

## **Radioluminescence and thermoluminescence of rare earth element and phosphorus-doped zircon**

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### **ABSTRACT**

The radioluminescence and thermoluminescence spectra of synthetic zircon crystals doped with individual trivalent rare earth element (REE) ions (Pr, Sm, Eu, Gd, Dy, Ho Er, and Yb) and P are reported in the temperature range 25 to 673 K. Although there is some intrinsic UV/blue emission from the host lattice, the dominant signals are from the rare-earth sites, with signals characteristic of the REE<sup>3+</sup> states. The shapes of the glow curves are different for each dopant, and there are distinct differences between glow peak temperatures for different rare-earth lines of the same element. Within the overall set of signals there are indications of linear trends in which some glow peak temperatures vary as a function of the ionic size of the rare earth ions. The temperature shifts of the peaks are considerable, up to 200°, and much larger than those cited in other rare-earth-doped crystals of LaF<sub>3</sub> and Bi<sub>4</sub>Ge<sub>3</sub>O<sub>12</sub>. The data clearly suggest that the rare-earth ions are active both in the trapping and luminescence steps, and hence the TL occurs within localized defect complexes that include REE<sup>3+</sup> ions.