

Current status of development in dry pyroelectrochemical technology of SNF reprocessing

A.V. Bychkov, O.V. Skiba, M.V. Kormilitsyn

(Federal State Unitary Enterprise "State Scientific Center of RF Research Institute of Atomic Reactors", Dimitrovgrad-10, Ulyanovsk region, Russia, 433510, E-mail: adm@niiar.ru, bav@niiar.ru, Web site: <http://www.niiar.ru>)

Abstract - The technology of SNF management in molten salts currently developed by a group of institutes headed by RIAR has had several stages of development:

- basic research of uranium, plutonium and main FP properties (investigation and reprocessing of different kinds of SNF in 1960 – 1970);
- development of the equipment and implementation of the pyroelectrochemical technology of granulated U-Pu fuel production. Development of the vibropacking method and in-pile testing of vibropacked fuel pins with granulated fuel as the most "logical" continuation of reprocessing: implementation of the technology for BOR-60 and BN-600 (1980 – 1990);
- development of closed fuel cycle elements. Checking of the technology using batches of SNF. In-pile tests. Feasibility study of the closed fuel cycle (CFC). Study of application of the technology to other objects (transmutation; nitride, cermet and other fuels) (1980 – 1990).

Bases of the technology:

The current status of the research is the following:

- *Basic research. Properties of uranium, plutonium, thorium, and neptunium in chloride melts have been studied in much detail. The data on physical chemistry and electrochemistry of the main FP is enough for understanding the processes. Detailed studies of americium, curium, and technetium chemistry are the essential investigation directions.*
- *Engineering development. The technology and equipment bases have been developed for the processes of oxide fuel reprocessing and fabrication. The technology was checked using 5500 kg of pure fuel from different reactors and 20 kg of irradiated BN-350 and BOR-60 fuel. The bases of the technology have been provided and the feasibility study has been carried out for a full-scale plant of BN-800 CFC.*
- *Industrial application: Since the technology is highly prepared, the activities on industrial application of U-Pu fuel are now underway. The BOR-60 reactor uses fuel obtained by the dry method, the design of the facility for implementation of CFC reactors is being developed. 9 FAs have been tested and 3 FAs are being irradiated in the BN-600 reactor. The facilities for production of U-Pu fuel of the BN-600 hybrid core are being modernized.*

Apart from the main technology of oxide fuel reprocessing and production, new dry processes are being studied:

- *obtaining of oxide fuel with neptunium and americium (for transmutation);*
- *reprocessing of nitride fuel (for the BREST closed fuel cycle);*
- *reprocessing of uranium fuel from research reactors (in order to solve the problem of unconventional SNF management);*
- *metallization of oxide fuel for long-term storage.*

The work performed in RIAR is actively supported by Japanese organizations; RIAR cooperates with France, the Republic of Korea, and the USA.