

Ionoluminescence of leucophanite

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ABSTRACT

The luminescence of three natural samples of leucophanite (ideally, NaCaBeSi₂O₆F) has been investigated with ion-beam excitation and by electron spin resonance (ESR). A blue luminescence, ascribed to a defect associated with SiO₄ or BeO₄ tetrahedra, and an orange luminescence, ascribed to an Mn²⁺ center, dominates the emission. Further luminescence centers in the investigated wavelength range (200–1100 nm) include those related to Gd³⁺, Dy³⁺, Tb³⁺, Sm³⁺, Eu³⁺, Tm³⁺, and Nd³⁺. In spite of a sheet-like structure, leucophanite is relatively resilient to the ion implantation and β-irradiation, compared with other minerals, but loss of luminescence intensity as a function of implantation show that some permanent defects are formed. No centers change their emission energy as a function of temperature in the investigated interval (40–300 K), but due to crystal-field interaction, a broadening of the Mn²⁺ emission band is observed with increasing temperature, and with low activator concentration. The variation in activator concentration is clearly seen from a pronounced concentration quenching. ESR data (9.7 and 188 GHz) show that Mn is only present in one crystallographic site and that the REE-richest sample has an additional signal with $g \sim 2.003$. No new defects could be seen with ESR in a β-irradiated sample.

Keywords: Ionoluminescence, leucophanite, ESR, REE, Mn²⁺, lanthanide