KIPT ADS Facility

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Abstract

Argonne National Laboratory (ANL) of USA and Kharkiv Institute of Physics & Technology (KIPT) of Ukraine are collaborating on the design, the construction, and the operation of an Accelerator Driven System (ADS) supported by the Russian Research Reactor Fuel Return (RRRFR) program of the United States Department of Energy. RRRFR is a trilateral initiative among the United States, the Russian Federation, and the International Atomic Energy Agency (IAEA) to repatriate high-enriched uranium fuels (fresh and irradiated) to Russia. The facility is planned to produce medical isotopes, train young nuclear professionals, support the Ukraine nuclear industry, and provide capability for performing reactor physics, material research, and basic science experiments. This ADS facility uses a qualified proliferation-resistant low-enriched uranium (LEU) fuel and it is driven with an electron accelerator. The target design utilizes tungsten or natural uranium for neutron production through photonuclear reactions from the 100 KW electron beam using 100 MeV electrons. The neutron source intensity, spectrum, and spatial distribution studied as function of the electron beam parameters to maximize the neutron yield and satisfy different engineering requirements. Physics, thermal-hydraulics, and thermal-stresses analyses performed and iterated to minimize the maximum temperature and the thermal stresses in the target materials. The subcritical assembly design has the highest possible neutron flux intensity for such configuration with an effective neutron multiplication factor of <0.98. Different fuel designs and reflector materials considered for the subcritical assembly design. Shielding analyses defined the biological dose map around the facility during operation as a function of the heavy concrete shield thickness. Safety, reliability, and environmental considerations are included in the design. The facility configuration can accommodate future design upgrades and new missions. In addition, it has unique features relative to the other international ADS facilities and it is suitable for studying accelerator driven systems. Several horizontal neutron channels for performing basic research including cold neutron source are built-in. This presentation highlights the main design features and the present facility status.