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$Dy^{3}+/Eu^{3}+$ Co-Activated Gadolinium Aluminate Borate Phosphor: Enhanced Luminescence and Color Output Tuning

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Abstract : $GdAl_3(BO_3)_4$ phosphors, incorporating $Dy^{3}+$ and $Dy^{3}+/Eu^{3}+$ activators, were successfully synthesized via the gel combustion method. Powder X-ray diffraction (XRD) was utilized to ascertain phase purity and assess the impact of dopant concentration on the crystallographic structure. Photoluminescence (PL) measurements revealed that luminescence properties' intensity and lifetime varied with $Dy^{3}+$ and $Eu^{3}+$ ion concentrations. The relationship between luminescence intensity and doping concentration was explored in the context of the energy transfer process between $Eu^{3}+$ and $Dy^{3}+$ ions. An increase in $Eu^{3}+$ co-doping concentrations resulted in a decrease in luminescence lifetime. Energy transfer efficiency was significantly enhanced from 26% to 84% with $Eu^{3}+$ co-doping, as evidenced by decay curve analysis. These findings position $GdAl_3(BO_3)4$: $Dy^{3}+$, $Eu^{3}+$ phosphors as promising candidates for LED applications in solid-state lighting and displays.

Keywords : $GdAl_3(BO_3)_4$ phosphors, $Dy^{3}+/Eu^{3}+$ co-doping, photoluminescence (PL) measurements, luminescence properties, LED applications, solid-state lighting
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