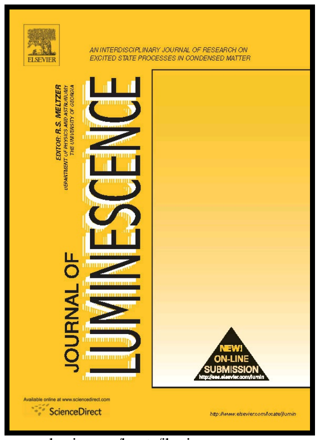
Author's Accepted Manuscript



www.elsevier.com/locate/jlumin

On the analysis of glow curves with the general order kinetics: reliability of the computed trap parameters

F. Ortega, M. Santiago, N. Martinez, J. Marcazzó, P. Molina, E. Caselli

PII: S0022-2313(16)30885-7
DOI: http://dx.doi.org/10.1016/j.jlumin.2016.11.034
Reference: LUMIN14372

To appear in: *Journal of Luminescence*

Received date: 5 July 2016
Revised date: 13 October 2016
Accepted date: 10 November 2016

On the analysis of glow curves with the general order kinetics: reliability of the computed trap parameters

F. Ortega[1], M. Santiago[2], N. Martinez[2], J. Marcazzó[2], P. Molina[2], E. Caselli[2]

[1]Facultad de Ingeniería (UNCPBA) and CIFICEN (UNCPBA – CICPBA – CONICET), Av. del Valle 5737, 7400 Olavarría, Argentina
[2]Instituto de Física Arroyo Seco (UNCPBA) and CIFICEN (UNCPBA – CICPBA – CONICET), Pinto 399, 7000 Tandil, Argentina

Abstract
Nowadays the most employed kinetics for analyzing glow curves is the general order kinetics (GO) proposed by C. E. May and J. A. Partridge. As shown in many articles this kinetics might yield wrong parameters characterizing trap and recombination centers. In this article this kinetics is compared with the modified general order kinetics put forward by M. S. Rasheedy by analyzing synthetic glow curves. The results show that the modified kinetics gives parameters, which are more accurate than that yield by the original general order kinetics. A criterion is reported to evaluate the accuracy of the trap parameters found by deconvolving glow curves. This criterion was employed to assess the reliability of the trap parameters of the YVO_4: Eu^{3+} compounds.

Introduction
Glow curve analysis is a frequently used procedure for investigating the kinetics involved in thermoluminescence (TL). Basically it relies on choosing a model, which is in accordance with experimental results at hand, and on deriving a theoretical expression for the emitted light $I_{th}(T,\alpha)$ (glow curve) from the set of differential equations describing the carrier traffic among traps and recombination centers. T stands for the temperature, and α for the set of parameters characterizing traps and recombination centers. The simplest model, known as one trap-one recombination center (OTOR), is shown in figure 1.

Fig. 1: OTOR model. A_m is the recombination probability, h is the concentration of holes in the recombination center, A_n is the retrapping probability, N is the concentration of traps, n is the concentration of trapped electrons, s is the frequency factor, E the activation energy, and k is the Boltzmann constant. The product s·exp(-E/kT) is the escape probability of an electron from a trap.

For the model shown in figure 1 the set of parameters is $\alpha=\left[E,s,n0,A_m,A_n\right]$, where n_0 stands for the initial concentration of trapped electrons. According to this model, during irradiation, a part of the electrons freed by the ionizing radiation are captured by traps. Later, when the sample is heated, the trapped electrons jump into the conduction band,