

1-13 A New Extraction Process for Future Reprocessing

— Development of Uranium and Plutonium Co-Recovery Process (Co-Processing Process) —

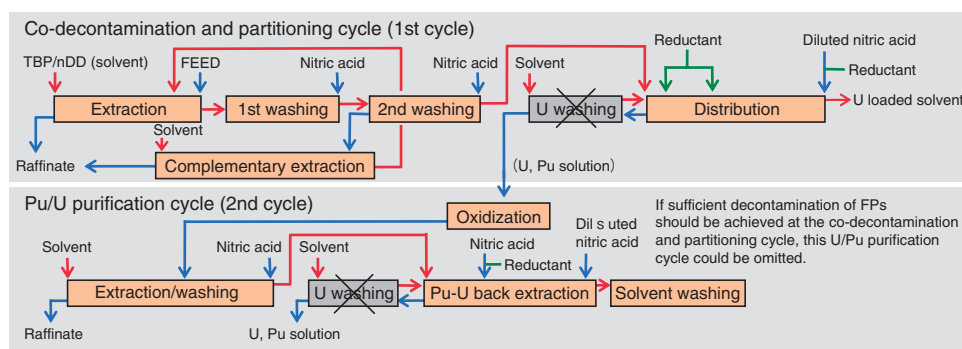


Fig.1-34 Schematic image of co-processing process

The elimination of the U washing stage (crossed-out part of Fig.1-34), which is used in the conventional PUREX process, is one of the characteristics of the co-processing process. It prevents Pu isolation in the process and improves proliferation resistance.



Fig.1-35 The situation of Pu stripping in the partitioning unit

An investigation of the smooth transition from the current light-water-reactor (LWR) cycle to the fast-breeder-reactor (FBR) cycle was carried out in association with government ministries, electric utilities, plant vendors, and the Japan Atomic Energy Agency (JAEA). One of the important items of the investigation was the appraisal of several reprocessing processes that will be applied after the end of the lifetime of the Rokkasho Reprocessing Plant. As a result, the co-processing process, which is a modification of the PUREX process for non-isolation of Pu, was selected as the most promising process^[1].

The co-processing process was developed through a flowsheet study on process calculation and its verification by miniature mixer-settler tests. In order to secure the internationally acceptable proliferation resistance, the flowsheet of the process was set up to prevent the isolation of Pu, even with changes in operational conditions such as reagents and flow rates. Furthermore, if the performance indices (such as decontamination factors (DF) of fission products (FPs)) of the co-decontamination and partitioning

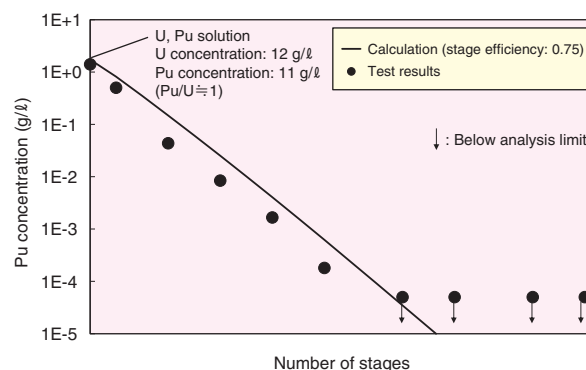


Fig.1-36 Pu concentration profile in the partitioning unit (organic phase, Pu/U = 3%)

The Pu stripping performance was good and the U/Pu ratio in the product solution was about 1.

cycle were good enough, then the omission of the subsequent Pu/U purification cycle could be viable (Fig.1-34).

The mixer-settler tests focusing on the partitioning unit were carried out using U/Pu nitric solution at the Operation Testing Laboratory (OTL) of the Tokai Reprocessing Plant. The Pu/U ratios of the feed solutions were prepared as 1%, 3%, and 20%; these compositions were adopted considering the composition of future spent fuels from LWR, LWR-MOX, and FBR systems and their mixing treatments. The stripping performance of Pu accompanied by U was good in the cases of Pu/U ratios of 3% and 20% (Fig.1-35 and Fig.1-36). The U/Pu ratios of the product solutions were suitable for the fabrication of FBR-MOX fuel ($0.5 < \text{U/Pu} < 2.0$)^[2]. Further experiments should be conducted under the condition of a Pu/U feeding ratio of 1% to ensure the applicability of the co-processing process for all future types of fuels.

This work is the result of a study entrusted to the JAEA by the Ministry of Economy, Trade and Industry (METI).

References

- [1] Investigation Council for FBR Cycle Demonstration Process, Future Exploitation of Nuclear Fuel Cycle-Appraisal of Technical Issues-, 28th Regular Meeting of Atomic Energy Commission, no.11, 2009, 52p. (in Japanese).
- [2] Japan Atomic Energy Agency, Result Report of 2010-Development of Decontamination Technology for Recovered Uranium from FBR Fuel-, 2011, (in Japanese), in CD-ROM, Available at JAEA Library.