Contribution ID: **147** Type: **Poster**

# #4-147 Phenomenological Analysis on 1,000℃ Material Irradiation Testing in HANARO using the Instrumented-Capsule(15M-03K)

*Wednesday, June 11, 2025 4:20 PM (5 minutes)*

The HANARO research reactor has conducted various irradiation tests to meet the demands from academia, industry, and research institutions for nuclear materials and fuel testing. Recently, as research on next-generation nuclear systems designed for high-temperature operations—such as Molten Salt Reactors (MSR), Sodium-cooled Fast Reactors (SFR), and Very High-Temperature Reactors (VHTR)—has advanced, the demand for irradiation testing of nuclear materials for these systems has also grown. This study covers the process, results, and main phenomena observed during an irradiation test in HANARO, reaching temperatures up to 1,000℃. For the HANARO irradiation test, the instrumentation-capsule (15M-03K) was designed and fabricated based on thermal and neutron transport calculations. The capsule contain tensile specimens and features a double thermal media structure (Ti/Fe). The fabricated capsule underwent a series of out-of-pile tests, including loading/unloading tests, hydraulic testing, and high-temperature integrity verification. The first irradiation test in HANARO was conducted in December 2018, during the 99th cycle of operation at 30 MW, where the maximum specimen temperature recorded was 791℃. Although an unexpected reactor shutdown led to the early termination of the test, the feasibility of high-temperature irradiation testing using HANARO was confirmed. The second irradiation test resumed in 2024, achieving two primary objectives. First, the test successfully achieved a maximum specimen temperature of 1,000℃ during the 108-1 cycle of operation at 27 MW, fulfilling the final goal for this phase of high-temperature irradiation test technology development. Second, the specimen temperature was stably maintained at 800℃, 850℃, and 900℃ during the 108-3 cycle (27 MW), 109-1 cycle (27 MW), and 109-2 cycle (25 MW), respectively, thereby providing valuable data on the stability of high-temperature irradiation test technology. During irradiation testing, two main phenomena were observed. First, after reaching the target temperature of 1,000℃, a subsequent temperature drop occurred, attributed to potential reactions between specimen impurities and the internal thermal media. Second, temperature variations were observed at different thermocouple positions in response to changes in the reactor control rod positions. This effect was analyzed through nuclear calculations to determine the impact of temperature variation at each thermocouple location.

**Primary author:** KIM, Jong Woo (Korea Atomic Energy Research Institute)

**Co-authors:** Dr PARK, June Sic (Korea Atomic Energy Research Institute); Mr YANG, Seong Woo (Korea Atomic Energy Research Institute); Dr CHOO, Kee Nam (Korea Atomic Energy Research Institute)

**Presenter:** KIM, Jong Woo (Korea Atomic Energy Research Institute)

**Session Classification:** #04 - Research Reactors and Particle Accelerators

**Track Classification:** 04 Research Reactors and Particle Accelerators