

Dosimetric characteristics of an optically stimulated luminescence dosimeter, OSLD, used for clinical measurements

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Purpose: to determine the dosimetric characteristics of OSLDs that are critical for their use in clinical measurements.

Methods and Materials: OSLDs and a reader were obtained from Landauer, Inc., Glenwood, IL. The OSLDs are plastic discs infused with aluminum oxide doped with carbon ($\text{Al}_2\text{O}_3:\text{C}$). These discs are encased in a light tight plastic holder. Crystals of $\text{Al}_2\text{O}_3:\text{C}$ when exposed to ionizing radiation store energy that is released as luminescence (420 nm) when the OSLD is illuminated with stimulation light (520 nm). The intensity of the luminescence depends on the dose absorbed by the OSLD and the intensity of the stimulation light. OSLDs were irradiated with a Varian 2100 EX.

Results: Repeated readings of an OSLD cause the signal to decrease by 0.05% per reading. Irradiated OSLDs could be totally discharged by illuminating them for >45s with a 150 W tungsten-halogen light. After irradiation OSLDs had a transient signal that decayed with a 0.8 min halftime. Reading of OSLD was done after an 8 minute wait after irradiation. After the transient decay, the OSLD signal was stable for days. OSLDs could be irradiated and read repeatedly with a precision of $\pm 1.8\%$. OSLD sensitivity was unchanged up to an accumulated dose of 15 Gy and thereafter decreased by 5% per 10 Gy of additional accumulated dose. For 6 and 15 MV x-rays and 6 to 20 Mev electrons the OSLD sensitivity was unchanged $\pm 1.8\%$.

Conclusions: OSLDs exhibit high precision and accuracy in measuring dose, are small in size, have no energy dependence, and can be read long after irradiation. OSLD can substitute for TLD and diodes for *in vivo* dosimetry and routine clinical dose measurements.