Experimental Investigation of LED module for VIS-NIR spectroscopy

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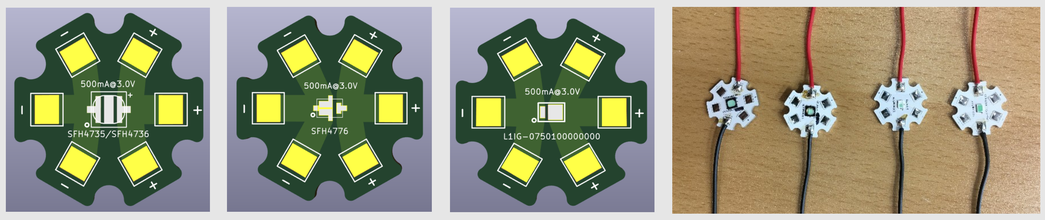
Introduction

- In VIS/NIR spectroscopy, and Hyperspectral imaging, Vis+NIR wavebands have been frequently used for various kinds of applications.
- The light source is one of the important requirements; the Tungsten-Halogen lamp is a common light.
- In order to miniaturize NIR spectral system and hyperspectral imaging system, a light source must be found for the new alternative, so called broadband NIR LED.
- We developed the test apparatus for several broadband NIR LEDs to be compared in terms of spectral radiation ranging of 700nm-1000nm.
- To address VIS-NIR spectroscopy(400nm-1000nm), the VIS+NIR LED module was developed with combination of warm-white LED and broadband NIR LEDs.

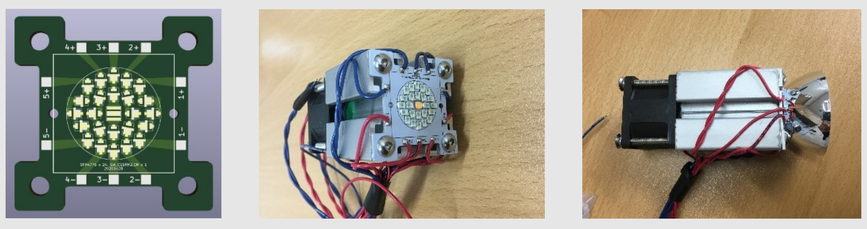
Materials & Method

◆ pc-NIR LED modules with MCPCBs



- For four types of pc-NIR LEDs, i.e., SFH4735, SFH4736, SFH4776 (OSRAM GmbH, Munich, Germany), and L1IG-0750100000000 (LUMILEDS, CA, USA), MCPCBs were developed to provide thermal resistance, and electrical properties at the stable level.
- Using irradiance integrating sphere (AvaSphere-50, Avantes, Apeldoorn, Netherlands) and VIS/NIR spectrometer (HR4PRO-VIS-NIR-ES, Ocean Optics, FL, USA), the comparison for the spectral intensities was preformed.

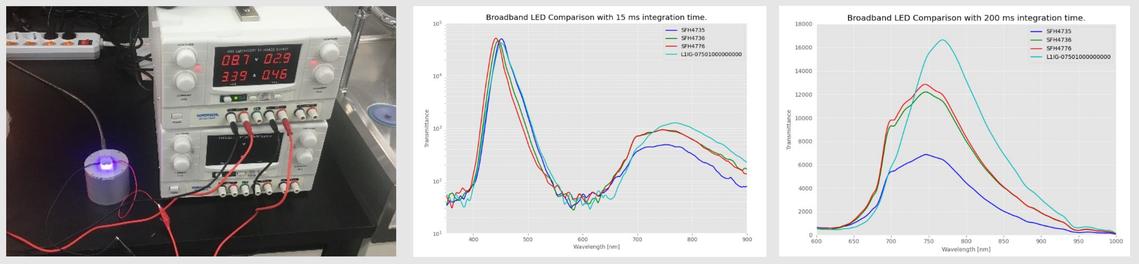
◆ VIS+NIR LED Module with 400~1000nm radiation



- For the full spectral coverage of the TH-lamp, two types of LEDs were used to build the Vis+NIR LED module; GW CSSRM2.EM (OSRAM GmbH, Munich, Germany) and SFH4776, which are a warm-white LED (400–650 nm) and pc-NIR LED(600-1000nm).

Results & Discussion

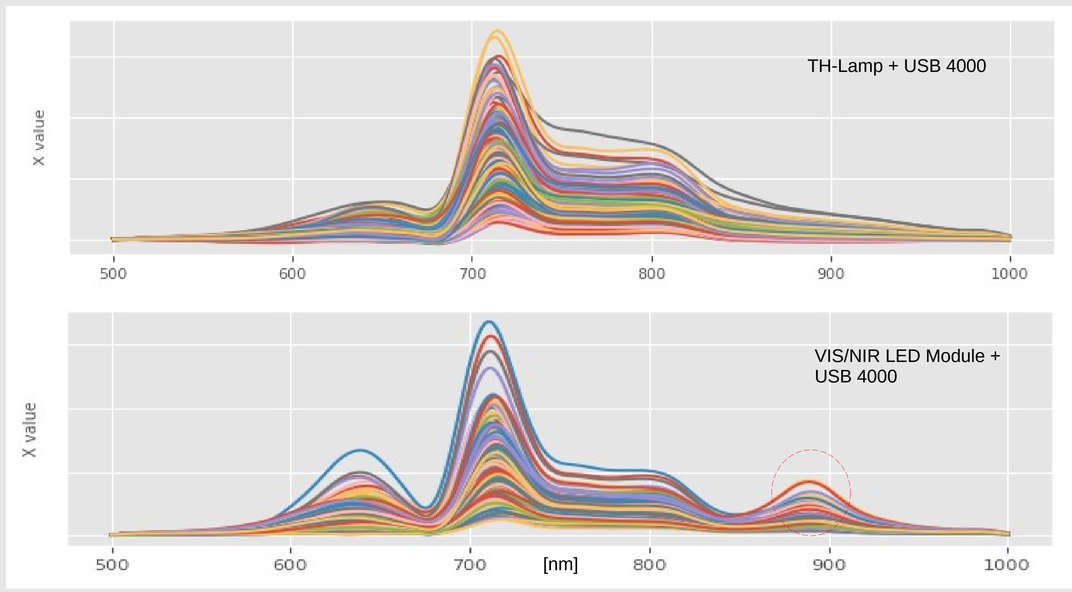
◆ Comparison of pc-NIR LED radiation



- The spectral characteristics were compared with spectral response of the pc-NIR LED in 200–900 nm, and 600-1000nm, respectively.

◆ Transmittance acquisition using VIS+NIR LED module

- the transmittance spectra of a Fuji apple were acquired using the TH-lamp, and VIS+NIR LED module.



- The peak at 650 nm is higher than that of TH-lamp.
- Note: the enclosed by the dotted circle at 900nm caused by the second order diffraction of the 450nm excitation of the blue LED

Conclusion

- The transmittance of Fuji apple using VIS+NIR LED module is preserving the typical characteristic for TH-lamp.
- The results of this study indicate the immense potential of the VIS+NIR LED as a replacement for the TH-lamp in VIS-NIR spectroscopy, which can lead to the emergence of portable spectrometers and hyperspectral imaging devices.

Acknowledgement

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