

Output Power Enhancement of GaN Light Emitting Diodes with p-type ZnO Hole Injection Layer

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The efficiency for LED lamps designed for replacement of incandescent bulbs for use in general home and commercial illumination has been steadily increasing, with an accompanying decrease cost in \$/lumen. These LED lamps are based on GaN-based devices. We report a new structural design for these devices that increases the efficiency by an added 20 – 40%. The design incorporates a p-type ZnO layer sandwiched into the GaN-based device during growth. The reported efficiency jump is due to an increased number of hole-type carriers that reduce the so-called “efficiency droop” that occurs at high drive current operation. This increase in efficiency is in addition to other efficiency improvements reported. This result is useful for development of highly-efficient GaN LEDs operating at high current densities that will play a critical role in replacement of incandescent lamps by high efficiency solid-state light bulbs.