Preparation and application of phosphor-in-glass for Fabricating white LEDs

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Abstract

Phosphor-in-glass (PiG) as fluorescent conversion material has been widely applied in high-power light-emitting diode (LED) owing to its good thermal stability, high thermal conductivity, and low thermal expansion coefficient. However, the preparation technology and optical performances of present PiG are difficult to satisfy the packaging requirement of high-power white LED. Thus, a preparation method based on screen-printing and low-temperature sintering was proposed to prepare PiG in this paper. Preparation technology and properties characterization of PiG were studied. The PiG was prepared by screen-printing and low-temperature sintering. The effects of sintering temperature on the performances of PiG were investigated, and the results indicate that the optimized sintering temperature is 600. In addition, the properties of PiG were analyzed, including microstructure and constituent analysis, phase analysis, transmittance, and emission spectra and excitation spectra.
The yellow PiG was prepared and used to package LED. The effect of yellow phosphor content on the optical performances of white LED was investigated, indicating that when the ratio of yellow phosphor is 40%, the optimized optical performances of LED are achieved. In addition, the reliability of PiG and PiG-based white LED was measured in different aging condition. Compared with the phosphor-in-silicone, the PiG and PiG-based white LED achieve superior thermal reliability.
The yellow and red PiG was prepared and used to package LED. The effect of yellow and red phosphors content on the performances of white LED was studied. The results indicate that when the ratio of yellow phosphor is 40% and the ratio of red phosphor is 9%, the optimal optical performances of LED were achieved. In addition, in order to inhibit spectral overlap, the multilayered PiG and patterned PiG were proposed, thus the optical performances of LED were improved.

Keywords: White LEDs, Phosphor, in, glass, Screen, printing, Optical performance, Application

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