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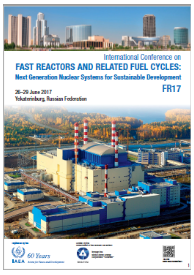

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Features of the physics of the MBIR reactor core

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Cores of research reactor facilities (RRF) as opposed to those of power reactors are designed taking into account their research function. This is their unique peculiarity reflected, among other features, in the flexibility (i.e. transformation in safe and reasonable limits) of the core arrangement according to the changing goals of specific experiments. Power generation for research reactor is a secondary function, significant as it is, therefore for RRF it is quite acceptable to change the power level and transform the arrangement of the core according to experimental requirements rather than to the plan of power generation. Flexibility of the MBIR core makes it possible to address many different tasks simultaneously. For example, the starting core can be considerably smaller than the design one, yet it can provide technologically acceptable transition to core arrangements that are more research and production intensive without the necessity of reloading unburnt assemblies.
The MBIR core has a small size and a very large (up to 25%) neutron leakage outside the core with fast neutron spectrum. As a result, there is no positive sodium void reactivity effect in the MBIR core whatever isotopic composition of plutonium. Neutron leakage also ascertains the stability of neutron flux and energy release distribution in the core.
Due to the high leakage, MBIR reactor features relatively high plutonium enrichment, hence even at very high power density of the core, the neutron flux density and the rate of the damaging dose accumulation in MBIR are quite moderate and lower than in BN-600 and BN-800-type power reactors. For the same reason (due to high enrichment), MBIR demonstrates significant increase of neutron flux density per micro-campaign, reduced energy release in the fuel assemblies per campaign, and significant loss of reactivity with fuel burnup. However, despite the fact that MBIR reactor is inferior to power reactors in terms of the neutron flux and the rate of damaging dose accumulation (which are critically important characteristics for research reactors), it provides conditions for a wide range of various experiments or isotope production.
High experimental volumes of the MBIR reactor and high sensitivity of fast neutron core to the location of research and irradiation subjects, as well as high thermal power of the reactor require gradual and careful testing of reactor power taking into account its physical characteristics.

Country/Int. Organization

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