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The results of a study of the durability of industrial light-emitting diodes (LEDs) fabricated on the basis of the AlGaInP heterostructure (λ = 630 nm) for the detection of fast neutrons at the IRT-T reactor are obtained.

In the process of research, for each LED, the direct branch of the current-voltage characteristic (CVC) and the watt-ampere (WAC) characteristic in the photometric sphere were measured by using a special measuring complex before and after irradiation. The measuring complex made it possible to measure the direct voltage of the LED in the range from 0 to 5 V for the range of direct currents (0 - 500) mA in increments of at least 1 mA. In this case, the error in setting the direct current from the set level is ± 3%, and the error in measuring the radiation power of the LED is ± 5%. The obtained measurement results were processed by methods of mathematical statistics.

LED irradiation in the passive power supply mode (without passing the operating current, while the LED contacts are open) was carried out on a setup for studying the effect of fast neutrons on various materials and products, which was mounted on a horizontal experimental channel (GEK-6) of the IRT-T reactor [1]. This setup is based on the use of a thermal neutron filter made of boron and cadmium carbide [2].

Regularities have been established that describe the change in the CVC and WAC of LEDs based on AlGaInP heterostructures (λ = 630 nm) upon irradiation with fast neutrons. The obtained experimental results are compared with known literature data.

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A PRELIMINARY ANALYSIS OF HIGH-BURNUP THORIUM-BASED FUELS FOR INCINIRATION OF WEAPON-GRADE STOCKPILES

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The potential advantages of thorium-based fuel cycles, such as improved fissile fuel utilization, increased resistance to proliferation of nuclear explosives, and a reduction in long-lived minor actinide production, have been influential motivations for using thorium-based fuels in power generation since the advent of nuclear reactors [1]. However, low uranium prices, long experience with uranium-based fuels, and complex procedures of licensing new fuel types have always impeded extensive use of thorium in the nuclear industry [2]. However, spotting the uranium market reveals that political tension could adversely affect the availability of uranium at reasonable prices in the future, and diversification of the fuel cycle is considered a wise decision [3]. Moreover, thorium can help transform large stockpiles of weapon-grade uranium and plutonium into nuclear fuels, alleviate public concerns over nuclear apocalypse, and pave the way for increasing the share of nuclear energy in the market. In this work, the lattice code WIMS-ANL and 172-group nuclear data library ENDFB-VI was used to compare neutronic performance of selected thorium-based oxide fuels under operational conditions of VVER reactors. The investigated cases are categorized into uranium oxide, uranium-thorium oxide, thorium-plutonium (weapon and reactor-grade) oxide, and thorium-uranium-plutonium oxide mixtures. The inventory of fissile components ranges from 2.5 to 50%. The metrics for the judgment include the burnup level, fissile fuel utilization, conversion ratio, concentration of long-lived transuranium elements, radiotoxicity at the end of life, and reactivity coefficients. Furthermore, in order to reduce initial excess reactivity in cases with high concentrations of fissile isotopes, the application of a layer of burnable poison ZrB_2 coating on fuel cladding and its optimum thickness were also investigated. Calculations show that the application of thorium generally improves the neutronic performance of the fuel compared to pure uranium oxide fuels with the same level of fissile inventory. Moreover, while the burnup level and duration of fuel campaign peaks in uranium-thorium mixtures and uranium-weapon-grade plutonium mixture, the former have a better fissile fuel utilization and negative feedback of reactivity, and the latter benefits from the lower growth rate of transuranium elements relative to the beginning of life (BOL).

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TURBULENCE MODELS FOR NUMERICAL SIMULATION OF TEMPERATURE DISTRIBUTION IN SCWR

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In the present study, Computational fluid dynamics (CFD) simulation was conducted for 2×2 rod bare bundle using water at supercritical pressures. Main objective of the simulation is to compare calculation results with varying temperatures. CFD simulation was performed to replicate the results from the experiment of heat transfer to supercritical water in 2 × 2 rod bundle conducted at Shanghai Jiao Tong University [1]. This report presents the results to assess capability of the commercial CFD software Ansys fluent in simulating the convective heat transfer of water at supercritical pressures in nuclear fuel rod. The type of flow for simulation is taken as steady state flow. The mass flux is 800 kg/m2s and the heat flux is 600 kW/m^2. The experiment was performed for the pressure of 25 MPa The temperature varies from 300°C, 340°C and 380°C. This simulation is conducted for steady state i.e. all the physical properties of water such as density and viscosity are considered as constant .K-epsilon turbulence model is used for our CFD simulation. K-epsilon model gives better results when there is mixing in the fluid flow. Solutions methods and scheme used for our investigation are provided in the table below.

Table 1. Solution methods

Solution method	Scheme	Solution method	Scheme
Pressure	simple	Energy continuity equations	2nd order Upwind
Pressure-velocity comp.	simple	Gradient	Least square cell based
Momentum equations	2nd order Upwind	Turbulent & kinetic energy equa.	2nd order Upwind