NEWS RELEASE

Hamamatsu Photonics has newly developed the world's tiniest grating spectrometer offering high sensitivity, compact size, light weight and low cost.
We start accepting sample product orders from November 1, 2018.

October 23, 2018
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Hamamatsu Photonics has newly developed the world's smallest (in-house survey), grating spectrometer "SMD series mini-spectrometer C14384MA" offering high near-infrared sensitivity, compact size, light weight and low cost. Our C14384MA has a cubic size of about 1/40th, and weight of about 1/30th that of our MS series mini-spectrometers with sensitivity in the same near-infrared range, yet the sensitivity is about 50 times higher. This makes the C14384MA ideal for applications where real-time on-site measurement is required such as quality inspections of food or agricultural crops and even environmental analysis from a quadcopters or drones. We will start accepting sample product orders from domestic and overseas measurement and inspection equipment manufacturers from November 1 (Thursday), 2018.

This product will be on display at the Hamamatsu Photonics exhibition "PHOTON FAIR 2018" to be held for the first time in 5 years at Act City Hamamatsu (Naka-ku, Hamamatsu City, Japan) for 3 days from November 1 (Thursday).

[Note] A grating is an optical element that separates light into its component wavelengths by utilizing the fact that the light refraction angle differs according to wavelength.

<Overview of product>

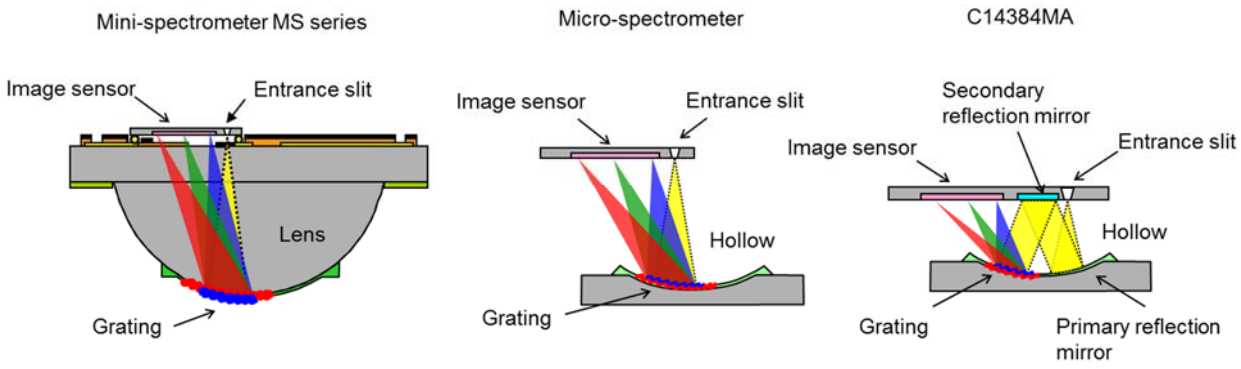
Hamamatsu Photonics already manufactures thumb-size mini-spectrometers MS series with near-infrared sensitivity and micro-spectrometers even smaller than the MS series having sensitivity in the visible light region.

Our new C14384MA is the world's tiniest grating spectrometer consisting of a light entrance slit, primary reflection mirror, secondary reflection mirror, diffraction grating and image sensor. Usually, light tends to travel while spreading outward. In the C14384MA, light

coming in through the entrance slit is collimated by the primary reflection mirror and guided by the secondary reflection mirror onto the grating. The light is then separated by the grating into its component wavelengths and focused on each pixel of the image sensor while being reflected from the concave surface of the grating. The image sensor outputs electrical signals matching the light intensity at each wavelength.

Shrinking the spectrometer size requires increasing the curvature of the concave surface and shortening the distance to the image sensor. However, fabricating a grating onto a concave surface with a large-curvature concave is extremely difficult. This time we employed a return structure composed of a primary reflection mirror and a secondary reflection mirror based on our unique optical design technology and succeeded in making the distance to the image sensor shorter while maintaining the desired curvature of the concave surface. That is how we created the C14384MA—the world's tiniest grating spectrometer. The C14384MA also offers enhanced near-infrared sensitivity by incorporating the latest high-sensitivity image sensor. What's more, we succeeded in slashing the cost by reducing the number of parts used in manufacturing the C14384MA. Specifically, the grating is formed directly on the inner side of the package, and the entrance slit, secondary reflection mirror and image sensor are integrated onto the same chip. This allows the C14384MA to be assembled into various types of equipment that limit the size and weight of components to be mounted, such as portable analytical instruments and quadcopters or drones. This makes the C14384MA promising for a wide range of applications where real-time on-site measurement is required.

We will make even further cost reductions by automating the manufacturing process.



Spectrometer configurations

<Background of development>

Spectrometers are devices for separating light into its component wavelengths and measuring the light intensity at each wavelength. They are used in spectrophotometry to measure the light at wavelengths emitted from or absorbed by substances to analyze the composition and properties of substances. Spectrophotometry is used for chemical and physical analysis in a wide range of fields such as industry, agriculture, environment, food, medicine, and pharmaceuticals. In recent years, grating spectrometers are becoming the mainstream in spectrophotometric applications because of their high resolution for separating light into wavelengths.

Spectrophotometry normally takes place in a chemical laboratory room equipped with high-performance benchtop or floor-standing spectrophotometers that are usually large, bulky, and expensive. We have been promoting development of compact spectrometers for portable analytical instruments that can be used on site without having to bring measurement samples into the chemical laboratory room. Meanwhile, there has been increasing interest in sensing technology to ensure the safety and security of food and agricultural crops. This has increased demand for more compact, lightweight spectrometers that are low cost yet have high sensitivity and can be mounted in portable analytical instruments and quadcopters or drones.

<Features of the C14384MA>

1. World's smallest grating spectrometer

The return structure fabricated based on our unique optical design technology achieves a cubic size of 11.7mm×4.0mm×3.1mm (W×D×H) and weight below 0.3 grams. These dimensions are respectively about 1/40TH and 1/30TH that of our MS series mini-spectrometers. This allows the C14384MA to be assembled into various types of equipment that limit the size and weight of components to be mounted, such as portable measuring or analytical instruments and quadcopters or drones. In spectrophotometry, the complex information from light absorbed by various components must be accurately measured. The grating spectrometer measures changes in the light intensity at each wavelength as continuous data and is capable of applying advanced analysis techniques.

2. High sensitivity measurement using near-infrared light

By incorporating the latest high-sensitivity image sensor, the C14384MA offers enhanced near-infrared sensitivity about 50 times higher than our currently available MS series mini-spectrometers. This allows high-sensitivity measurement of various components in food such as water, sugar, and organic acids that absorb near-infrared light.

3. Low cost due to the reduced number of parts

We succeeded in slashing the cost by forming the grating directly on the inner side of the package and also by integrating the entrance slit, secondary reflection mirror, and image sensor all onto the same chip to reduce the number of parts.

●Main specifications

Parameter	C14384MA	Unit
Spectral response range	640 to 1050	nm
Spectral resolution (FWHM) Note 1	Max.20 (Typ.17)	nm
Sensitivity Note 2	50	-
Spectral stray light Note 3	< -23	dB
Slit size (H×V)	15×300	µm
Numerical aperture	0.22	-
Dimensions (W×D×H)	11.7×4.0×3.1	mm
Weight	<0.3	g

Note 1: At 800 nm or longer wavelengths

Note 2: At 1000 nm wavelength relative to the MS series mini-spectrometer sensitivity that is defined as 1.

Note 3: At 850 nm wavelength

Mini-spectrometer SMD series C14384MA and currently available mini-spectrometer and micro-spectrometer