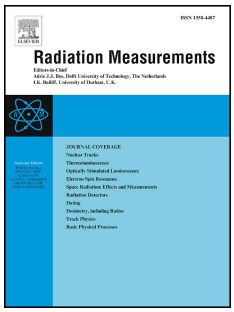
Accepted Manuscript



On the validity and accuracy of the initial rise method investigated using realistically simulated thermoluminescence curves

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PII: S1350-4487(17)30817-X

DOI: 10.1016/j.radmeas.2018.07.010

Reference: RM 5959

To appear in: *Radiation Measurements*

Received Date: 6 December 2017

Revised Date: 9 July 2018

Accepted Date: 16 July 2018

Please cite this article as: Coleman, A.C., Yukihara, E.G., On the validity and accuracy of the initial rise method investigated using realistically simulated thermoluminescence curves, *Radiation Measurements* (2018), doi: 10.1016/j.radmeas.2018.07.010.

On the validity and accuracy of the initial rise method investigated using realistically simulated thermoluminescence curves

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Abstract

The objective of this work was to investigate the validity and accuracy of the initial rise method (IRM) in combination with step-annealing procedures for the analysis of realistically simulated thermoluminescence (TL) curves with strongly overlapped TL peaks. First-order TL curves associated with a variety of trapping center distributions (e.g. discrete, uniform and Gaussian distributions in activation energy) subjected to a step-annealing procedure were simulated. Noise was added to the data to simulate actual experimental conditions of strongly overlapped TL peaks and investigate various approaches to recover the underlying activation energy (E) distributions. The results demonstrate that the IRM alone is insufficient to recover the input E-distributions, but that the calculation of the trap density using methods similar to those proposed by Gobrecht and Hofmann (1966) and Van den Eeckhout et al. (2013) provide a reasonable estimation of the E-distributions in most but not all cases. We also show that a histogram of E values obtained by applying the IRM to various portions of the TL curve can provide an indication of whether one is dealing with a single discrete E-distribution or not. The results show the utility of the IRM as part of a researcher's toolbox for understanding a materials' underlying E-distribution, but it also reveals the method's limitations and the need for further developments.