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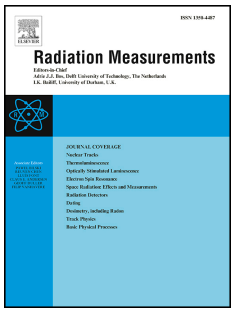

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AN OVERVIEW OF RECENT DEVELOPMENTS IN LUMINESCENCE MODELS WITH A FOCUS ON LOCALIZED TRANSITIONS

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ABSTRACT

Advances in modeling during the past 20 years have contributed to better understanding of the luminescence properties of dosimetric materials. Three types of models have been used extensively in the literature: delocalized models based on transitions involving the conduction and valence bands, localized models usually involving different energy levels of the same trap, and semilocalized models which are based on a combination of localized and delocalized energy levels. The purpose of this paper is to provide an overview of recent developments in luminescence models, with an emphasis on the importance of delocalized transitions. Two recent theoretical developments are discussed, namely analytical equations based on the Lambert W-function which are applicable for delocalized models, and analytical equations based on tunneling in a random distribution of defects which are applicable for localized models. A new model for luminescence in quartz is proposed, which is applicable for time scales ranging from microseconds to seconds. Recent Monte Carlo simulations of ground state tunneling in a random distribution of traps and centers are discussed, which are based on a modified version of a previously published model. Some of the current challenges associated with luminescence signals measured at elevated temperatures are pointed out, and suggestions are made for future work in this research area.

Key Words: localized luminescence models; Time resolved luminescence; feldspar models; quartz models.

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