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Calculation of the materials activation with BPSD code

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The isotopic kinetics code BPSD is developed by IBRAE RAN in "Codes of New Generation"subproject of "Proryv"project. BPSD solves fuel, absorber (boron carbide, dysprosium hafnate) transmutation, coolant (lead, sodium) and steel activation problems. Moreover, it carries out activation and residual heat calculations of materials. BPSD is intended to model materials, applied in fast reactors with sodium and lead coolants and closed nuclear fuel cycle facilities.
BPSD is one of the modules of integral multiphysics EUCLID code used to simulate the liquid metal cooled fast neutron reactor systems under normal operating conditions, anticipated operational occurrences, design basis accidents. Also BPSD is included in the integral code COMPLEX for radiation safety assessment of reactor and nuclear fuel cycle facilities.
The isotopic kinetics problem is solved for cases with the fixed transmutation chains. Each chain accords to its material. Steel chain contains 501 nuclides, lead chain –201 nuclides, boron carbide chain –115 nuclides, dysprosium hafnate –99 nuclides. Chain takes into account the impurities of the materials considered. The two linked transmutation chains (actinide chain and fission products chain) are used in the isotopic kinetic problem solution.
The problem is solved by an iterative method. It enables to calculate any type of transmutation chains and to exclude negative solution appearance. In addition to calculation of the nuclide concentrations, the problem of their uncertainty (caused by input data uncertainty –initial material composition, decay constant, reaction rate) estimation –is solved.
Transmutation chains realized in BPSD code are built on the base of the ROSFOND database. The CONSYST-RF/BNAB-RF system intended to calculate nuclear constants is also used in the code.
The calculation data of the materials irradiation obtained by BPSD code in comparison with the experimental data are presented in the contribution.

Country/Int. organization

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