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## Mechanisms of luminescence in carbon-doped alpha aluminium oxide: Investigations using time-resolved optical stimulation technique

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### Abstract content (Max 300 words)

Luminescence is the light emitted in the visible or near-visible region of the electromagnetic spectrum from certain materials after they have absorbed excitation energy from such sources as ionizing radiation. The process is the result of relaxation of electronic charges from excited states to ground state configurations and the subsequent emission of photons. The presence of certain crystal defects or impurities in luminescent materials introduces localized levels in the forbidden gap which act as charge traps. The captured charges store energy which appears as a set of temperature-resolved luminescence peaks (thermoluminescence) upon stimulation by heating or as a time-dependent signal if the stimulation is by light. In this work, we are investigating the dynamics of luminescence in carbon-doped alpha aluminium oxide ( $\alpha$ -Al<sub>2</sub>O<sub>3</sub>:C), an ultra-sensitive luminescence dosimeter. The temperature dependence of luminescence lifetimes i.e. the delay between stimulation and emission of luminescence, the dose response, fading characteristics and the dynamic luminescence throughput of the sample, have been investigated after beta irradiation using time-resolved optical stimulation using pulsed stimulation at 470 nm. In particular, the dependence of luminescence lifetimes on measurement temperature showed evidence of thermal quenching, a phenomenon associated with the reduction of luminescence efficiency at higher temperatures. In addition, we noticed a remarkable increase in lifetimes between 40 – 60 °C whose cause is still being investigated. The dose response is linear at low doses, becomes supralinear and then sublinear before saturating. The dynamic luminescence throughput decreases with increased pulse width, and the samples also showed a 5 % fading amount after being stored for 10 days after irradiation.

### Apply to be considered for a student award (Yes / No)?

yes

### Level for award (Hons, MSc, PhD)?

MSc

### Main supervisor (name and email) and his / her institution

Professor ML Chithambo  
M.Chithambo@ru.ac.za

### Would you like to submit a short paper for the Conference Proceedings (Yes / No)?

**Primary author:** Mr NYIRENDA, Angel (Rhodes University)

**Presenter:** Mr NYIRENDA, Angel (Rhodes University)

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