Abstract #2715, 224th ECS Meeting, © 2013 The Electrochemical Society

Efficient luminescence in Eu^{2+} activated (Ba,Ca)2Si5N8 phosphor

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In this paper, we discuss luminescence properties and reliability under UV/blue flux for $(Ba,Ca)_2Si_5N_8:Ce^{3+},Eu^{2+}$. The barium silicon nitride known to exist in an orthorhombic crystal structure with PL emission ~580nm, whereas, the calcium silicon nitride composition crystallizes in a monoclinic crystal system with emission ~ 620nm. Partial substitution of calicum upto ~25% in $Ba_2Si_5N_8$ increases crystal field around Eu^{2+} ion maintaining original orthorhombic structure of $Ba_2Si_5N_8$. This result in red shift of the emission position ~40nm (Figure 1). Futher, the emission of $(Ba,Ca)_2,Si_5N_8$ at elevated temperature (upto 150^{o}C) are more stable than their end members (Figure2). Our investigation on the stability of this material under UV/blue radiation suggest that at specific concentration levels of Ca, the host $Ba_2Si_5N_8$ has shown better stability towards radiation damage in this system (Figure3). We further investigate the reason for less radiation damage in $(Ba,Ca)_2Si_5N_8$ host compared to $Ba_2Si_5N_8$ and nature of their emission and excitation bands at different Eu^{2+} concentration levels.

Acknowledgements: Authors thank GE Lighting Solutions for supporting this work.

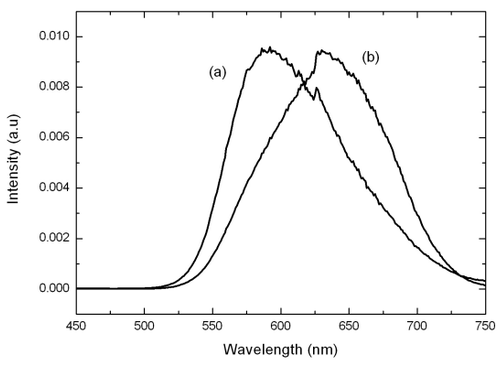

Figure 1. PL emission (λ_{ex} = 405nm) of (a) $Ba_2Si_5N_8:Ce^{3+},Eu^{2+}$ and (b) $(Ba,Ca)_2Si_5N_8:Ce^{3+},Eu^{2+}$

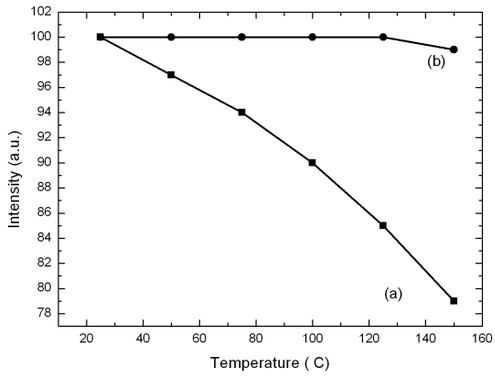

Figure 2. Temperature dependence of luminescence intensity for (a) $Ba_2Si_5N_8:Ce^{3+},Eu^{2+}$ and (b) $(Ba,Ca)_2Si_5N_8$: Ce^{3+}, Eu^{2+}

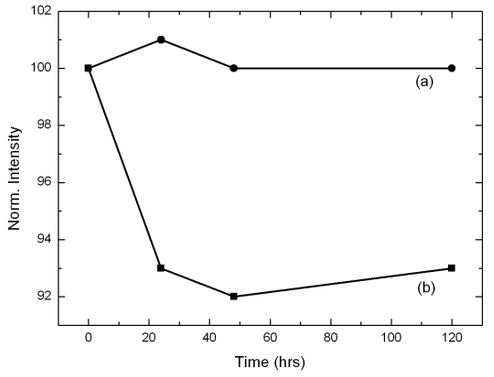

Figure 3. Integrated PL emission intensity as a function of time under, λ_{ex} = 405nm, for (a) $(Ba,Ca)_2Si_5N_8:Ce^{3+}$, Eu^{2+} and (b) $Ba_2Si_5N_8:Ce^{3+},Eu^{2+}$.