

**A non-contact method for measuring junction temperature of AlGaInP
LED array**

By

Keng Chen

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Approved by the Examining Committee:

Nadarajah Narendran, PhD, Thesis Adviser

Andrew Bierman, Committee Member

Lalith Jayasinghe, PhD, Committee Member

Rensselaer Polytechnic Institute
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ABSTRACT

Generally, higher junction temperature will lead to lower light output and shorten lifetime of light emitting diodes (LEDs). Therefore, by knowing the junction temperature of an LED, one can predict the performance of this device. Currently, most methods for measuring junction temperature require access to the LED lead wires, which is not suitable for a completed LED lighting system. The goal for this thesis study was to develop a non-contact method for measuring the average junction temperature of an AlGaInP LED in an array.

Previous research and literature has shown that for a single AlGaInP LED, the peak wavelength will show a “red shift” with junction temperature, and the correlation is linear. Because of its good linearity, many researchers are trying to use this property to develop a non-contact method to measure junction temperature.

However, other studies have found that different AlGaInP LEDs with different Al doping levels will have different peak wavelength and will show different rates of peak wavelength shift as a function of temperature. This will make the uncertainty of peak detection for the LED array with different peak wavelength AlInGaP LEDs very high. Alternately, in this thesis study, it is shown that the center wavelength of full width at half max (FWHM) also has a linear correlation with junction temperature and the uncertainty of center wavelength detection is much lower compared to peak wavelength detection. Therefore, center wavelength of FWHM can be used as a property to measure the average junction temperature of an AlGaInP LED array.

Finally, the non-contact method based on center wavelength shift was applied to an AlGaInP LED lighting fixture built for this thesis study. The estimated results showed good match with the measured results. Therefore, detection of the center wavelength of FWHM is a promising method for determining the average junction temperature of an LED array in real-life fixtures.