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Dependence of the photo-ionization cross-section of α-Al2O3:C on the measurement temperature

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Abstract content
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In this study we report the temperature dependence of the photo-ionization cross-section i.e. the effective area of interaction between incident photons and charge trapping states, in &alpha-Al2O3:C, a highly sensitive dosimetric material. Samples irradiated to 1.0 Gy of beta dose were subjected to linear-modulation-optically-stimulated-luminescence (LM-OSL) technique which involves ramping the optical stimulation power from a minimum value to some maximum value at a constant wavelength. Blue LEDs (470 nm) with a total maximum power of 80 mWcm-2 at the sample position were used as a stimulation source. In our investigations, the stimulation power was ramped from 0% to 100% of the maximum power. The resultant LM-OSL curve was deconvoluted using the Bulur's analytical expression [1] for first order kinetics. For the sake of comparison, the LM-OSL first order expression which is based on experimental quantities [2] was also used. The apparently single LM-OSL peak is comprised of at least two components, herein referred to as fast and slow components. The peak positions of the component peaks shift to lower values with increasing measurement temperature. In addition, the photo-ionization cross-sections for both fast and slow components vary from (1.19-1.69)x10⁻¹⁸ cm⁻² and (4.05-7.20)x10⁻¹⁹ cm⁻² respectively as measurement temperature increases from 30-120℃. Furthermore, the results obtained through the analytical expression of first order are consistent with those obtained using its experimental counterpart.

References

1. Bulur E., 1996. An alternative technique for optically stimulated luminescence (OSL) experiment. Rad. Meas. 26, 701-709

2. Kitis G. and Pagonis V., 2008. Computerized curve deconvolution analysis for LM-OSL. Rad. Meas.

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