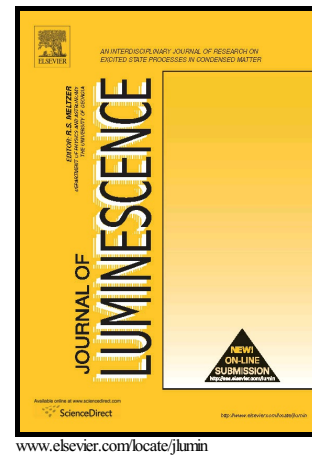


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A critical look at the kinetic parameter values used in simulating the thermoluminescence glow-curve

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Highlights:

- ❖ Objections against using the TL peak fitting method are discussed.
- ❖ Improper selection of simulation inputs may lead to non realistic TL peaks.
- ❖ Considering the irradiation and the relaxation stages in simulation is crucial.
- ❖ TL expressions could not describe TL peaks with unrealistic geometrical properties.
- ❖ The accuracy of the peak fitting method depends on the model used in the fitting.

Abstract

Objections against utilizing the peak fitting method in computing the kinetics parameters of thermoluminescence (TL) glow-peaks were discussed previously in the literature. These objections came through testing the accuracy of the peak fitting by applying on simulated peaks. The results showed that in some cases the simulated peaks may have unusual geometrical properties and do not reflect the real properties of TL peaks. Thereby, estimating the accuracy of the peak fitting by applying on such peaks would be misleading. Two main reasons may lead to unrealistic simulated peaks; the improper selection of the simulation inputs, and performing the TL simulation process via the heating stage only. It has been proved that considering the irradiation and the relaxation stages in the simulation process is crucial. However, there are other cases in which the analytical methods were not able to reveal the real values of the simulated peaks. These cases were successfully resolved using analytical expressions derived from the one trap-one recombination (OTOR) level model and the non-interactive multiple trap system (NMTS) model. A general conclusion can be drawn that the accuracy of the peak fitting method is critically dependent on the TL analytical expressions utilized in this method. The failure of this method in estimating the TL kinetic parameters should be attributed to the TL model equation utilized in fitting process.

Keywords

Thermoluminescence; glow-curve analysis

Introduction:

A major part of TL literature deals with efforts to extract useful information from the experimental thermoluminescence (TL) glow-curves. Methods suggesting evaluating the trap parameters based on the shape of the TL glow-peak are the most popular and are extensively used. Therefore, under the quasi-equilibrium (QE) assumption, many single TL peak expressions were derived in order to be implemented in fitting the experimental TL glow-curves. In addition, many peak shape methods (PSMs) were also developed in order to extract the trap parameters using the geometrical properties of the TL glow-peak. However, in parallel to these efforts, serious objections were arisen concerning the validity of the analytical TL expressions and other methods for evaluating the trap parameters. Perhaps, the most serious objections come from the work of Kelly *et al.* (1971) as well as Opanowics (1992). The most crucial objections of the above authors are summarized as:

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