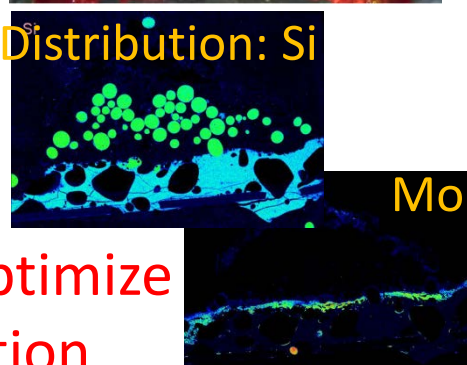
Tokai Reprocessing Plant (JAEA)



TRP experience on operation & maintenance, modifications.



Distribution: Si



Mo

Rokkasho Reprocessing Plant (JNFL)



Basic studies to optimize vitrification condition

R & D for Future Fuel Cycle Technology

R & D on advanced fuel cycle technologies are underway for future improvements:

- ◆ Enhanced inherent proliferation resistance
- ◆ Reduce waste burden by recovery of MA
- ◆ Improve economical sustainability



1. Advanced Aqueous Separation Technology
2. Fast Reactor Fuel Cycle Technology
3. Pyrochemical Reprocessing Technology

1. Advanced Aqueous Separation Technology

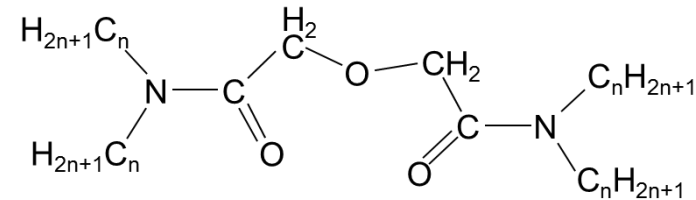
- ◆ Conventional Solvent Extraction (TBP-PUREX) is not suitable for MA recovery.



Needs for new extractant to recover MA(Am and Cm)



JAERI (former JAEA) found DGA extractant, and demonstrated applicability for MA recovery from high-level liquid waste.



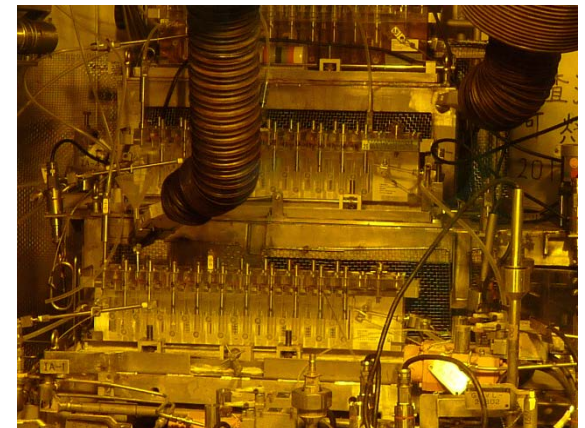
Tetra-alkyl diglycolamide(DGA)

TODGA (n=8) is being studied in various countries.

TDdDGA (n=12) was selected in JAEA because of the high solubility of the complex in n-dodecane, and tested with real high-level liquid waste.

TEDGA (n=2) is used in French EXAm process as water-soluble complexing agent.

New outstanding solvent, **HONTA**, Hexaocetyl-nitrilotriamide, exhibits its high ability to separate MAs from lanthanides.



Test of TDdDGA process with real high-level liquid waste

2. Fast Reactor Fuel Reprocessing Technology

- ◆ **Integration of Advanced Reprocessing Technologies for closing Fast Reactor Fuel Cycle.**
 - Research on **reprocessing process for fast reactor** has been started from 1982 at CPF by using “JOYO” spent fuel pins and overseas irradiated fuel pins.
 - As a result of examination study, we confirmed that **PUREX process was applicable to the fast reactor fuel.**
 - Development of flowsheets for **MA partitioning process.**
 - **Small-scale demonstration of MA-MOX fuel cycle is underway.**

Reprocessing of MA-MOX pellet irradiated at JOYO is being carried out at CPF. Recovered MA will be served for fabrication of fuel to be irradiated at JOYO.
 - Performances of **devices for reprocessing** such as centrifugal contactor were confirmed on engineering scale



(CPF: Chemical Processing Facility)

3. Pyrochemical Reprocessing Technology

◆ **Pyrometallurgical reprocessing technologies have been developed since 90's through domestic / international collaborations.**

■ Key basic data to recover U, Pu and MA were published by CRIEPI-ANL and JAEA-CRIEPI etc. (Referred worldwide for design & evaluation of pyroprocess.)

■ Process equipment & auxiliary technologies have been developed in engineering scales.

■ **Recovery of MAs from irradiated MA bearing metal fuel was first demonstrated** through CRIEPI-JRC-CEA collaboration; fuel fabrication in JRC, irradiation in Phénix, electrorefining of irradiated fuels in JRC.

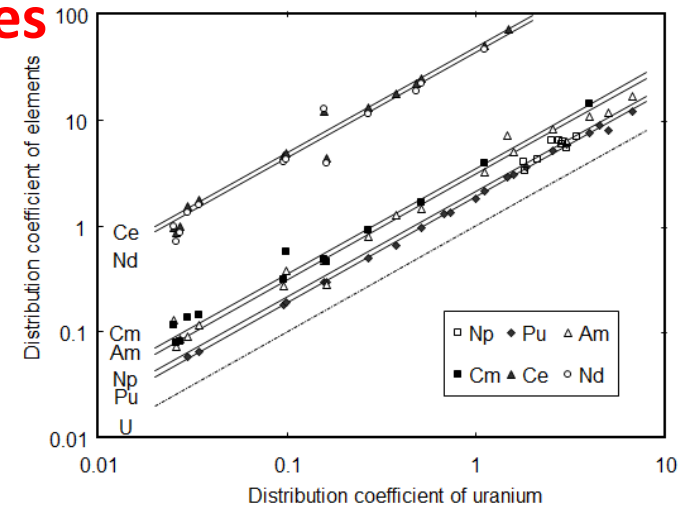


Fig.1 Distribution of actinides and lanthanides between salt and metal.

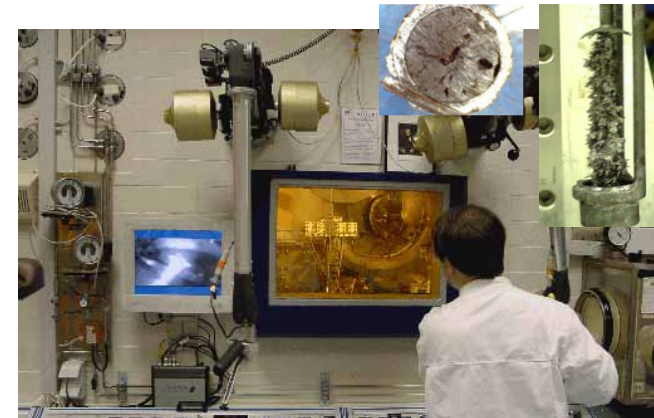


Fig.2 Scene of Electrorefining test with photos of U deposit & fuel residue.

Conclusions

- ◆ Japanese R&D on reprocessing of spent nuclear fuels are in steady progress for advancing the fuel cycle.
- ◆ Various research resources (researchers and infrastructures) are still dedicated for study on fuel cycle, though many researchers share their effort with the study on Fukushima Daiichi countermeasures.
- ◆ Various Programs on fuel cycle research are funded & managed by Government, Societies, Industries etc., and are expected for fostering many promising young scientists.