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FEASIBILITY STUDY OF HETEROGENEOUS TRANSMUTATION OF AMERICIUM IN FAST REACTORS

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The most dangerous of the minor actinides is americium. Transmutation of external americium in the fuel of a fast reactor is possible when its content is over than 1% heavy atoms, however the lower content of an americium, on the contrary, it will accumulate. But curium isotopes with a high heat release are formed from it, complicating the unloading of spent assemblies. Therefore, the content of americium in the fuel should not exceed 1% (which corresponds to the equilibrium state and actually closes the possibility of transmutation of external americium), and the retaining time such fuel in the in-reactor storage should be at least 2 years.
Many researchers believe that heterogeneous transmutation in separate assemblies or blankets is preferable. However, the concentration of americium transmutation products in a small number of burnout assemblies will lead to a manifold increase in the residual heat release in them, and the discharge of such assemblies from the reactor will become very problematic.
Heterogeneous transmutation in the blankets of devices with a strong moderator (zirconium or yttrium hydride) seems to be more rational. Theoretically, this method makes it possible to convert all loaded americium into fission products in one campaign, eliminate the need for multiple handling of it and its transmutation product - curium, and also eliminate the problem of high residual heat release. In this way, all “own” americium, which is formed in the fast reactor, can be converted into fission products.
At the same time, it seems economically feasible to burn out in fast reactors not americium itself, but its predecessor, 241Pu. This is possible due to the use of “fresh” plutonium from VVER spent fuel, which will allow reducing the annual production of americium by almost 2 times without developing expensive technologies.
An unpleasant feature of neptunium transmutation is the formation of the plutonium-236 isotope, which decays into uranium-232 and then into a whole series of high-energy gamma emitters. Therefore, burning out neptunium in fuel should be recognized as inexpedient, and burning it out in the same irradiation devices with moderator as americium seems to be the most preferable.

Country/Int. organization

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