Encapsulation of oxynitride phosphors into sintered Li$_2$O-ZnO-B$_2$O$_3$-P$_2$O$_5$-CaF$_2$ glass body

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The conditions for the fabrication of transparent glass body in the Li$_2$O-ZnO-B$_2$O$_3$-P$_2$O$_5$-CaF$_2$ system were examined by a pressureless firing and subsequent oxygen-supplied hot isostatic pressing (O$_2$-HIP). The starting glass was prepared by melting the mixture of LiOH, ZnO, H$_3$BO$_4$, H$_3$PO$_4$ and CaF$_2$ at 1100°C in air, followed by quenching on copper plates cooled by liquid nitrogen. The glass powder compact was pressurelessly-fired at 370°C for 1 h in order to remove the open pores, and the subsequent O$_2$-HIP treatment at 370°C for 24 h under the pressure of 130 MPa made the clear light transmission possible, regardless of the formation of Ca$_2$P$_2$O$_7$ on the surface. The glass body obtained by firing at 370°C for 1 h and the subsequent O$_2$-HIP treatment at 370°C for 24 h was hydrothermally-treated in water at 100°C for 1 h, and found that the mass loss of this body was as low as 0.25%, showing excellent water resistance. When the oxynitride phosphors, i.e., blue-emitting (La$_{0.96}$Ce$_{0.04}$)$_3$Si$_8$O$_{11}$N$_{11}$ and yellow-emitting (Ca$_{0.97}$Eu$_{0.03}$)Si$_2$O$_2$N$_2$, were encapsulated into the glass, no peak shifts in the emission/excitation spectra were found, which demonstrated that no significant degradation of phosphors has occurred during the encapsulation operation. Pseudo-white light emission was observed by the equi-mass addition (total amount: 3 mass%) of (La$_{0.96}$Ce$_{0.04}$)$_3$Si$_8$O$_{11}$N$_{11}$ and (Ca$_{0.97}$Eu$_{0.03}$)Si$_2$O$_2$N$_2$. Overall, the transparent glass body could be fabricated by the pressureless firing and subsequent O$_2$-HIP treatment, and the phosphors were encapsulated into the glass without significant degradation.

Biography

Nanako Akiyama is a student of Sophia graduate school. Her research interest is the luminescence properties of oxide, oxynitride and nitride phosphors, and the encapsulation technique of the phosphors in the glass.

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