SURVIVAL OF THE MINOR ACTINIDES IN THE EPITHERMAL SPECTRUM OF NEUTRONS

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An important point in the management of spent nuclear fuel is the accumulation of the minor of the actinides, which constitute a small percentage relative to other fission products and Pu. The percentage of actinides has a high radiotoxicity.

The relevance of the developments of the minor actinides consists in necessity of development of methods of burning actinides for safe handling of the spent fuel of existing reactors and new perspective. Knowing nuclear physics and radiation parameters of the actinides can effectively choose the way which will reduce their activity. It should be guided by the rule min-max: minimum activity of the spent fuel with a maximum burn-up [1].

Approximately 4/5 of all actinides are α- about 1/5 of emitters and β-emitters. The average energy of γ-quanta mixture of actinides in 5-7 times lower than the average energy of a mixture of fission products. Many of the actinides are capable of spontaneous division. Neutrons from spontaneous fission and (α,n)-neutrons do not make a significant contribution to the total flux of neutrons is a nuclear reactor operation, however the spent fuel of the spontaneously fissioning isotopes and strong α-emitters imposes significant restrictions on the technology of spent nuclear fuel.

The actinides are long-lived and relatively long-lived isotopes of Pu, Np, Am and Cm. The process of burning of actinides lies in the transformation of their nuclei by the fission reaction. Transmutation can be done in nuclear power reactors (thermal and fast), in research reactors, subcritical systems, as well as using the neutrons produced during the fusion of deuterium and tritium in a fusion reactor [2].

In the thermal spectrum sharing $Pu^{239,241,243}$, $Am^{241,243}$, $Cm^{241,243,245}$. The fission cross section of the initial (even) actinides by neutron spectrum easily-water reactor is small, so the destruction takes place after the reaction of neutron capture in the fission products.

In epithelium spectrum sharing all actinides. However, as in thermal and fast reactor irradiation are formed radiotoxicity Pu^{238} and Cm^{244}, which are dangerous actinides.

Epithermal neutron spectrum for burning younger actinides is more preferable not only because in it I share all the actinides, but also in terms of neutron balance. For example, in works [3,4], in which the study of high-temperature gas-cooled reactor plant operating in epithermal spectrum of the neutrons, if the original download option to increase the content of even-numbered actinides (1,5–2) % this can lead to useful their use and developments of the odd fissile actinides.

The process of transmutation in a nuclear reactor results in the accumulation of Pu^{238} and Cm^{244}, which are dangerous actinides. On the one hand, these two isotopes create a kind of storage of sources of long-lived radiotoxicity, while the self-protection of the fuel from spread, with another, the formation of these isotopes in the reactors of the IV generation requires the development of procedures and regulations for handling such fuels.

In the operations presents computational studies aimed at determining the distribution function and the spectrum of neutrons in the spent fuel of the thorium high temperature reactor plant operating in the thermal and epithermal spectrum of neutrons.

Studies performed in the work, will allow to calculate the intensity and spectrum of neutrons produced in reactions (α,n) and spontaneous fission, prepare the input file in the form convenient for simulation of radiation situation.

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OPTIMIZED FILTERED BACKPROJECTION TOMOGRAPHIC RECONSTRUCTION ALGORITHM FOR STEP-SHIFT SCANNING OF THE SAMPLE

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Currently tomographic analysis is one of the most widespread methods of industrial noninvasive examination. Modern X-Ray inspection systems can accurately detect defects in manufactured details or mechanisms of small and medium size. Complex X-Ray analysis of a large size samples, aimed on identifying of defects, as well as their classification and visualization, facing a number of challenges. One of these problems are the difficulties to use the standard geometry of tomography experiment, due to the physical size of the tomographic installation and test sample - namely, a significant excess of the size of the sample in compare with installation dimensions. In this work we propose to solve this problem by application of step-shift scanning of such samples and further reconstruction by optimized filtered backprojection algorithm.

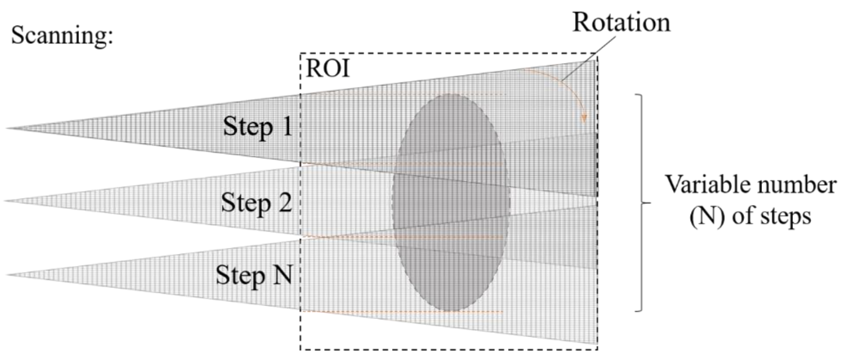

Figure 1 – Step-shift scanning geometry scheme

The algorithm provides opportunity to conduct non-destructive control of certain areas or parts of the sample by analysis of the data from the single scanning step or reconstruct entire volume of the examined object from all the scanning steps.