

Compositional Effects on Dosimetric Properties of Potassium Aluminophosphate Glasses

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Phosphate glasses are promising dosimeter materials for radiation detection due to their excellent optical properties and compositional flexibility [1]. Dosimetry using thermally stimulated luminescence (TL) offers high sensitivity and a wide dose-response range. In this study, we prepared potassium aluminophosphate glasses with varying potassium-to-phosphorus (K/P) ratios to evaluate the compositional effects on their dosimetric properties. By analyzing the optical and TL characteristics, we aim to clarify how the K-P ratio influences the trap levels and luminescence behaviors of these glasses.

Photoluminescence (PL) quantum yield (QY) measurements showed that the QY decreased with increasing the K/P ratio, suggesting that changes in the glass network modified the relaxation pathways. In contrast, TL properties exhibited the opposing trend. As shown in Figure 1, the TL glow curves after 100 mGy X-ray irradiation indicate that the TL intensity remarkably increased with the K/P ratio, suggesting that a higher K/P ratio promotes the formation of trapping centers. Furthermore, Figure 2 shows that the samples exhibited excellent linear dose-response behavior over the range of approximately 10 to 1000 mGy. These results demonstrate that increasing the K/P ratio is an effective way to enhance the TL dosimeter performance, despite the reduction in PL QY. Additional dosimetric characteristics, including fading and reproducibility, will be reported in detail during the presentation.

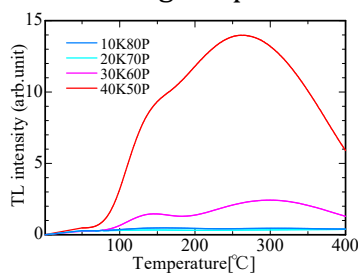


Figure 1 TL glow curves of Ce:K₂O–Al₂O₃–P₂O₅ glasses after X-ray irradiation.

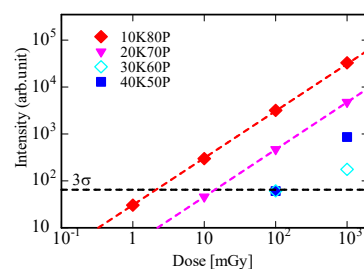


Figure 2 Relationships in TL intensity vs irradiation doses of Ce:K₂O–Al₂O₃–P₂O₅ glasses.

[1] Y. Miyamoto, et al. (2011) Radiat. Meas., 46, 1480–1483.

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