Performance improvement of vertical ultraviolet-LEDs with AlSi alloy substrates

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ABSTRACT

A composite AlSi alloy substrate was fabricated to eliminate thermal expansion coefficient mismatch in high-power vertical light-emitting diodes (VLEDs). At 2000-mA injection current, the light output power performance of LED/sapphire, VLED/Si, and VLED/AlSi are 1458, 2465, and 2499 mW and the wall-plug efficiencies are 13.66%, 26.39%, and 28.02%, respectively. The enhanced performance is attributable to the lower tensile stress and series resistance in VLED/AlSi than in LED/sapphire. The surface temperature of LED/AlSi is almost identical to and lower than that of LED/Si and LED/sapphire, respectively. Raman spectroscopy confirms that the residual strain in GaN film bonding on the composite AlSi is lower than that on bulk sapphire.

Keywords: vertical light-emitting diodes (VLEDs)

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