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Excitation Based Tunable Emissions from the Nanocrystalline $Ca_2Gd_8Si_6O_{26}$: Sm^{3+}/Tb^{3+} Phosphors for Novel Inorganic LEDs

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Nanocrystalline $Ca_2Gd_8Si_6O_{26}$ (CGS) : Sm^{3+} and CGS : Tb^{3+}/Sm^{3+} phosphors were prepared by solvothermal reaction method for light emitting diode (LED) and field emission display (FED) applications. The XRD patterns of these phosphors confirmed their oxyapatite structure in the hexagonal lattice. The visible luminescence properties of these phosphors were investigated by exciting with ultraviolet (UV) or near-UV light and low voltage electron beam. The photoluminescence (PL) properties of $Ca_2Gd_8Si_6O_{26}$ (CGS) : Sm^{3+} and CGS : Tb^{3+}/Sm^{3+} phosphors were investigated as a function of Sm^{3+} concentration. Cathodoluminescence (CL) properties were examined by changing the acceleration voltage. The CGS : Sm^{3+} showed the dominant orange emission due to the $^4G_{5/2} \rightarrow {}^6H_{7/2}$ transition. The CGS : Tb^{3+}/Sm^{3+} phosphor showed the green, white and orange emissions when excited with 275, 378, and 405 nm wavelengths, respectively. The chromaticity coordinates of these phosphors were comparable to or better than those of standard phosphors for LED or FED devices.

Keywords: $Ca_2Gd_8Si_6O_{26}$: Sm^{3+}/Tb^{3+}, Phosphors, LED