ANIMMA 2021

Prague, Czech Republic June 21-25, 2021

Contribution ID: **192** Type: **Poster**

#04-192 Measuring gamma doses over the mGy-MGy range with a single type of TLD detector

Wednesday, June 23, 2021 4:30 PM (5 minutes)

Thermo-luminescent detectors are currently used to measure gamma doses in the medical and environmental surveillance fields. During the past few years, the CEA Reactor Studies Division tested and validated the use of these detectors for gamma flux characterization and nuclear heating measurements in mixed neutron/gamma fields of low power reactors. Doses were comprised between a few mGy and a few Gy for dose rates up to a few Gy/h. However, in MTR or TRIGA reactors, the gamma flux level is much higher (> 10^{12} n/cm²/s) and the TLD currently in use (TLD400 (CaF_2:Mn) and TLD700 (^{7}LiF:Mg,Ti)) and their readout protocol are no longer suitable for the resulting doses. In order to extend the applicable dose range up to ~1MGy (dose rate of a few kGy/h), several options were explored. On one side, some adjustments were made to the readout protocol of TLD400 and TLD700, notably by testing the use of filters to reduce the amount of light received by the reader PMT to avoid saturation. On the other side, a new type of TLD (LiF:Mg,Cu,P) with different Li enrichments (natural –MCPN or enriched in ^{7}Li –MCP7) was tested.

This paper presents the calibration measurements results performed in pure gamma fields, at the irradiation platform of the CEA Cadarache Radioprotection Division, between 250 mGy and 3 Gy for all detector types. In addition to the calibration, these measurements also studied the MCPN and MCP7 response: reproducibility, dose rate dependence, incoming photon energy dependence, high temperature effect when reading TLD, etc. In parallel, a numerical model of the thermoluminescence process was developed. This numerical model was validated using the calibration measurements and used to optimize the heating laws of all TLD types.
Using these optimized heating laws, TLD detectors will be used to characterize the gamma field and nuclear heating in the TRIGA Mark II reactor at the Jožef Stefan Institute (JSI) in Slovenia. Measurements are expected to take place in the second half of 2021, in the frame of a CEA-JSI collaboration dedicated to the benchmark of the TRIGA reactor neutron and photon 3D transport model.

Primary authors: GRUEL, Adrien (CEA/DES/IRESNE/DER/SPESI/LP2E); SARDET, Alix (CEA/DES/IRESNE/DER/SPESI/LP2E); CHAUS
SONNET, Vincent (CEA/DES/IRESNE/DER/SPESI/LDCI); HOUDOUIN-QUENAULT, Maxime (CEA/DES/IRESNE/DER/SPESI/LP2E)

Presenter: GRUEL, Adrien (CEA/DES/IRESNE/DER/SPESI/LP2E)

Session Classification: 04 Research Reactors and Particle Accelerators

Track Classification: 04 Research Reactors and Particle Accelerators