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#4-92 Irradiation Rig Design and Preliminary Dosimetry Experiment for CORANI Phase 1 at HANARO Reactor

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The Korea Atomic Energy Research Institute (KAERI) and France's Commissariat à l'énergie atomique et aux énergies alternatives (CEA) have initiated the CORANI (KAERI/CEA cOllaboration for Research reactor Application of Neutron dosimetry and Instrumentations) project, a collaboration aimed at testing CEA's instrumentation sensors within KAERI's research reactor, HANARO (High-Flux Advanced Neutron Application Reactor). This collaboration highlights the importance of international partnerships in advancing nuclear sensor technology and enhancing real-time monitoring in irradiation environments. This project is designed in two phases: Phase 1 focuses on neutron field characterization within irradiation holes using CEA's self-powered neutron detector (SPND) and fission chamber (FC), including their acquisition systems (Libera Current Meter for SPNDs and Libera MONACO 3 system for FCs), while Phase 2 will involve testing sensors for gamma and temperature measurement. Currently, the project is in Phase 1, with irradiation tests scheduled to begin at HANARO in the first half of 2025. The HANARO reactor, an open-pool type reactor with a maximum thermal power of 30 MW, contains seven vertical holes in the core that provide neutron fluxes up to 4.39×10^{14} and 1.54×10^{14} neutrons/cm²/sec for thermal (E < 0.625 eV) and fast (E > 1.0 MeV) neutrons, respectively, along with 17 vertical holes in the reflector region with fluxes up to 1.95×10^{14} and 2.20×10^{12} neutrons/cm²/sec. The Phase 1 experimental setup includes two irradiation rigs designed to accommodate the specific conditions of HANARO's operating environment. The first rig, intended for dosimetry experiments using activation foils, allows measurements at 3–5 axial points in the center of the vertical hole. An activation foil container was designed to accommodate an approximately 1.5-mm-thick B4C filter. The second rig, designed for online sensor testing, accommodates six FC and three SPND sensors arranged axially and enables simultaneous dosimetry. This presentation focused on the design and fabrication of the irradiation rigs, along with preliminary dosimetry results in preparation for Phase 1. The preliminary experiment was a dosimetry test for the HANARO irradiation hole using the dosimeters and mobile HPGe spectroscopy acquisition system from CEA's MADERE (Measurement Applied to DosimEtry in REactors) facility. This first irradiation campaign was realized in an almost fully thermalized neutron spectrum (98%) leading to specific analysis of the X and gamma-spectrometry to unfold some unusual contributions from isotopes produced by high-level thermal reactions. The analysis results were compared with those measured using the HPGe measurement system at the HANARO facility. This experiment has demonstrated the performance of the new CEA mobile spectrometry acquisition device; it allows precise X and Gamma emitter measurements with the identical HPGe diode.

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