Nickolay D. Goletskiy et al., J Nucl Ene Sci Power Generat Technol 2017, 6:4
DOI: 10.4172/2325-9809-C1-006

The variants of Zirconium, Technetium and Neptunium localization in the first cycle of NPP high burn-up spent fuel reprocessing

Nickolay D. Goletskiy, Boris Ya. Zilberman, Yuriy S. Fedorov, Alexander S. Kudinov, Alexey P. Krinitsyn, Egor A. Puzikov, Dmitriy V. Ryabkov (Drs) and **Alexey A. Timoshuk (Lead. Eng)**
Khlopin Radium Institute (ROSATOM State Corporation), St-Petersburg, Russia

NPP spent fuel reprocessing should be environmentally and commer-cially admissible and lead to recycling of regenerated material as well as to minimization of the radioactive waste final volume. The goals of the reprocessing, originally developed for Pu and U recovery for weapons material production now changed considerably on passing to NPP SNF, as the fuel fraction to be utilized (U and Pu) dropped to 95-97%, while the amount of non-utilized elements increased from 0.05% to 3-5% of the total SNF mass. Only < 5% of these elements are hazard-ous long-lived radionuclides, namely, α-nuclides (transplutonium elements, Np) and Tc, of which Np, Tc and Zr are notably extractable by diluted TBP causing difficulties in the 1st cycle of the PUREX process. Zr, Tc and Np localization within the framework of the 1st extraction cycle of the Purex process is possible by several ways (See Table 1). Experi-mental data were obtained on Tc localization in the HL raffinate as applied to the RT-1 flowsheet, in the zirconium and tritium strip product, (Superpurex-1) and in the Pu and Np strip product or in the strip product from the unit of the barrier reductive scrubbing of the uranium extract as applied to six-block extraction scheme in the project of the Pilot Demonstration Center (PDC). All above variants were implemented at RT-1 plant or successively tested on "hot' rigs for PDC using real WWER (PWR) fuel of high burn-up (40 -70 GW*d/t HM) and 2,5 – 6 y. storage. The obtained PF/DF for PDC flowsheets are shown in Table 2. The possibilities of Np localization before and after Pu stripping with the opposite Tc withdrawal were also examined, and the first one (see Fig.) was proposed to be implemented at PDC for production of REMIX fuel made of dioxides of regenerated Pu and enriched regenerated U, suitable for uploading of 100% WWER-1000 active zone. At the same time the process provides the HLW evaporation without Zr/Mo and $Ba(NO_3)_2$ precipitate formation. The flowsheet should be tested using real spent fuel of PWR type. No withdrawal of Pu, Np, Zr and Tc separately to generally different products, as well as Np with Tc together is possible in the frame of six-unit extraction flowsheet t excluding precipitation-free HLW evaporation which is the limiting factor for optimization of process chain as a whole.

Biography

Nickolay D. Goletskiy graduated from Physico-Chemical Department of SPb Institute of Technology (Technical Uni-versity), St-Petersburg, Russia, in 1998 and since then he has been working at Department of Applied Radiochemistry of Khlopin Radium Institute in the team headed by Prof. B. Ya. Zilberman. He received his Ph. D. in 2012 for thesis "Molybdenum extraction by TBP, HDBP, it's zirconium salt and their mixtures from nitric acid media as applied to NPP SNF reprocessing" and holds now the position of leading researcher. His main interests include aqueous reprocessing of NPP SNF – process chemistry, mass transfer and control equipment, material balance of the radiochemical plant and closed fuel cycle as a whole. He is interested also in stoichiometry and kinetics of interphase extraction reactions, the use of simulation of extraction units and cycles. He supervises two applicants for Ph. D. and is the author of more than 50 papers and 19 patents.

goletsky@khlopin.ru

Notes: