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MicOS characterizes III-V semiconductor microstructures

Photoluminescence Characterization of GaN Alloys and Other Semiconductor Microstructures

GaN and related alloys are important materials used to build short-wavelength light sources (lasers and LEDs). Room- and low-temperature photoluminescence (PL) are used to characterize these materials as well as device performance. Parameters such as IQE of quantum wells (QW) can be measured for patterned structures using selective optical excitation of microstructures made from these materials. Selective excitation means fine control of laser-excitation beam size and positioning, and visualization of the sample under measurement.[1]

In many such measurements, important electronic structure information can only be revealed at low temperatures. Therefore the PL measurement system also must be compatible with a cryostat. Fig. 1 shows a typical configuration of a HORIBA MicOS measurement system, and Fig. 2, the resultant PL spectra.[2] Our MicOS (Fig. 3) also has the flexibility to accommodate different user-selectable excitation laser wavelengths for III-V material excitation, and includes vision so that the user can readily see excitation position and areas of interest on the sample (Fig. 3).

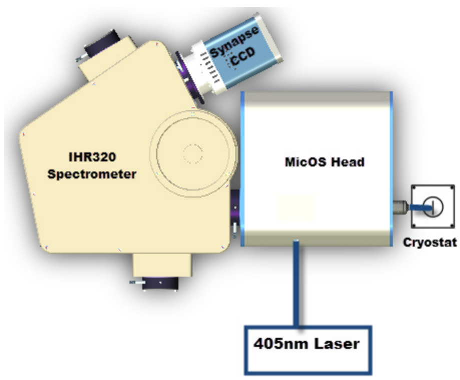

Fig. 1. Typical low-temperature, direct-coupled micro-PL setup. Direct coupling of the microscope's front end increases throughput to the spectrometer (for low-light samples). System also has flexibility to measure sample via the side window of an upright cryostat or in a down-looking configuration.

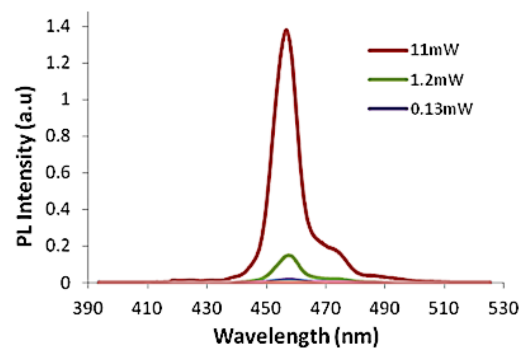

Fig. 2. GaInN PL spectrum taken at 10 K after 405 nm laser-excitation at different excitation power-levels.

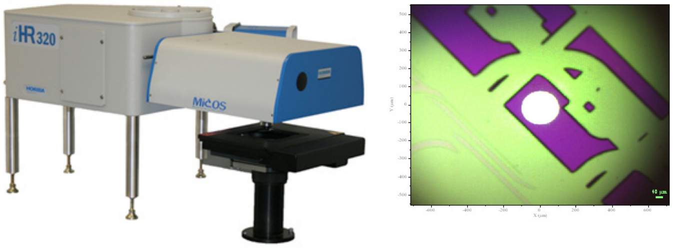

Fig. 3 (left) Down-looking version of HORIBA MicOS with mapping stage. (Right) Representative image of a patterned sample showing laser excitation on a region of interest.

References

1. *J. Korean Phys. Soc.*, **58**(6) June 2011, 1660–1663.
2. Proprietary—semiconductor manufacturer.

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ELEMENTAL ANALYSIS
FLUORESCENCE
GRATINGS & OEM SPECTROMETERS
OPTICAL COMPONENTS
FORENSICS
PARTICLE CHARACTERIZATION
RAMAN
SPECTROSCOPIC ELLIPSOMETRY
SPR IMAGING

Specifications*

Spectrometers		iHR320		iHR550
Spectral range[1]		200 nm to 1600 nm		
Spectral resolution[2]		0.18 nm		0.1 nm
Detector	Type	CCD 1024 × 256 OE[3]	IGA 512 × 25	Single-channel
	Range	200–1050 nm	800–1600 nm	190–1600 nm[4]
Excitation laser[5]		532 nm	633 nm	785 nm
Microscope Objective	Magnification	10×	50×	100×
	Spot size	100 µm	<20 µm	<10 µm
Sample stage		*xyz* (manual or motorized)		

[1]Depends on choice of objective, filters, and detectors.
[2]For 1200 gr/mm grating and open-electrode CCD
[3]BIUV, BIVS, and BIDD formats available for specific quantum-efficiency requirements.
[4]Needs two detectors to cover entire range.
[5]Other options are available upon request.

*Specifications are subject to change without notice.

JOBIN YVON Technology

info.sci@horiba.com
www.microspectroscopy.com

HORIBA Scientific

USA: +1 732 494 8660
UK: +44 (0)20 8204 8142
China: +86 (0)21 6289 6060
France: +33 (0)1 69 74 72 00
Italy: +39 2 5760 3050
Brazil: +55 (0)11 5545 1500
Germany: +49 (0)89 4623 17-0
Japan: +81 (0)3 6206 4721
Other: +33 (0)1 69 74 72 00