Neutronic Behavior of SMART-ATFs Nuclear Fuel

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Managing nuclear fuel through the operation of nuclear power reactors is an important step of the nuclear fuel cycle till it is discharged from the reactor core. The operational conditions affect the cycle length of nuclear fuel. As Small Modular Reactors are designed to operate at high burn up to support energy supplies. SMR technology has improvement in the economics achieved through system simplification, component modularization, construction time reduction, and increased plant availability. One of SMRs types is the Korean design named System-Integrated Modular Advanced Reactor (SMART).

SMART is a small-sized integral type PWR with a rated thermal power of 330 MW_{th}; its design characteristics contributing to safety enhancement through utilizing an advanced nuclear fuel designs such as Accident Tolerance Fuels and advanced cladding materials such as High-performance Alloy for Nuclear Application into the reactor core.

Accident Tolerance Fuels (ATFs) was manufactured to improve fuel performance during normal operation, transient conditions, and accident scenarios. Also, to increase fuel cycle length, to reduce oxidation and hydrogen generation, to reduce the fuel cycle cost and its accommodation of fission products is high. High performance Alloy for Nuclear Application (HANA) was developed by Korean Atomic Energy Research Institute (KAERI) and Korean Nuclear Fuel Company (KNFC) and tested to sustain high discharge burn up to more than 70GWd/MTU at Halden research reactor .

The neutronic behavior for SMART-ATFs with HANA cladding alloy will be studied for an average nuclear fuel assembly through its criticality, inventory and radioactivity using MCNP 6.1 code and the enhanced safety features will be reviewed.