

# Accepted Manuscript

A model explaining the anomalous heating-rate effect in thermoluminescence as an inverse thermal quenching based on simultaneous thermal release of electrons and holes

R. Chen, V. Pagonis

PII: S1350-4487(16)30375-4

DOI: [10.1016/j.radmeas.2016.11.004](https://doi.org/10.1016/j.radmeas.2016.11.004)

Reference: RM 5661

To appear in: *Radiation Measurements*

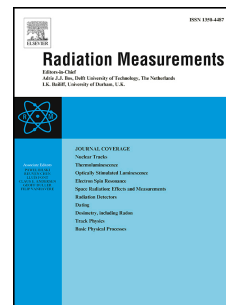
Received Date: 27 July 2016

Revised Date: 11 November 2016

Accepted Date: 16 November 2016

Please cite this article as: Chen, R., Pagonis, V., A model explaining the anomalous heating-rate effect in thermoluminescence as an inverse thermal quenching based on simultaneous thermal release of electrons and holes, *Radiation Measurements* (2016), doi: 10.1016/j.radmeas.2016.11.004.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



A model explaining the anomalous heating-rate effect in thermoluminescence as an inverse thermal quenching based on simultaneous thermal release of electrons and holes

R. Chen<sup>a\*</sup>, V. Pagonis<sup>b</sup>

<sup>a</sup>Raymond and Beverly Sackler School of Physics and Astronomy, Tel-Aviv University, Tel-Aviv 69978, Israel

<sup>b</sup>Physics Department, McDaniel College, Westminster, MD21157, USA

**Abstract.**

A model is presented which explains the anomalous heating-rate effect of thermoluminescence (TL) in which the peak area increases with increasing heating rate. In a similar way to the Schön-Klasens model, the present model is based on delocalized transitions only. In addition to the occurrence of an electron trapping state and a hole recombination center, we assume the participation of a hole reservoir which competes with the other levels and participates in the process during both the excitation and the read-out stages. Moreover, we assume that the reservoir is close enough to the valence band so that holes may be thermally released in the same temperature range in which electrons are thermally raised into the conduction band. Simulations with this model show that, with certain sets of trapping parameters, an increase of the heating rates results in an increase in the area under the normalized TL curve. Inverting the roles of the recombination center and the reservoir so that the recombination of a free electron with a hole in the reservoir is assumed to be radiative and the other recombination is radiationless yields opposite results. Increasing the heating rates causes a significant decrease in the area under the TL curve which is a demonstration of the well-known thermal quenching heating-rate effect of TL. An intuitive qualitative explanation of these two effects within the proposed model is given. A recently discovered case in which two consecutive TL peaks respond to the heating rate change in opposing directions, one decreases and the other increases with increasing heating rate can also be explained by this model.

**Keywords:** Thermoluminescence; Normal and anomalous heating-rate effect; Simultaneous electron and hole thermal release, thermal quenching.

\*Corresponding Author. Tel: +972-3-6408426; Fax: +972-9-9561213. *E-mail address:* chenr@tau.ac.il (R. Chen).

Download English Version:

<https://daneshyari.com/en/article/8250105>

Download Persian Version:

<https://daneshyari.com/article/8250105>

[Daneshyari.com](https://daneshyari.com)