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#4-29 Results of South East Flux Trap Dosimetry Measurements for the Advanced Test Reactor Critical Facility in support of Advanced Sensors and Instrumentation Development

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Reactor dosimetry measurements are commonly used to validate simulation and modeling in nuclear reactor experiments. Numerous standard dosimeter materials exist which are commonly utilized for their sensitivities to different energy ranges of neutrons. At the Advanced Test Reactor, cobalt alloy and pure nickel wires are installed every cycle to monitor thermal- and fast-neutron fluence rates. However, there is growing interest in exploring less commonly used materials which are either more sensitive to different parts of the neutron energy spectrum or which can incorporate multiple activation paths in a single material. Epithermal and fast-neutron energies beyond the typical 1-MeV threshold are of particular interest. Two Advanced Test Reactor Critical Facility Flux Runs took place during 2024; each flux run included supplemental dosimetry packages in the South-East Flux Trap. The focus of the dosimetry package for flux run 23-4 was to test two novel dosimetry methods that can provide simultaneous thermal and threshold (fast) sensitivity in a single dosimeter wire. A selection of 3% gold in copper alloyed wires was available that provided sensitivity to fast and thermal neutrons through 5 different reactions. Likewise, iron offers multiple interaction pathways with sensitivity to both thermal and fast neutrons. The main question to be answered by these irradiations was if sufficient radioactivation would take place in the Advanced Test Reactor Critical Facility South-East Flux Trap during a nominal 20-minute irradiation at typical power levels (near 600Wth) to allow the observation of the threshold reactions with smaller activation cross-sections than the thermal reactions, without being saturated by interfering interactions and Compton continuum during the High-Purity Germanium measurements. The results from comparing the measurement results to anticipated activity levels provide confidence in our ability to activate both traditional and novel dosimetry materials in Advanced Test Reactor Critical Facility, however not all the measured values matched with the predicted activities. This leaves further room for investigation both on the experimental and computational approaches for future irradiation experiments.

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