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Gaussian thermoluminescence in long-range disordered K-feldspar

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Abstract

The thermoluminescence behavior of long-range ordered crystals is usually explained by the band structure model, using first- and second-order kinetics. However, feldspars have order-disorder phenomena and twinning, and consequently these mathematical descriptions are not helpful in most cases. In this work, the thermally stimulated intrinsic blue luminescence at 440 nm from X-ray induced defects of the K-rich feldspars is used to show a progressive behavior change along the order-disorder series. It is observed a gradual conversion of the TL signal from a very asymmetric peak with exponential rise and power law decay in microcline and orthoclase, where a τ coefficient in log-log plots decreases with twin/domain size, to a more symmetric signal in a partially disordered sanidine, up to reach a completely symmetric Gaussian peak in fully disordered sanidine. These results are compatible with the Bässler's model of disorder, which suggest that atomic disorder involves the transformation of delocalized bands first into band tails as the source of electron traps, and later in localized density of states following a Gaussian distribution.

Keywords: K-feldspars, thermoluminescence, order-disorder series, density of states