HORIBA Scientific

MicOS for photoluminescence research

Integrated Micro and Macro Photoluminescence

The system

The MicOS-based system (Fig. 1) described in this Technical Note uses a versatile platform for performing micro- as well as macro-photoluminescence (PL) measurements, and which can take transmittance and absorbance measurements, at an affordable price.

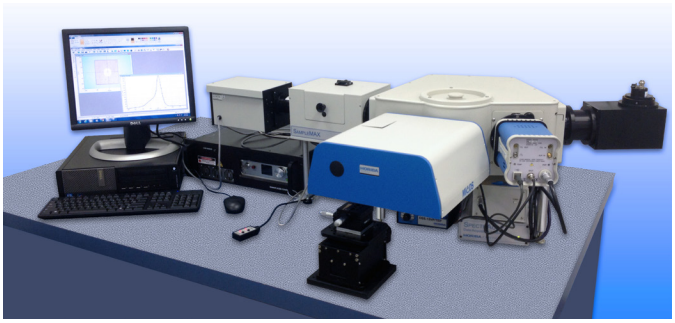

Fig. 1. MicOS multi-spectroscopy system.

The core of the system is a HORIBA Scientific triple-grating spectrometer with two entrance ports and two exit ports. The MicOS head—the Micro-PL accessory—is coupled to the front entrance port, while the transmission accessory (sample chamber and tunable light source) is coupled to the side entrance port. Direct coupling of these accessories ensures the highest throughput of light through the spectrometer to the detectors, which are attached the two exit ports. The exit ports can accommodate up to three different detectors (one port can accept two detectors) to cover a wide spectral range (200 nm–40 µm). HORIBA Scientific's LabSpec software controls all components, and also collects and analyzes the data.

Micro-PL measurements

Figs. 2a and b are photoluminescence spectra of InP and GaAs wafers collected using the Micro-PL accessory on the platform. The inserts in the graphs are the samples themselves with the bright circular laser spot at the center. The samples were excited at 532 nm. The InP data were collected using an InGaAs single-channel detector on the side exit port, while the GaAs PL spectrum was collected using a CCD array detector on the front exit port. The spectral range spans 200–1600 nm.

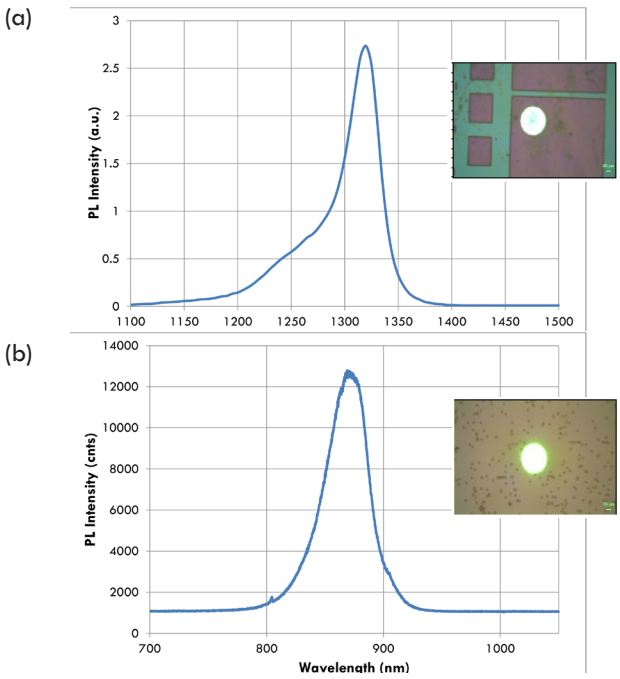

Fig. 2. PL spectra of (a) InP and of (b) GaAs wafer.

Macro-PL measurements

Fig. 3 shows the configuration of the system for macro-PL measurements. An optional monochromator (not shown) may be added between the light source and sample chamber for tunability in the excitation wave-

length. A 250 W tungsten-halogen lamp was used, but an optional 450 W Xe light source is available as well. For these measurements, a bandpass filter was used inside the sample chamber to select the excitation wavelength. The sample was a cuvette of aqueous coumarin. Fig. 4 shows the fluorescence spectrum following UV excitation of the sample.

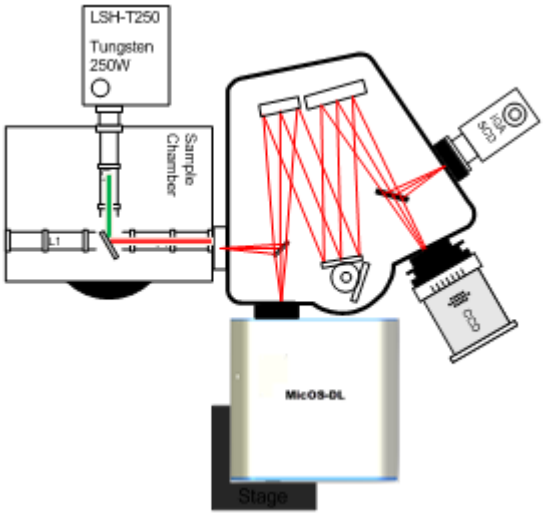

Fig. 3. Macro luminescence setup.

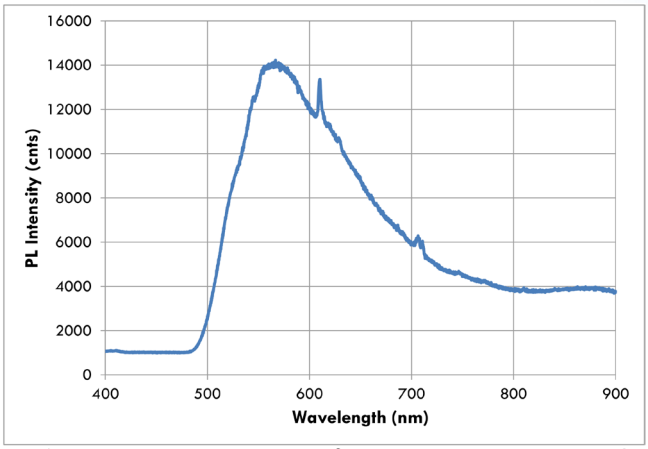

Fig. 4. Luminescence spectrum of aqueous coumarin excited at approximately 325 nm

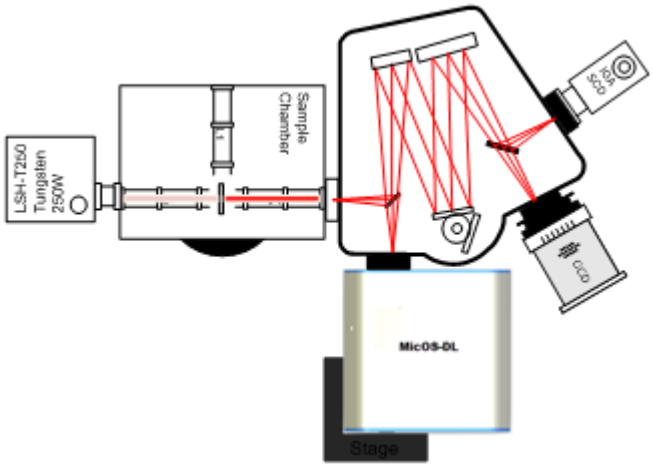

Fig. 5. Micro-PL measurement setup.

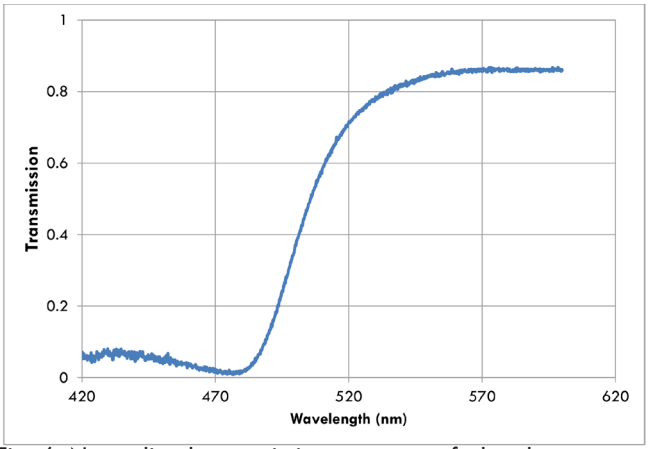

Fig. 6. Normalized transmission spectrum of glass long-pass filter.

Macro-transmission measurements

Fig. 5 shows the system configuration for macro-transmission measurements. A collimated white-light beam was directed through the sample in the sample chamber; lenses collected and imaged the transmitted light onto the input slit of the spectrometer. Fig. 6 is the transmission spectrum of a long-pass glass filter, normalized to a reference measurement without the sample.

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