NEWS RELEASE

Hamamatsu Photonics is the first in the world to succeed in mass-producing a compound opto-semiconductor that detects mid-infrared light to a wavelength of 14.3 µm without using hazardous substances restricted under the RoHS directive.
Sales of this new compound opto-semiconductor begins September 2, 2019.

August 27, 2019
Hamamatsu Photonics K. K.
Headquarters: 325-6, Sunayama-cho, Naka-ku, Hamamatsu City, Japan
President and CEO: Akira Hiruma

By utilizing compound opto-semiconductor manufacturing technology developed in-house over many years, we are the first in the world to succeed in mass-producing a compound opto-semiconductor (type-II superlattice infrared detector*[1]) not containing harmful mercury (Hg) and cadmium (Cd) but able to detect mid-infrared light to a wavelength of 14.3 micrometers (a micrometer, abbreviated µm, is one millionth of a meter). Mercury and cadmium are common materials used for mid-infrared detectors but are restricted substances under the RoHS directive issued by EU (European Union) that prohibits use of certain hazardous substances in electrical and electronic products sold in the EU market. So our new product will likely replace currently available mid-infrared detectors that contain restricted substances. Our new product will prove ideal for analytical instruments that rely on mid-infrared light to identify substances contained in the air, foods, and drugs. We start selling this new product to domestic and overseas analytical instrument manufacturers on September 2 (Mon), 2019.

Our new product will be on display at the JASIS 2019 exhibition held in Makuhari Messe (Mihama-ku, Chiba-city, Japan) for 3 days from September 4 (Wed) to 6 (Fri). This is Asia's largest exhibition of the latest in analytical and scientific instruments.

*1: Type-II superlattice infrared detector is a compound opto-semiconductor with a unique structure composed of thin films of two different materials alternately laminated on a substrate to form a photosensitive layer.

<Product overview>

This new product is a compound opto-semiconductor having a unique structure composed of InAs (compound of indium and arsenic) and GaSb (compound of gallium and antimony) thin films only a few nanometers thick (a nanometer, abbreviated nm, is one billionth of a meter) that are alternately laminated onto a substrate.

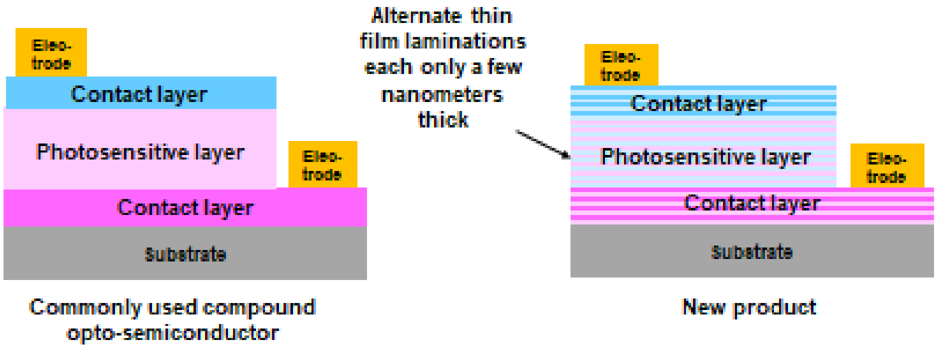
Opto-semiconductors made of silicon (Si) are the most widely used for detecting visible light. Compound opto-semiconductors composed of two or more semiconductor materials are used to detect mid-infrared light with wavelengths longer than the visible light range. We developed and produced compound opto-semiconductors using materials of indium, arsenic and antimony that are capable of detecting infrared light up to 11 µm. Mid-infrared light at wavelengths longer than 11 µm are detectable by employing a unique structure in which InAs and GaSb thin films are alternately laminated onto a substrate. However, creating such a structure requires highly sophisticated manufacturing technology which makes compound opto-semiconductors extremely difficult to mass-produce.

Now, however, based on compound opto-semiconductor manufacturing technology we have developed over many years, we optimized its manufacturing conditions by high-precision control of the manufacturing equipment. This allowed us to create manufacturing technology for alternately laminating InAs and GaSb thin films with uniform thickness and high repeatability. In this way we succeeded in the world's first mass production of a type-II superlattice infrared detector that detects mid-infrared light up to 14.3 μm without containing harmful mercury and cadmium which are restricted substances under the RoHS directive.

This new product will likely replace currently available mid-infrared detectors that contain RoHS restricted substances and are installed in analytical instruments such as Fourier transform infrared spectrophotometers (FT-IR*2) which utilize mid-infrared light to identify substances in the air, foods, and drugs. This new product can also replace existing mid-infrared detectors commonly used in gas component analyzers and infrared thermometers that make non-contact surface temperature readings with high sensitivity and high speed.

We will never cease our efforts to achieve even higher sensitivity at longer wavelengths and develop module devices incorporating this new product.

*2: FT-IR is an analytical technique used to identify molecular structures and the state of substances by irradiating infrared light onto the sample and then obtaining information from the transmitted or reflected light. FT-IR spectrophotometers are widely used to analyze and identify substances containing organic matter.



Different structures: common (left) and new (right) compound opto-semiconductors

Light entering the photosensitive layer of an opto-semiconductor is converted into electrical signals that are extracted via the contact layer and electrode. Commonly used compound opto-semiconductors have a photosensitive layer of materials with a uniform composition. Our new product, however, has a photosensitive layer of InAs and GaSb thin films each only a few nanometers thick and alternately laminated onto the substrate in more than 2000 layers.

<Main product features>

1. Succeeded in mass-producing a type-II superlattice infrared detector capable of detecting mid-infrared light up to 14.3 μm
   Based on compound opto-semiconductor manufacturing technology we have learned over many years, we optimized manufacturing conditions such as temperature and pressure. In addition, we precisely controlled the timing and quantity that InAs and GaSb are supplied onto the substrate. In this way we created a manufacturing technology for laminating thin films with uniform thickness and high repeatability and succeeded in mass-producing a type-II superlattice infrared detector that detects mid-infrared light up a wavelength of 14.3 μm.

2. Uses NO substances restricted by the RoHS directive
   The RoHS directive is an EU standard that restricts use of certain hazardous substances in electrical and electronic products. It prohibits sales of electrical and electronic products in the EU market that contain restricted substances at higher than a specified concentration. However, our new product does not contain harmful mercury and cadmium substances restricted under the RoHS directive. So it will likely replace existing detectors currently installed in analytical instruments that make use of mid-infrared light.

<Development background>

The bonded state of molecules and atoms making up a substance absorb light at a specific wavelength. So, examining the absorption wavelength of mid-infrared light allows identifying various substances contained in the air, foods, drugs, etc. Currently available analytical instruments such as FT-IR spectrophotometers usually use mercury cadmium telluride (MCT) infrared detectors. Since MCT detectors contain harmful mercury and cadmium prohibited under the RoHS directive, a high-quality detector capable of replacing the MCT detector is needed. Also, accurately identifying the substances contained in the analyte requires measuring mid-infrared light to near 14 μm and comparing the difference in light-absorbing characteristics. To achieve this, we have developed this new detector using no RoHS prohibited substances. It employs a unique structure in which InAs and GaSb thin films only a few nanometers thick are alternately laminated in more than 2000 layers on the substrate to detect mid-infrared light up to near 14 μm.

● Main specifications (Tchip = -196°C)

Parameter	P15409-901	Unit
Photosensitive area size	0.1 dia.	mm
Cutoff wavelength※	14.3	μm
Specific detectivity	1.6×10^{10}	$cm\cdot Hz^{1/2}/W$
Photosensitivity	2.6	A/W

※Wavelength at which the signal (S) to noise (N) ratio is 1.

●Product release date: September 2 (Mon), 2019
●Sales target: 10 units per year in first year and 1000 units per year after 3 years

Type-II superlattice infrared detector P15409-901