RESEARCH ACTIVITIES ON RUTHENIUM AND TECHNETIUM CHEMISTRY IN PUREX SYSTEM ORGANIZED BY THE JAPANESE ATOMIC ENERGY SOCIETY

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Toward the advancement of PUREX reprocessing system, improving the economy with ensuring the safety becomes an urgent issue. In the initial developing stage of the reprocessing technology, major studies were directed to attain high recovery ratios and purities of uranium and plutonium products. Some data bases were generated during these studies. Further, as separation of long-lived minor actinides is also becoming a current topic, the chemical behaviors of minor actinides are well investigated not only in the PUREX process but also in the novel extraction processes. However, investigation of the fission-products of spent fuel was insufficient in comparison to those of actinides. Actually information of chemical properties and extraction behaviors of the fission products were not well defined up to now.

Among the fission-products, in particular ruthenium and technetium form extractable species[1] to TBP and other organic extractants. Therefore, they tend to distribute in the whole reprocessing plant and to the environment. In the modern reprocessing plants, these two nuclides - Ru-106 and Tc-99 - are the dominant nuclides to determine the whole decontamination factors of the uranium and plutonium products. In other words, decontamination of these two nuclides will determine the design of the main separation process. Furthermore, Tc-99 is a fission-product with long half-live (T: 2.12×10^5y) and will be a possible target nuclide for future transmutation by FR or Accelerator (Tc-99 + $n \rightarrow$ Ru-100(stable)). On the other hand, Ruthenium is one of the rare metal fission-products to be potentially utilized in future, because Ru-106 has a short half-live (T: 368d) and its specific radioactivity will be negligible after cooling down for several decades.

Therefore, we think it will be imperative to investigate and summarize their solid/liquid chemistry, complex chemistry, separation chemistry and chemical engineering data. The data will be also available as a scientific data base for the safety operation of the Tokai- and Rokkasho-reprocessing plants. Furthermore it can be a base to ensure the minimization of radioactive wastes generation during a future decommissioning of the reprocessing plants.

Members of the Japan Atomic Energy Society have organized a scientific committee on October 1999 to respond to these contemporary issues. The committee, entitled “Ruthenium

and Technetium Chemistry in the PUREX System", consists of more than 30 members. At present, the committee is scientifically contributing to deepen the understanding of the PUREX-type LWR and FR reprocessing systems' in respect to the design, the construction, the operation and the safety evaluation. Half-day meetings have been periodically held. Up to now, ten meetings were made to discuss the key subjects[2] and decide the topics to be solved.

The scope of work of the committee includes the following major topics:

1/ Basic solution / Solid-state chemistry.

2/ Basic solution / Solid-state chemistry of MA (Np).

3/ Partitioning chemistry in the PUREX system and environmental behaviors.

4/ Recovery, purification and utilization technology in respect to rare metal FP.

5/ Field data on plant design, operation, decontamination and decommissioning.

6/ Numerical process simulations, process control technology.

7/ Establish the database for process chemistry and plant engineering.

The paper will summarize the activity of the committee with a focus on basic information of technetium in the PUREX solutions, the plant design basis and the behavior during the final waste treatment.

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[1] This is caused by a variety of chemical complexes of ruthenium and pertechnetate anions of technetium in nitric acid.

[2] Note: The topic of Np-237 behavior was included since the 8th meeting.