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Pulsed-laser Raman scattering for measurement of junction temperature of white-LED

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Recently, the characteristic of a light emitting diode (LED) has been improved dramatically, and the application to illumination is recognized as one of the most important issue to the manufacturers. It is well known that the efficiency, the output power, the life-time and the reliability of LED degrade with a temperature rise of the junction of LED. In order to fabricate a high quality LED module for illumination, it is necessary to keep the junction temperature low by improving the characteristic of LED chip itself, or by effective heat removal through a heat radiation design of the module. Therefore, it is strongly required to establish a standard method to measure the junction temperatures in LED module. Although several techniques, such as micro-Raman spectroscopy, infrared imaging, and temperature coefficient of diode-forward voltage are applied to estimate the junction temperature, there is no method that can simultaneously measure the junction temperature of the several chips located in a LED module, especially in a phosphor-deposited white-LED. Under these situations, we have been developing a pulsed-laser Raman scattering method for estimation of the junction temperature of LED, where the Raman shift of E_2^H mode of GaN layer is observed. This method has potentials of remoteness and simultaneous multipoint measurement, which lead to 2D mapping of the temperature of the LED module. This technique has been applied successfully to measure the junction temperature of phosphor-less blue-LED, and is considered to be one of the prospective candidates of temperature estimation method of white-LED. In this presentation, simultaneous observation of Raman spectra from several LED chips in a phosphor-less blue-LED module by a pulsed-laser Raman scattering method is demonstrated. Also, the influence of a phosphor deposited on the surface of blue-LED on Raman spectra will be discussed.

Biography

Yukihiko Yamagata has his expertise in Atomic and Molecular Physics, especially in Laser-aided Diagnostics. He has completed his PhD from Kyushu University, Japan. He is an Associate Professor and Leader of a Research Project focusing on standard measurement technology for solid state lighting devices in the Department of Engineering Sciences for Electronics and Materials, Kyushu University, Japan.

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