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Spatially Resolved Thermal Analysis of High Power LEDs Using Thermoreflectance Microscopy HEXUAN WANG, KADHAIR AL-HEMYARI, SUSU YAN, JOSEPH SUMMERS, JANICE HUDGINGS, Mount Holyoke College — The efficiency, reliability, and lifetime of high power light emitting diodes (LEDs) depend critically on their operating temperature. The lateral temperature distribution is of particular importance with large area, high power LEDs as defects related to overheating in high power LEDs usually occur at a high rate at the surface. In this work, we present the use of lock-in thermoreflectance imaging to measure the spatially resolved surface thermal distribution of operating LEDs. This non-invasive thermography technique offers high spatial and thermal resolutions. We show that results of thermoreflectance surface temperature are quantitatively consistent with temperature measurements obtained using forward voltage bias and wavelength shift techniques. We demonstrate the power of spatially resolved thermoreflectance by imaging the highly non-uniform surface temperature distribution of an operating LED at high electrical bias power. We conclude that the non-uniform surface temperature distribution is resulted from non-uniformly distributed inject current and overheating at the contacts. We also investigate the thermal impact of encapsulating commercial LEDs with a plastic lens and silicone epoxy.

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