High-resolution UV microscope

High resolution ultraviolet microscope

KOREA BASIC SCIENCE INSTITUTE

Patent title Lens array for image sensor

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KR 10-1917341 (2018.11.05)

Authority status Publicized

Technicality

Technology overview

A high-resolution UV microscopy is a technology for inspecting microsurfaces after processing freeform optical components. The technology is an ultra-high resolution microscope measurement system development technology in which a 200 nm-class resolution UV laser light source, an optical system, an objective lens, and the like are developed so that the measurement resolution can be increased by laser oscillation with a wavelength (193 nm) of a UV band or lower. The technology can be applied to semiconductor inspection equipment, bio, automobile industries, endoscope fields, and the like.

Development background and problem to be solved

- As ultra-small smart devices continue to be released, there is an increasing demand for the development of an image sensor module miniaturization design technology.
- The thickness of an imaging optical system is 5 mm or more, and the thickness of an image sensor module is about 10 mm. Thus, there is a limit in responding to the miniaturization trend of smart devices. The difficulties of designing a sensor module are to be resolved through a lens array for a compound eye-type image sensor, which can be produced to be ultra-thin.

Excellence and discrimination of technology

▶ Excellence of technology

- By measuring an ultraviolet ray, which has a shorter wavelength than visible light, as a light source, it is possible to output a stable light source with a high output in an optical system and the atmosphere.
- Ultra-high resolution of hundreds of nanometers can be achieved with laser oscillation of 200 nm or less.
- By developing an optical system design technology for ultra-small image sensors, it is possible to produce 0.5 mm-level lens arrays and 2 mm-level image sensors. Thus, precise processing of ultra-thin optical systems is possible, and changing the size and weight is easy. Accordingly, the technology can be applied to various ultra-small devices.

▶ Discrimination of technology

- An original technology for optical lenses is possessed, and a measurement device can be directly developed and produced in the institute.
- As a process of particle removal and impurity treatment for vacuum microsurface inspection can be measured at the room temperature, there is no need for sample pretreatment and real-time measurement is possible.
- A free-form optical system can be produced through ultra-precision processing and self-polishing.

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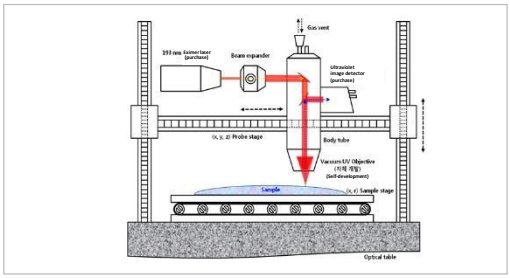
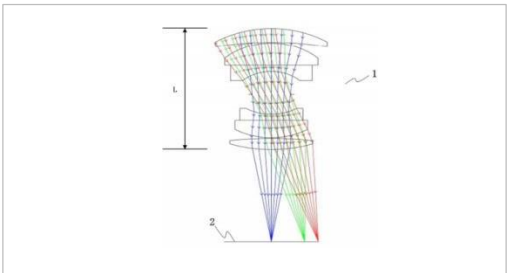
Implementation method

According to the present invention,

- Included are a plurality of unit lenses arranged in an MXN matrix.
- The plurality of unit lenses are formed in different shapes so that light incident from each of predefined observation fields can be incident on a detection area corresponding to a photodetector.
- The upper surface of a UV microscope refracts incident light and emits the light to the lower surface, and the lower surface focuses the incident light from the upper surface and emits the light to a photodetector.



Picture 1 Microsurface inspection stage design and production



Picture 2 Image sensor description reference diagram

Degree of technology completion (TRL)

Degree of technology completion: TRL6 (Full Scale prototype development stage)

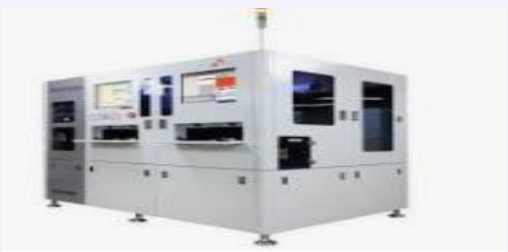
TRL1	TRL2	TRL3	TRL4	TRL5	TRL6	TRL7	TRL8	TRL9
Technical principle presentation	Technology concept setting	Technology concept verification	Lab Scale prototype development	Implementation environment application experiment	Full Scale prototype development	Quasi-commercial product development	Commercial product development	Commercial product implementation

Utilization

Utilization field and applied product

Utilization field

- Semiconductor inspection equipment
- Bio field
- Automobile industry
- Endoscopy field



Picture 1 Semiconductor inspection equipment

Applied product

- Display production device
- Ultra-small device

Picture 2 Display production equipment

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Technology trend

- If an advanced lens array and micro-patterns are produced by using a roll-to-roll process, there is an advantage in unit price competitiveness. Therefore, it is necessary to develop a system which can process a micro lens pattern after processing rolls with DTM.
- In order to secure a core source technology and national competitiveness, it is necessary to develop various techniques by utilizing induction devices such as lenses, reflectors, and optical fibers.

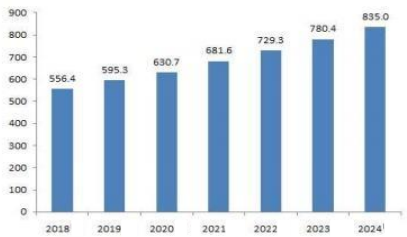
Family patent status

Application nation	Application No. (Application date) / Registration No.	Title of the invention
KOR	KR 10-2015-0104898 (2015.07.24) / KR 10-1736055 (2017.05.17)	Wavelength variable UV laser oscillation device for ultrahigh resolution microscope light source, and method therefor
KOR	KR 10-2016-0149670 (2016.11.10) / KR 10-1833245(2018.02.22)	Calibration method and system for surface inspection device using phase measurement beam deflection scheme
KOR	KR 10-2016-0149958 (2016.11.11) / KR 10-1873392 (2018.06.26)	Laser optimization system including laser optimization device and laser diagnostic device

Market prospect

Target market size and prospect

The domestic market for optical components is expected to grow by an average of 20% to 2020 from KRW 5277.6 billion in 2016. Of the approximately 2,000 domestic mining companies, the proportion of small and medium sized enterprises (SMEs) with sales of less than KRW 10 billion accounts for 75.7% of the total. In order to improve competitiveness, it is important to converge companies and provide a new customer value to improve competitiveness. The introduction of an optical technology for ultra-small devices appears to play a major role in the corporate growth.



Graph **Global mining industry market size and prospect**

<Data: Global Photonics Market (2018.12)>

(Unit : 0.1 billion won, %)

Division	'16	'17	'18	'19	'20	'21	CAGR
Domestic market	52,766	63,993	77,431	93,691	113,366	137,173	21.3

* Data : Estimated on the basis of an LED and an optical IT strategic technology roadmap (Ministry of Knowledge Economy, 2009), 2012 Korea Light Industry Promotion Association and KISTI strategies Unlimited/GBI Research 2011

Table **Domestic market size and prospect for the fields of optical components and devices**

<Data: Global Photonics Market (2018.12)>

Technology transfer query

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Technology transfer process