ST 3: Radiation monitoring and dosimetry II

Time: Wednesday 11:00–12:00 Location: H-HS II

ST 3.1 Wed 11:00 H-HS II

TL-DOS dose estimation study considering pre- and post-irradiation fading — •Hannah Jansen[1], Kevin Kröninger[1], Florian Mentzel[1], Jens Weingarten[1], and Jörg Walbersloh[2] — [1]TU Dortmund — [2]Materialprüfungsamt NRW

The sliding film dosimeters currently used for personal dosimetry have to be replaced soon, because they do not meet the legal requirements for a renewal of their type approval any more. The TL-DOS dosimetry system will replace them in the western part of Germany. TL-DOS is developed by the *Materialprüfungsamt NRW* and the *TU Dortmund*. It is based on thermoluminescence using LiF:Mg, Ti. Ionizing radiation excites electrons so that electrons and holes get captured in local energy states (traps). They get released by heating the detector and recombine. The number of recombination photons is proportional to the deposited dose. The so-called glow curve is a plot of the number of photons as function of detector temperature. The glow curve is mainly affected by two processes: the pre- and the post-irradiation fading. Electron and hole traps change their configuration over time which is called pre-irradiation fading. Additionally, the electron release already starts at room temperature which causes a time-dependent photon number. This is the post-irradiation fading. A better understanding of their effect on the glow curve is necessary to draw more precise conclusions about the irradiation circumstances such as the irradiation date. In this talk, I will present results of a measurement program varying pre- and post-irradiation fading times and radiation dose.

ST 3.2 Wed 11:15 H-HS II

Irradiation date estimation for personal dose monitoring using artificial neural networks — •Florian Mentzel[1], Kevin Kröninger[1], Jörg Walbersloh[2], and Jens Weingarten[1] — [1]TU Dortmund — [2]Materialprüfungsamt NRW

In cooperation with the Chair for Experimental Physics IV at the TU Dortmund, the Materialprüfungsamt NRW (MPA NRW) is developing the new dosimetry system TL-DOS based on thermoluminescence. This system will replace the currently used film badge dosemeter for personal dose monitoring.

During irradiation, thermluminescence dosemeters store deposited energy by trapping excited electrons in metastable states. These electrons are released and can recombine when the detector is heated. The amount of recombination photons is proportional to the irradiation dose. If additional information is derived from a personal dosemeter, this can be beneficial for the radiation protection of the monitored person. Knowledge about the irradiation date, for example, allows for better retracing of the source and reason for an unnoticed exposition to radiation.

I present the results of a study on the date of irradiation of personal dosemeters. Neural networks are used to analyze the time- and temperature-dependent recombination photon counts. We focus on the case of a single irradiation with a high dose within the monitoring interval of one month. Currently conducted studies are extending this proof-of-concept study with the long-term goal to transfer the developed methods to routine dose monitoring.

ST 3.3 Wed 11:30 H-HS II

Development of radiation-induced frequency shifts in TCXO crystal oscillators — •Luisa Speicher[1], Marius Hötting[1], Kevin Kröninger[1], Markus Markgraf[2], Florian Mentzel[1], Jan Pitann[2], Jörg Walbersloh[3], Jens Weingarten[1], and Andreas Spoerl[2] — [1]TU Dortmund, Lehrstuhl für Experimentelle Physik IV — [2]Deutsche Zentrum für Luft- und Raumfahrt — [3]Materialprüfungsamt NRW

The German Space Operations Center has observed a shift in the clock frequency of GPS modules used in various satellite missions. This frequency is generated by a temperature compensated crystal oscillator (TCXO) and is important for position determination. The effect is caused by radiation on the satellites orbit.

The goal of this project is to find out whether this effect could be used in the field of dosimetry. As part of a master thesis which is part of a cooperation with the TU Dortmund, a more detailed investigation of the radiation effects on the quartz is carried out. Existing read-out systems and analysis methods are adapted for variable clock frequencies to gain a better understanding of this effect.

In this talk we will present recent results from the aforementioned project. The main focus of this talk will be the discussion of the correlation between the radiation-induced frequency shifts and the variable clock frequencies.

ST 3.4 Wed 11:45 H-HS II

Investigation of radiation-induced frequency shifts in TCXO crystal oscillators — •Marius Hötting[1], Kevin Kröninger[1], Markus Markgraf[2], Florian Mentzel[1], Jan Pitann[2], Luisa Speicher[1], Andreas Spoerl[2], Jörg Walbersloh[3], and Jens Weingarten[1] — [1]TU Dortmund, Lehrstuhl für Experimentelle Physik IV — [2]Deutsches Zentrum für Luft- und Raumfahrt — [3]Materialprüfungsamt NRW

The German Space Operations Center has observed a shift in the clock frequency of GPS modules used in various satellite missions. This frequency is generated by a temperature compensated crystal oscillator (TCXO) and is important for position determination. The effect is caused by radiation on the satellite's orbit.

The goal of this project is to find out whether this effect could be use in the field of dosimetry. As part of a master thesis which is part of a cooperation with the TU Dortmund University, a more detailed investigation of the radiation effects on the quartz is carried out. The observed frenquency shifts are very small compared to the signal frequency. Therefore, a read-out system and analysis method with very high precision is developed.

In this talk we will present recent results from the aforementioned project. This will include a short overview of the developed read-out system and the analysis method. The main focus of this talk will subsequently be the discussion of the correlation between the frequency shift and the radiation dose.