# AbstractID: 11260 Title: Energy dependence of TLD-100 chips and microcubes for the Xoft Axxent® 50 kV miniature x-ray source and 137Cs relative to 60 Co 

Purpose: To use experimental methods to measure the overall energy dependence of $\mathrm{LiF}: \mathrm{Mg}, \mathrm{Ti}$ thermoluminescent dosimeters (TLDs) for the Xoft Axxent ${ }^{\circledR}$ miniature x-ray source (mean energy $\sim 27 \mathrm{keV}$ ) and ${ }^{137} \mathrm{Cs}\left(662 \mathrm{keV}\right.$ ) relative to ${ }^{60} \mathrm{Co}(1250 \mathrm{keV})$, to calculate the absorbed-dose energy dependence with the Monte Carlo (MC) code MCNP5, and to determine the intrinsic energy dependence of the TLDs by dividing the measured overall energy dependence by the absorbed-dose energy dependence.

Method and Materials: TLDs were irradiated to a known air kerma with all three sources. The air kerma rate of the miniature x-ray source was measured using an Attix free-air chamber. Each irradiation was performed for TLDs of two different sizes, microcubes $\left(1 \mathrm{~mm}^{3}\right)$ and chips $\left(3 \times 3 \times 1 \mathrm{~mm}^{3}\right)$. MC simulations were performed for each setup to calculate dose to the TLDs including photon scatter from the holders. MC methods were also used to calculate the air kerma.

Results: The overall measured energy response was greater than the MC calculated absorbed-dose energy dependence for both sources and both chip sizes. The difference between the measured and calculated energy dependence for the miniature x-ray source was greater than for ${ }^{137} \mathrm{Cs}$, which means that the intrinsic energy dependence of $\mathrm{LiF}: \mathrm{Mg}$, Ti TLD chips and microcubes relative to ${ }^{60} \mathrm{Co}$ is more pronounced at lower energies.

Conclusion: This experiment provides further evidence that TLDs have intrinsic energy dependence in addition to the absorbed-dose energy dependence that can be calculated using Monte Carlo methods. MC corrections alone are not able to calculate the overall energy dependence of TLDs. Therefore, appropriate energy dependence corrections must be measured and applied to TLD measurements when calibration irradiations are performed at a different energy.

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