FUNDAMENTAL PROBLEMS OF NUCLEAR POWER ENGINEERING

METHOD FOR CALCULATION CAPTURING ENERGY REACTIONS CONTRIBUTION TO TOTAL ENERGY RELEASE IN NUCLEAR REACTORS

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The basic features of energy release in nuclear reactors and its components have been examined. The method for calculation fraction of capturing reactions – reactions with neutron disappearance (reaction channels (n,γ), (n,α), (n,p), etc.) – in total energy release in nuclear reactors has been developed. Using this method, characteristics of three models of WWER-1000 have been calculated. It is shown, that capturing reaction contribution depends not only on the type of a nuclear reactor and fuel assemblies, but also on fuel enrichment. The total energy per fission released in WWER-1000 has been calculated, its value is 200.1 MeV for fuel assembly model (type 13ZS) and 201.0 MeV for fuel assembly with gadolinium model (type 30ZSV) [1]. The fraction of capturing energy in total energy release for two models is 3.18% and 3.64% correspondingly.

The results show that depending on fuel assembly's type the total energy release could grow by 0.5%. At present, the majority of calculating programs use the value of capturing energy obtained for fuel assemblies of the second generation with low uranium enrichment, and without burnable absorbers. Using this data for fuel assemblies with gadolinium would create an error in total energy release at the level of 0.5%.

The developed method enables to obtain more precise value of the total energy release for different reactor types, and to estimate its dependency on fuel enrichment, burnable absorbers content, fuel burn-up and other characteristics of fuel core.

1. A.K.Gorohov, Yu.G.Dragunov, G.L.Lunin, *et al.* Justification of neutron-physical and radiation characteristics of WWER designs. Moscow: IKC Academkniga, 2004. P.496.