Contribution ID: **116** Type: **Poster**

#9-116 Response of RPL and RADFET passive dosimeters in 6 and 7 MeV gamma field around KATANA water activation facility

Wednesday, June 11, 2025 5:05 PM (5 minutes)

Water activation is a critical consideration in fusion reactors, where the interaction of neutrons with cooling water leads to the production of radioactive isotopes, including ${}^{16}_{7}N$, which emits high-energy γ rays. The activated cooling water contributes to intense radiation fields around fusion reactor cooling loop that require careful monitoring to ensure the safety of personnel and the integrity of surrounding facilities. Accurate dose measurements are essential in these environments to assess radiation levels, optimize shielding strategies and minimize exposure during operation and maintenance. Reliable dosimetry instrumentation is critical for assessing radiation doses in the vicinity of activated water systems, which is essential for both routine monitoring and the development of safety protocols in fusion reactors.

In this study, the response of radio-photoluminescence dosimeters (RPL) and radiation-responsive field-effect transistor dosimeters (RADFET) to high-energy γ radiation, in particular 6 and 7 MeV photons emitted during the decay of ${}^{16}_{7}N$, is investigated in the vicinity of the KATANA water activation facility, JSI. The main objective is to evaluate the dosimetric performance, sensitivity and reliability of RPL and RADFET dosimeters under controlled high-energy γ radiation, simulating the complex radiation fields typical in nuclear facilities. The study includes both experimental and simulation methods, using the Monte Carlo N-Particle (MCNP) code to model energy deposition and particle transport, providing a solid basis for interpretation and validation of the dosimeter response.

Some dosimeters are shielded with lead to assess the attenuation and evaluate the response of the shielded dosimeters to high-energy γ radiation. The performance of lead shielding is analyzed by comparing the readings of shielded and unshielded dosimeters, providing practical insights into radiation protection and shielding concepts. The MCNP simulations allow a analysis of particle transport in the γ radiation field, which enables accurate prediction of dose distribution and provides a complementary tool for the interpretation of experimental results, improving radiation monitoring and safety protocols in nuclear and radiological applications.

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Session Classification: #09 - Environmental and Medical Sciences

Track Classification: 09 Environmental and Medical Sciences