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"The electronic structure of luminescent centers in doped phosphors"

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Barium magnesium aluminates doped with europium and manganese (BaMgAl10O17 (BAM): Eu+2 (1%) and Mn+2 (1%)) is widely used as phosphors material in optics and electronics applications, e.g. PDPs (Plasma Display Panels), lamps, and LEDs (Light Emitting Diodes). Despite their widespread use the exact reason for the varying luminescent efficiency is not known and neither is the exact position of the Eu and Mn ions in the BAM structure. In order to address these questions we applied X-ray spectroscopy as an element selective probe to study the local coordination and electronic structure. The experimental data are compared to theoretical calculations based on the finite difference method (FDM) using FDMNES code.
Mn2+ may occupy octahedral or tetrahedral sites by replacing Mg/Al in the BAM structure while Eu2+ enters the mirror layer replacing a Ba ion. The X-ray absorption spectroscopic (XAS) data show a clear signature of Mn2+ in tetrahedral sites. However, XAS cannot rule out Mn in an octahedral environment and we therefore applied X-ray emission spectroscopy (XES) as a complementary tool to probe the occupied electronic orbitals. The rich XES spectrum is expected to show whether Mn also occupies octahedral sites.

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