

Abstracts

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Monochromatic Neutron Flux Densities at Experimental Facilities of the IR-8 Reactor

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The paper describes the experimental method and presents data obtained when measuring the flux density of monochromatic neutrons in the sample position at installations located on the horizontal experimental channels of the IR-8 reactor (NRC “Kurchatov Institute”), and used in research in the field of condensed matter physics and materials science.

Key Words: reactor IR-8, facilities for investigation of condensed matter, the flux density of monochromatic neutrons.

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Evaluation of the Water Radiolysis in the Serpentinite Concrete of the VVER-1200 Reactor Shielding

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The first (inner) layer of a VVER-1200 reactor shielding is made of serpentinite concrete, which is heat-treated (dried) 10—12 days after concrete placement (installation). The possibility of eliminating heat treatment is currently being discussed. In this regard, an assessment was made of the rate of radiolysis of water in serpentinite concrete during the reactor operation. Calculations were made of the field of the absorbed dose rate of neutrons and gamma radiation in the water of serpentinite concrete after the first reactor power start, when the neutron leakage from the core loaded with fresh fuel assemblies is maximum. The estimation of the hydrogen yield due to radiolysis of free and bound water in serpentinite concrete is carried out for cases when concrete is or is not dried after placement.

Key Words: VVER-1200 reactor, serpentinite concrete, reactor shielding, radiolysis of water, hydrogen yield, neutron absorbed dose, gamma absorbed dose.

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Automated System of Neutron Data Preparation for Neutron-Physical Models of Simulators

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A software complex TREK-ASKO for the preparation of neutron data for neutron-physical models of full-scale and analytical simulators of VVER-type reactors is described.

Key Words: neutron-physical calculation, VVER, simulator.

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**Calculation of Non-stationary Three-dimension Neutron Tests
of the International Benchmark C5G7-TD with a Change of the Coolant Density
by the Code SUHAM-3D-TD**

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As part of the international non-stationary benchmark C5G7-TD, three-dimensional tests of this benchmark are calculated using the SUHAM-3D-TD code in the Kurchatov Institute. This paper presents the results of calculations of four non-stationary tests associated with the disturbance of the coolant density in the core of the PWR type light-water reactor model, namely, tests TD5-1, TD5-2, TD5-3 and TD5-4.

The time-dependent distributions of the total power and reactivity, the dependence on time of the total fuel assemblies power, the dependence on the longitudinal coordinate z of the power of the fuel assemblies for individual time points and the distribution of the local power integrated along the z axis as function of the x, y coordinates for individual time points are given.

Key Words: surface harmonics method, non-stationary neutron transport equation, code system SUHAM-3D-TD, non-stationary benchmark C5G7-TD, reactivity, moderator density.

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**Benchmark Model of Medium-Sized Metal Fueled Fast Reactor MET-1000_T
for Simulating Control Rods Movements. Calculations by the ShIPR.**

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Non-stationary calculations of benchmark model of the fast reactor with metal fuel, created on the basis of the international stationary benchmark with a hard spectrum MET-1000 with a thermal power of 1000 MW, are discussed. Prompt dropping of all control rods and a single central rod are simulated. The advantages of this benchmark are simplicity and small runtimes in the symmetry of 60 degrees required for modeling the time depending spatial kinetics processes in fast reactors.

Key words: MET-1000 test, control rod efficiency, spatial kinetics, inverse solution of the kinetic equation, delayed neutrons, diffusion approximation, ShIPR intellectual code system.

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Thermal-hydraulic Characteristics of the Test Molten Salt Reactor with Cavity-type Core

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The results of neutron and thermal-hydraulic calculations for the test molten salt reactor (Test-MSR) with cavity-type core are summarized. Characteristics of the cavity-type core and primary circuit for the 10 MWt Test-MSR with fuel $0,99(0,73\text{LiF}-0,27\text{BeF}_2)-0,01\text{PuF}_3$ salt mixture were calculated basing on the experimental data available. The reactor circuit satisfies the following requirements: vortex flows of fuel salt in the core are eliminated, maximum temperature of core reflectors made from the Ni—Mo alloy kHN80MTY is reduced to an acceptable level (1057 K), the fuel loading outside the core is minimized.

Key Words: cavity-type core, test molten salt reactor, minor actinides, plutonium, lithium and beryllium fluorides, primary circuit, thermal-hydraulics.

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Effect of Metallurgical Factors on the Lifetime of VVER-1000 and VVER-1200 RPV Welds

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The analysis of the effect of metallurgical factors on the lifetime of the VVER RPV standard welded joints is performed. The radiation resource of the weld was estimated by the absolute value of the ductile-to brittle transition temperature after operation for 60 years. For estimation at the time of 60-year operation, the conservative value of the fast neutron fluence of $60 \cdot 10^{22} \text{ m}^{-2}$ ($E > 0.5 \text{ MeV}$) for the VVER-1000 and VVER-1200 RPVs was used. The following factors were considered as influencing ones chemical composition, welding wire type and type of cutting.

Key Words: reactor pressure vessel (RPV), weld metal, ductile-to brittle transition temperature, alloying and impurity elements, radiation embrittlement.

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Chernobyl. Some Results and Further Plans

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35 years have passed since the Chernobyl accident. This is a long time and during this time a huge amount of work has been done to eliminate its consequences. The article summarizes their main results related to the transfer of the emergency Unit 4 to an ecologically safe state. Plans for further activities are being considered. Special attention is paid to the forthcoming extraction of fuel-containing materials and radioactive waste, their temporary storage and disposal.

Key Words: accident, Chernobyl nuclear power plant, Shelter object, new safe confinement, fuel-containing materials, extraction.