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Study for Accelerator-driven System in J-PARC/JAEA

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The management of radioactive waste is one of the critical issues for sustainable nuclear energy application especially after the Fukushima accident. In the latest strategic energy policy of Japan express to enhance a research and development to reduce the burden of long-lived nuclides in spent nuclear fuel using both fast reactors and accelerator-driven systems (ADS). Japan Atomic Energy Agency (JAEA) proposes a transmutation of minor actinides (MA) by ADS. A lead-bismuth eutectic alloy (LBE) is used as a spallation target and a coolant of subcritical core because LBE has a good spallation neutron production performance and a chemically inert characteristic. However, the compatibility with steels is unfavourable for the typical structural materials such as a 316 stainless steel. To obtain the data for ADS design, JAEA plans to construct the Transmutation Experimental Facility (TEF) within the framework of the J-PARC project, which consists of two buildings, an ADS Target Test Facility (TEF-T) and a Transmutation Physics Experimental Facility (TEF-P).

A 250kW LBE spallation target will be installed in TEF-T to prepare the irradiation database for candidate ADS structural materials in flowing LBE environment. Engineering tests for LBE loop operation and experiments to determine the effective lifetime of proton beam window will be also performed. Spallation neutrons from LBE target will be used for multi-purpose applications. A critical/subcritical assembly with a certain amount of MA fuel will be set up in TEF-P to perform the neutronic experiments for MA-loaded core.

To realize both TEF-T and TEF-P, various studies are being carried out. Test loops for the TEF-T LBE target were manufactured and are ready for operation. One is a loop for TEF-T target mock-up and the other is that for collection of material corrosion characteristics in flowing oxygen controlled LBE environment. Sensor systems for LBE flow and oxygen potential have been also developed. Remote handling tests for TEF-T LBE target loop maintenance are underway to fix a design of the loop and the spallation target trolley. Basic tests to handle MA-bearing fuel have been performed and low power proton beam injection is under preparation. The activities to realize the TEF, a roadmap to establish the ADS transmutor and latest elemental test results for TEF construction will be introduced.

Country/Int. Organization

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