

# NEWS RELEASE

Hamamatsu Photonics has developed a system capable of rapid 100 percent inspection of micro-LEDs for next-generation displays to detect abnormalities in their external appearance, intensity and wavelength of their light emissions. Sales of this inspection system will begin on March 8, 2021.

March 3, 2021

**Hamamatsu Photonics K. K.**

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Hamamatsu Photonics has developed a system for high-speed inspection of micro-LEDs on wafers to detect abnormalities in their external appearance, intensity and wavelength of their light emissions. This inspection system utilizes a photoluminescence (PL) measurement technique\* that is based on our advanced image processing technology and a newly developed imaging module with our unique optical design technology. We call this micro-LED PL inspection system the 'MiNY™ PL', type number C15740-01.

The MiNY™ PL makes fast pass/fail decisions when inspecting micro-LEDs, which will contribute to an increased product yield for use in display applications and will also help to increase the R&D efficiency of micro-LEDs. Furthermore, the MiNY™ PL will also streamline the 100 percent inspection process of micro-LEDs in future mass production lines. Sales of the MiNY™ PL will start Monday March 8, 2021 to LED and display manufacturers in domestic and overseas markets.

\* PL measurement technique is a versatile method for evaluating characteristics of LED and other devices by capturing and analyzing light-excited photoluminescence images in a non-contact and non-invasive manner.

## Development background

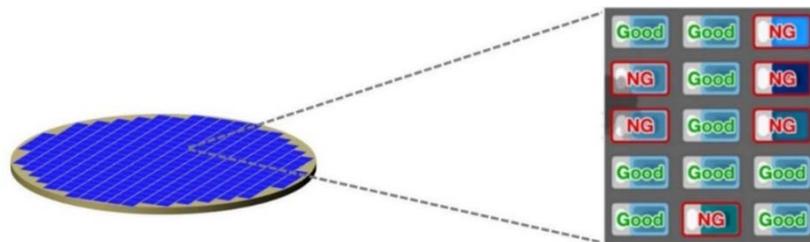
LEDs with dimensions of less than 100 micrometers per side (1 micrometer or  $\mu\text{m}$  is one-millionth of a meter) are called micro-LEDs. Compared to widely used liquid crystal and organic EL displays, micro-LEDs offer higher intensity, lower power consumption and longer lifetime. This makes them ideal for next-generation displays, which have a vastly expanding future market. For this reason, intensive R&D efforts aimed at improving the production yield of micro-LEDs are actively underway.

When testing ordinary LEDs, in addition to visual inspection of visible light images, an electroluminescence inspection (EL inspection) is made to check the luminous characteristics. This is made by applying a needle to each of the tens of thousands of LEDs on a wafer, therefore supplying power to make them actually emit light. In the case of micro-LEDs, since millions of micro-LEDs are fabricated on a single wafer, EL inspection on all the micro-LEDs is not practical. Although luminous characteristics can be tested by using a spectrometer, only a limited area can be tested at one time. Due to this restriction, there are increasing demands for micro-LED inspection systems which can quickly detect abnormal intensity and wavelength in light emissions, in addition to making visual inspections.

## Product overview

The MiNY™ PL performs high-speed inspection of micro-LEDs on wafers to detect abnormalities in external appearance, as well as intensity and wavelength in their light emissions. The MiNY™ PL does this by capturing and analyzing two types of images, visible light and PL.

When inspecting micro-LEDs fabricated on a wafer of about 150 mm in diameter, the wafer is set on the stage in the MiNY™ PL. This allows for a first visual inspection to acquire external appearance information such as chipping or scratches on micro-LEDs from the visible light image. In the next step, information on intensity and wavelength of the light emission is acquired from the PL image. Pass/fail decisions on each micro-LED are made by combining and analyzing both types of information.



Individual micro-LED chips on a wafer are inspected

The imaging module mounted in the MiNY™ PL was developed using optical components created with our unique optical design technology, and by redesigning the camera configuration. This imaging module can simultaneously capture both the intensity and wavelength of light emitted from micro-LEDs, formed on the entire wafer surface, from the PL image without using a spectrometer. This allows information on the intensity and wavelength of light emitted from the micro-LEDs to be rapidly acquired. To acquire the PL image, the micro-LEDs are irradiated with a stable light source, which has a uniform intensity over the irradiated surface, to deliver highly reliable measurement results. This new imaging module has enabled us to succeed in the development of the MiNY™ PL, for the rapid inspection and detection of abnormalities of micro-LEDs.

The MiNY™ PL makes quick pass/fail decisions when inspecting micro-LEDs to detect abnormalities in their external appearance, intensity and wavelength of their light emissions. The MiNY™ PL streamlines the micro-LED R&D process to improve micro-LED product yield. The MiNY™ PL will also perform efficient 100 percent inspection of micro-LEDs in future mass production lines.

We will continue developing micro-LED inspection systems with ever higher speeds and work together with our local subsidiaries in South Korea, China, and Taiwan to receive and process product orders mainly in the Asian region.

## Major product features

### 1. Makes simultaneous inspection for abnormal intensity and wavelength in the light emission

Using the PL technique allows rapid inspection of micro-LEDs to detect abnormalities in their intensity, wavelength of the light emissions, as well as in their external appearance.

**2. Enables 100 percent inspection, impossible using EL inspection**

EL inspections cannot perform 100 percent inspection of micro-LEDs, due to the huge amount of time needed to complete them. However, the MiNY™ PL makes rapid inspection to detect abnormalities in external appearance, intensity and wavelength of the light emission, enabling efficient 100 percent inspection of micro-LEDs.

**3. 100 percent inspection improves product yield during the production process**

The MiNY™ PL performs 100 percent inspection of micro-LEDs during the production process, therefore improving the design and production process based on the inspection results, increasing product yield.

**● Main specifications**

Item	C15740-01
Applicable wafer size	6 inches (Consult us for other sizes.)
Measurement time	Approx. 20 minutes (objective lens: 10x, PL measurement, measurement area:100 mm×100 mm)
PL measurement wavelength	R, G, B
Spatial resolution	1 μm/pixel (objective lens:10x)
Measurement item	Abnormalities in external appearance, PL intensity and PL wavelength
External dimensions (W×D×H)	2,000 × 1,130 × 1,878 mm
Weight	1,800 kg
Clean room compatibility	Yes



MiNY™ PL micro-LED PL inspection system C15740-01