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HETEROGENEOUS BURNING OF MINOR ACTINIDES IN A FAST REACTOR

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Transmutation of minor actinides (MA) into stable or short-lived ones by their irradiation in reactors will alleviate the problem of long-term activity of spent nuclear fuel (SNF), increase the efficiency of nuclear fuel due to energy produced by MA fission, and also accumulate and produce useful radionuclides. The economic efficiency of closed-cycle nuclear power cannot be achieved without MA disposal and safe final isolation of radioactive waste.
Fast reactors are the most suitable for homogeneous MA transmutation and heterogeneous MA burning.
With homogeneous transmutation, MA in a small amount (less than 5%) is introduced into the standard nuclear fuel. With this approach, MA will be both burnt and accumulated from MA introduced into nuclear fuel, as well as from uranium and plutonium of standard nuclear fuel. During repeated recycling of such nuclear fuel, its nuclide composition stabilizes and MA accumulation rate is compared with their decrease rate, and the equilibrium SNF nuclide composition is reached.
The concept of heterogeneous MA burning involves their inclusion into inert matrices (no uranium and plutonium) and placement in separate fuel assemblies (fuel rods) either in the fast reactor core or blanket.
Heterogeneous MA burning in the fast reactor blanket has a more flexible strategy for MA handling than homogeneous MA transmutation and can be used to achieve high MA burning with minimal effect on reactor characteristics. The use of inert matrices will avoid the formation of secondary MA.
In Russia, there is a unique opportunity for MA transmutation in existing fast reactors (BN-600, BN-800). Therefore, a technology for MA separation from SNF and production of fuel with MA should be developed, and scientific research and reactor experiments should be performed.

Country/Int. organization

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