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Low characteristic temperature glass ceramic for LED lighting

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With the needs in higher efficiency, enlarged power, and longer lifetime, phosphor-converted, PC, LED lighting has been developed and continuously pushed for better performance. In a YAG/Blue-LED white light system, the degradation of the polymer-based YAG containing layer for light conversion the key. In this work, borosilicate glass systems with functional additives, including Li, Bi, Zn, and La, for YAG phosphor incorporation process at relative low temperatures down to 500°C are studied. Controlled thermal annealing for YAG phosphor powders to be contained in the softened glass to form a 5-150 μm glass-ceramic layer is researched. Through structural and bonding analyses, the addition of Bi is beneficial to a relaxed glass structure, leading to the promotion of refractive index and decrease in characteristic temperatures. The Li and La doped glass systems exhibit a relatively higher glass softening point over 650°C, nevertheless a thicker glass-ceramic layer for conversion can be produced under controlled annealing. The developed YAG containing borosilicate glass-ceramics are applied in the LED lighting package for performance evaluation. A tunable light from yellow, white to blue can be manipulated through YAG containing glass-ceramic layer thickness control.

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