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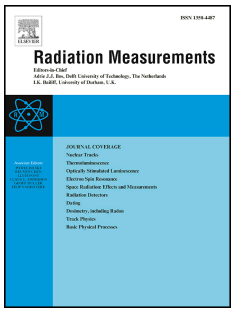

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On the dose rate dependence of radiofluorescence signals of natural quartz

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Abstract

The general behaviour of the main UV emission during radiofluorescence (RF) in natural quartz with dose rates ranging from 10 – 500 mGy s^{-1} is analysed. RF emission spectra were recorded and deconvolved to extract information on the C band, which is often the main emission of quartz annealed at a temperature close to 500 °C. Our results confirmed theoretical findings, e.g., the direct proportionality of the initial RF signal of the C band with dose rate and the direct proportionality of the initial slope with the squared dose rate. Furthermore, numerical simulations employing a three-energy-level model and experimental data are in agreement. A first concept of using quartz UV-RF for dosimetric application is given based on the findings that different absorbed doses resulting from different dose rates match well into a single UV-RF decay curve.

Keywords: luminescence, radiofluorescence, quartz, dose rate, simulation

1. Introduction

Thermoluminescence (TL) and optically stimulated luminescence (OSL) are well established methods to determine the energy dose absorbed by natural minerals, such as quartz and feldspar. A key aspect in the accuracy of luminescence dating is the reproducibility of natural processes in the laboratory. However, typical dose rates applied in the laboratory differ by several orders of magnitude from the dose rate in nature. The effect of different dose rates on TL signals of quartz were investigated in different studies: Groom et al. (1978) reported a decrease of TL