HAMAMATSU

PHOTON IS OUR BUSINESS

Manufacturing process support products

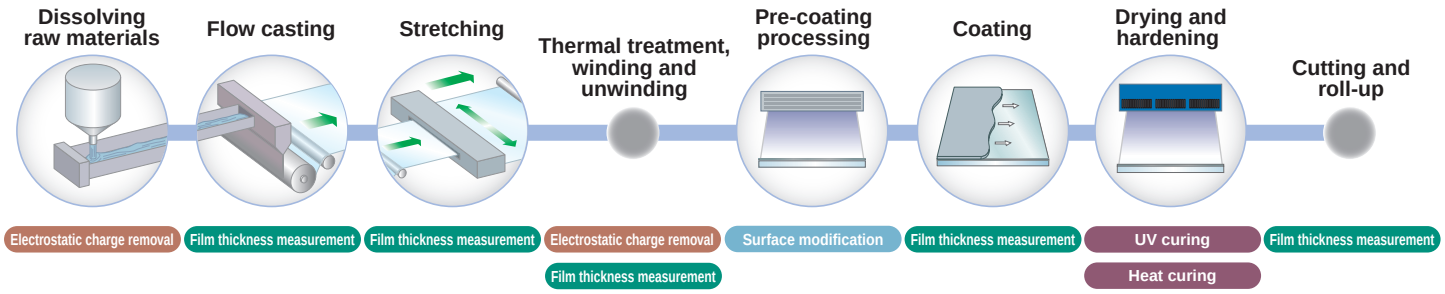
Films / Touch panels / FPD (Flat panel display) / Semiconductor devices / Secondary batteries

Films

Electrostatic charge removal, total thickness control, coating film thickness measurement, surface modification, UV curing, heat curing, appearance inspections

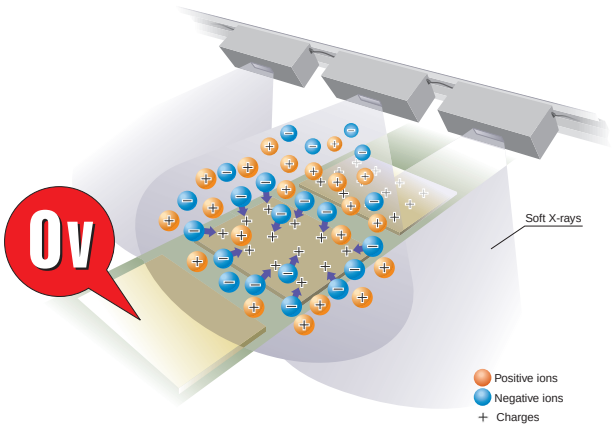
Highly functional films are now essential in cutting-edge industries that make liquid crystal displays, secondary batteries, solar panels and a host of other items. To help improve performance and productivity of such films, Hamamatsu offers a wide lineup of diverse inspection and testing devices.

Film manufacture pre-processing | **Film manufacture post-processing**



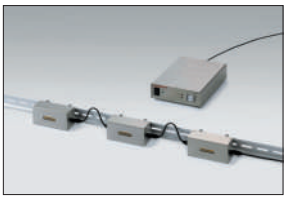
Easy electrostatic charge removal set-up adapts to production line

Photoionization



PhotoIonBar electrostatic charge remover using photoionization

L12536



The PhotoIonBar L12536 neutralizes electrostatic charges by applying weak soft X-rays at an energy level lower than our standard photoionizers. This makes it even easier to shield out X-rays, allowing complete shielding with just an acrylic plate only 3.3 mm thick. As with other photoionizers, the L12536 needs no air flow to move ions and generates no dust or electromagnetic noise.

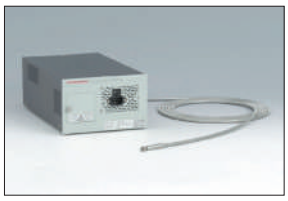
Features

- Compact size for flexible installation layout
  Comes with DIN rail attachment for easy attachment and detachment
- Electrostatic charge neutralization area is changeable to match production line
  A maximum of 10 ionizer heads can be daisy-chained to cover an area up to 2 meters wide
- Eco-friendly structure (no beryllium used) permits easy disposal

Film thickness measurement of coating layers and transparent films

Optical NanoGauge film thickness measurement system (equipment mount type)

C13027



The Optical NanoGauge C13027 measures film thickness and color simultaneously using the non-contact spectral interferometry technique, and can be connected to PLC sequencers.
More compact than the conventional model, the C13027 is easier to integrate into manufacturing equipment.
It can measure film thicknesses from 10 nm to 100 µm at high speed (200 Hz).

Features

- Connects to PLC sequencers
- Measurable thickness range: 10 nm to 100 µm (refractive index of 1.5)
- Capable of measuring samples coated on both sides
- Compact, space-saving design for easy mounting into equipment
- Stable against height variations (defocus dependent)

Total thickness control in film stretching process

Optical MicroGauge thickness measurement system

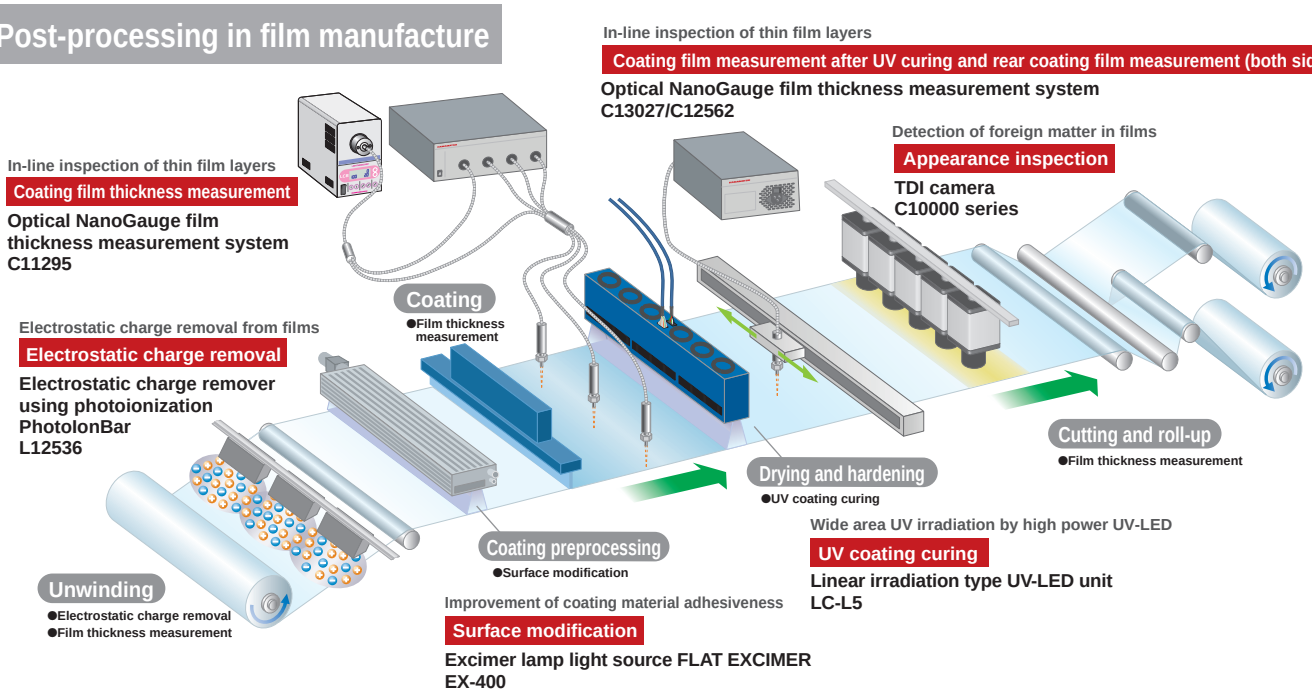
C11011-01, -01W

The Optical MicroGauge makes high-speed measurements of total film thickness in flow casting and stretching pre-processes, and so is the ideal support for in-line measurement in production sites. The Optical MicroGauge can also measure thickness distributions (mapping) in combination with a mapping stage for off-line measurement.

Features

- Measurable thickness range (silicon refractive index of 3.67):
  10 µm to 1200 µm
- Measurable thickness range (SiO_2 refractive index of 1.5):
  25 µm to 2900 µm
- Supports mapping function (option)
- Supports wafers with patterns and/or protective films
- Long working distance

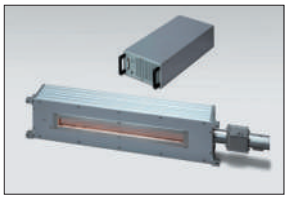
Post-processing in film manufacture



Clean surface modification

Excimer lamp light source FLAT EXCIMER

EX-400



Compared to ordinary modification techniques, modifying a surface using an excimer lamp allows more precise results since it occurs via a chemical reaction on the atomic and molecular levels. It also ensures clean modification that does not harm the material and does not generate dust particles, and so is considered an effective technology in fields requiring more advanced levels of modification.

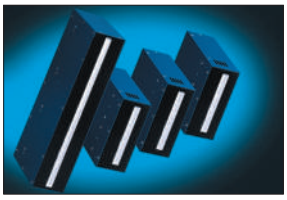
Features

- Uniform irradiation intensity over a large area
- Stable output with less flicker
- Monochromatic wavelength at 172 nm
- Instantaneous on/off operation

UV coating curing & film lamination

Linear irradiation type UV-LED unit

LC-L5

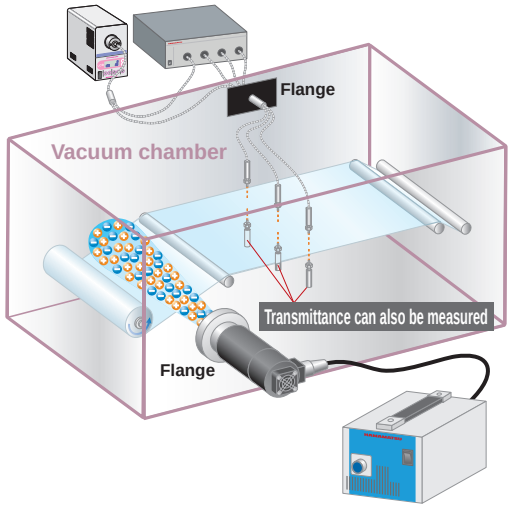


The LC-L5 is a linear irradiation type UV-LED unit equipped with high power UV-LED at 365 nm or 385 nm. Our advanced heat dissipation technique achieves both high intensity and a long service life allowing stable UV irradiation with drift kept to a minimum. Its unique optical system ensures uniform UV irradiation over a large area that suppresses fluctuations in intensity.

Features

- Compact size due to air cooling
- Wide product lineup
- Uniform UV irradiation over a large area with minimal intensity fluctuations
- Advanced heat dissipation technique achieves both high intensity and long service life

Film deposition measurement and electrostatic charge removal in vacuum environments



In-line inspection of thin film layers

Film deposition measurement in vacuum environments

Multipoint NanoGauge Film thickness measurement system C11295

The C11295 connects to multiple light guides that are inserted into a vacuum chamber through a flange installed on the light guides. Up to 15 light guides to a total length of 3 meters can be installed in the vacuum chamber.

* Please contact us for details.

Neutralizes electrostatic charges over a wide area under reduced pressure

Electrostatic charge removal in vacuum environments

VUV ionizer - Electrostatic charge remover using photoionization L12542

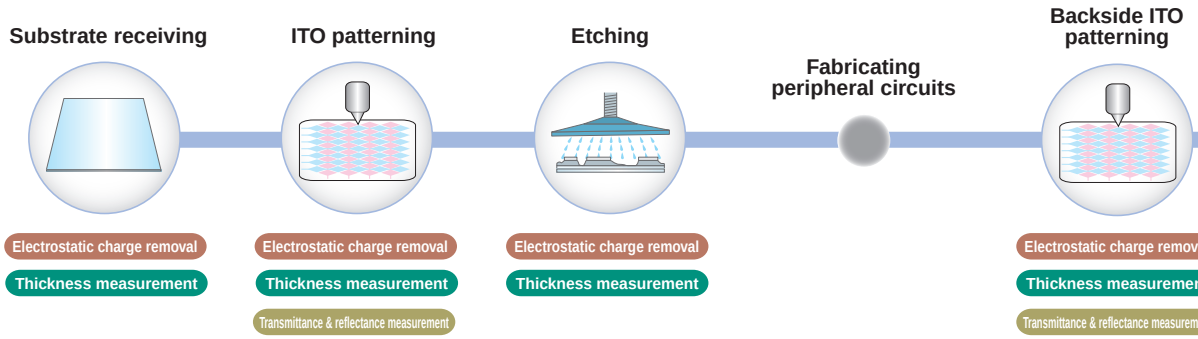
The L12542 is an electrostatic charge remover that utilizes vacuum UV light. It is designed to easily attach to a vacuum flange to neutralize electrostatic charges in a vacuum chamber. Due to its wide irradiation angle about 3 times wider than other devices, just a single L12542 unit can remove electrostatic charges over a large area.

Touch panels

Electrostatic charge removal, UV curing, transmittance and reflectance measurements, thin film measurement, laser welding, thickness measurement, surface modification, light intensity control

Touch panels or touch screens are key components in today's hottest digital products such as smartphones, tablet PCs, digital cameras' rear liquid crystal displays, and cutting-edge gaming devices. Touch panels employ different detection methods. Here, we introduce a typical process for manufacturing projected capacitive touch panels, as well as our products used in that process.

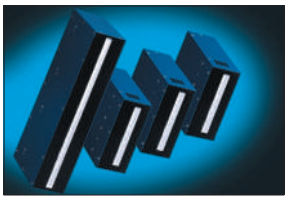
Glass substrate manufacturing process (capacitive type)



UV coating curing & film lamination

Linear irradiation type UV-LED unit

LC-L5



The LC-L5 is a linear irradiation type UV-LED unit equipped with high power UV-LED at 365 nm or 385 nm. Our advanced heat dissipation technique achieves both high intensity and a long service life allowing stable UV irradiation with drift kept to a minimum. Its unique optical system ensures uniform UV irradiation over a large area that suppresses fluctuations in intensity.

Features

- Compact size due to air cooling
- Wide product lineup
- Uniform UV irradiation over a large area with minimal intensity fluctuations
- Advanced heat dissipation technique achieves both high intensity and long service life

Surface modification

Excimer lamp light source FLAT EXCIMER

EX-mini

The EX-mini is a compact excimer lamp light source designed for R&D work. Surface modification using an excimer lamp does not harm substrates and does not generate dust particles since it occurs via a chemical reaction at the atomic and molecular levels. Despite its compact and lightweight body, the EX-mini still has the same great features offered by the EX-400 (see page 3) with a large irradiation area.

Features

- All-in-one light source built into irradiation box
- Compact size
- Ozone decomposition unit (optional unit installed on top of the EX-mini, sold separately) allows indoor air exhaust (no exhaust duct needed)

Irradiation intensity measurement of excimer lamp and UV-LED light sources

UV light intensity measuring device

UV power meter

C12144, H12684 series

C9536, H9535 series

Hamamatsu provides compact, hand-held UV power meters designed to measure UV light intensity. These UV power meters are portable and simple to operate, making them easy to use for daily checks of excimer lamp and UV-LED light sources. Two models are available according to the UV intensity and wavelength to be measured. (C12144, H12684 series and C9536, H9535 series)

Features

- Absolute UV power monitoring (mW/cm^2)
- Less deterioration in sensitivity against exposure to UV light

Clean removal of electrostatic charges by light

Photoionizer electrostatic charge remover using photoionization

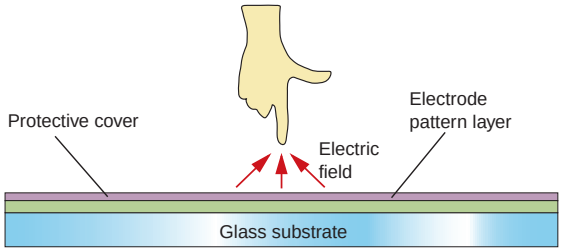
L12645

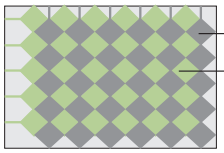
The Photoionizer eliminates problems such as poor ion generation balance causing overshoot (charging with opposite polarity) and generation of ozone and dust and so can neutralize electrostatic charges smoothly and efficiently. The Photoionizer can also neutralize electrostatic charges on high-speed moving objects and even on powder, which is impossible to achieve by conventional corona discharge ionization.

Features

- High ion density: Instantaneously neutralizes electrostatic charges on high-speed moving objects
- No overshoot: Good ion generation balance
- No air flow required: Neutralizes electrostatic charges on powder, etc.
- Generates no dust, electromagnetic noise, or ozone (Uses photoionization NOT discharge ionization)

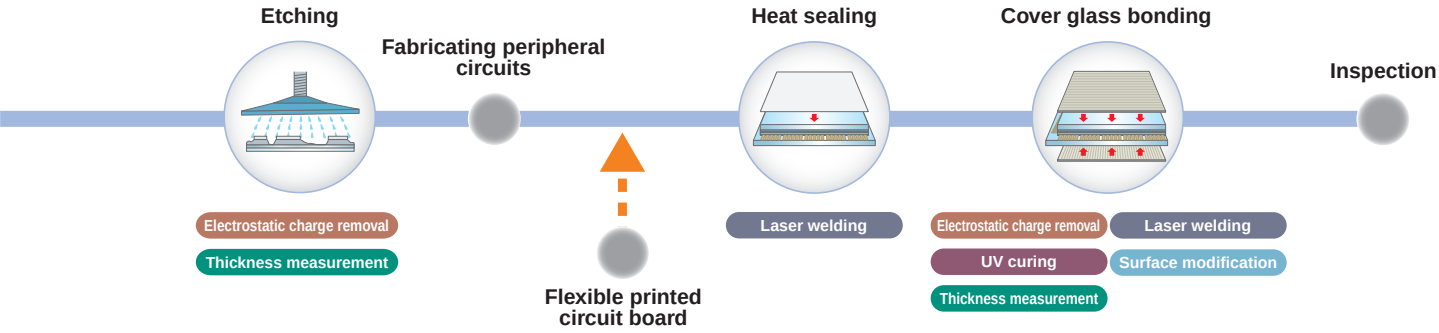
Projected capacitive type





Glass substrate manufacturing process

Product manufacturing process (capacitive type)



Transmittance and reflectance measurement of ITO (transparent conductive film)

PMA-12

Photonic Multichannel Analyzer

The PMA-12 is a compact spectrum analyzer that combines a spectrometer and a photodetector into one unit. The PMA-12 can measure the reflectance, transmittance and absorbance of films and optical filters as well as coating films such as ITO (transparent conductive film).

Features

- Integrates a spectrometer, photodetector and power supply into one unit
- Real-time measurements (simultaneous measurement of multiple wavelengths)
- Various measurement modes optimized for reflectance, transmittance, absorbance, and color measurements
- Easy measurements using optical fiber
- Calibrated spectral response and wavelength axis characteristics

Film-to-glass & film-to-film laser sealing

LD irradiation light source (SPOLD) **L11785, L12333 series**

LD irradiation light source with process monitor **L12333-x11P series**

L12333-x11P series

These are small, lightweight laser spot light sources consisting of a fiber-output laser diode module, driver circuit and cooling system assembled together into one compact unit. The L12333-x11P series includes a monitoring function that visualizes the effect of laser processing.

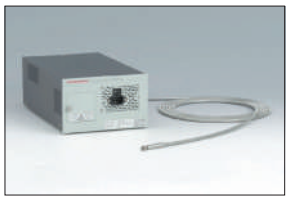
Features

- Air-cooled thermoelectric cooling
- Wide product lineup
- External control available
- Various types of irradiation units provided (for condensed light, collimated light, elliptical beam, etc.)
- Compact light source suitable for mounting into equipment

Film thickness measurement of coating layers and transparent films

Optical NanoGauge film thickness measurement system (equipment mount type)

C13027



The Optical NanoGauge C13027 measures film thickness and color simultaneously using the non-contact spectral interferometry technique, and can be connected to PLC sequencers.
More compact than the conventional model, the C13027 is easier to integrate into manufacturing equipment.
It can measure film thicknesses from 10 nm to 100 µm at high speed (200 Hz).

Features

- Connects to PLC sequencers
- Measurable thickness range: 10 nm to 100 µm (refractive index of 1.5)
- Capable of measuring samples coated on both sides
- Compact, space-saving design for easy mounting into equipment
- Stable against height variations (defocus dependent)

Total thickness measurement of coating layers and intermediate layers

Optical MicroGauge film thickness measurement system

C11011-01, 01W

The Optical MicroGauge is ideal for high-speed measurement of total film thickness including coating layers, intermediate layers and the substrate, making it the perfect support for in-line measurement in production sites. The Optical MicroGauge can also measure thickness distribution (mapping) when used in combination with the C8126 mapping stage.

Features

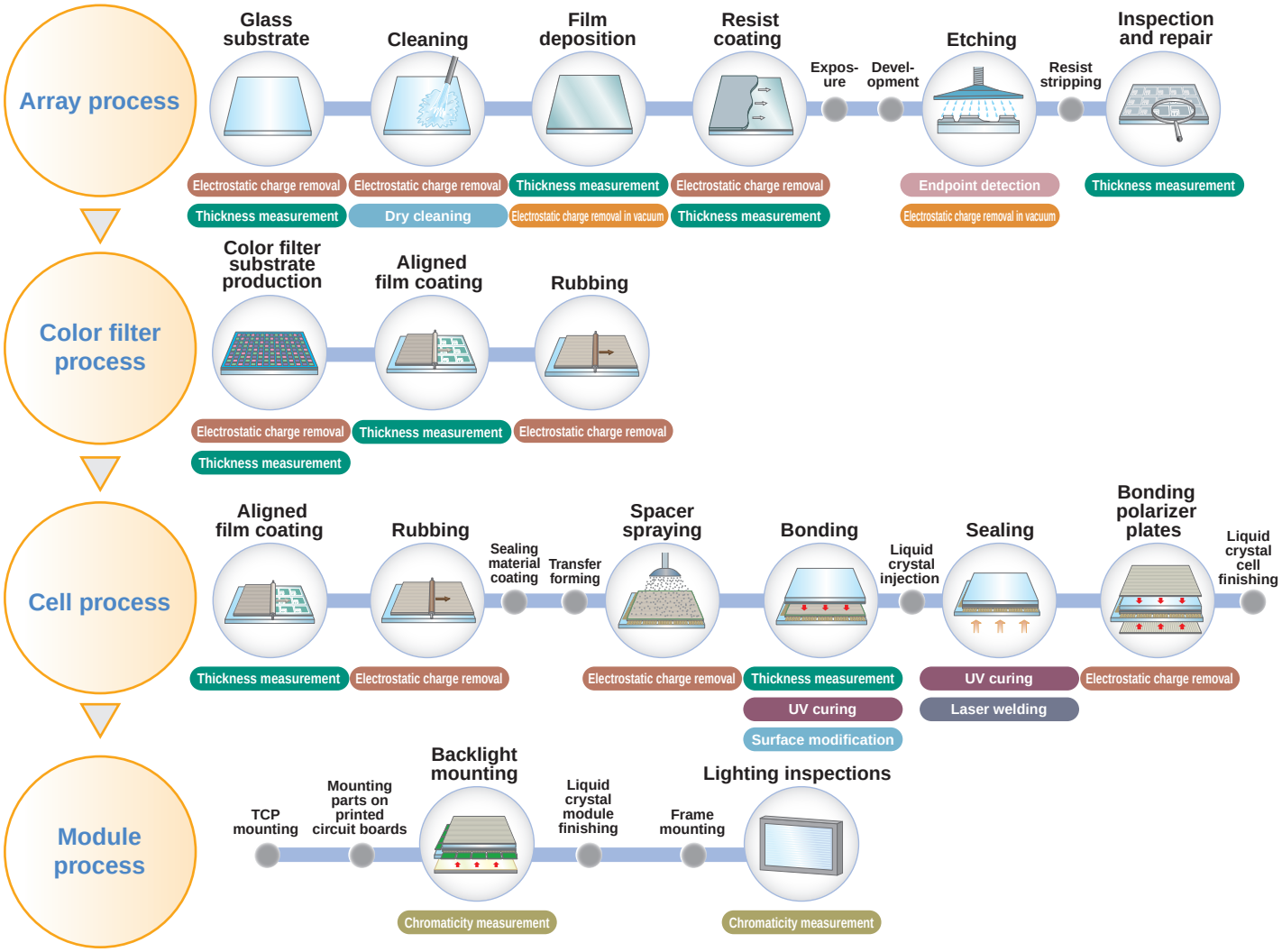
- Measurable thickness range (silicon refractive index of 3.67): 10 µm to 1200 µm
- Measurable thickness range (SiO_2 refractive index of 1.5): 25 µm to 2900 µm
- Supports mapping function (option)
- Supports wafers with patterns and/or protective films
- Long working distance

FPD

Electrostatic charge removal, film thickness measurement, thickness measurement, finding etching endpoints, chromaticity measurement, laser welding, UV curing

Hamamatsu provides various products useful in a diverse range of manufacturing processes for FPD (flat panel displays) such as liquid crystal, LED, organic EL, VFD (vacuum fluorescent display), and plasma display panels.

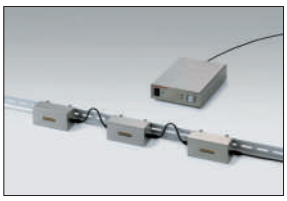
Manufacturing processes



Easy electrostatic charge removal set-up adapts to production line

PhotoIonBar electrostatic charge remover using photoionization

L12536



The PhotoIonBar L12536 neutralizes electrostatic charges by applying weak soft X-rays at an energy level lower than our standard photoionizers. This makes it even easier to shield out X-rays, allowing complete shielding with just an acrylic plate only 3.3 mm thick. As with other photoionizers, the L12536 needs no air flow to move ions and generates no dust or electromagnetic noise.

Features

- Compact size for flexible installation layout
  Comes with DIN rail attachment for easy attachment and detachment
- Electrostatic charge neutralization area is changeable to match production line
  A maximum of 10 ionizer heads can be daisy-chained to cover an area up to 2 meters wide
- Eco-friendly structure (no beryllium used) permits easy disposal

Electrostatic charge removal in a vacuum

VUV ionizer electrostatic charge remover using photoionization

L12542

The L12542 is an electrostatic charge remover that utilizes vacuum UV light. It neutralizes electrostatic charges under reduced pressure by directly ionizing residual molecules with vacuum UV light. The L12542 removes electrostatic charges over a large area due to its wide irradiation angle that is 3 times wider than our other VUV ionizers.

Features

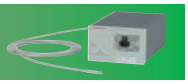
- Wide irradiation angle (3 times wider than our other VUV ionizers)
- Generates ions with high efficiency under reduced pressure
- No air flow required to neutralize electrostatic charges
- No overshoot (charging with opposite polarity)
- Generates no dust or electromagnetic noise

Glass substrate and film thickness measurements

Optical NanoGauge & Optical MicroGauge series

Hamamatsu Optical Gauge series is a family of optical thickness measurement systems. Our lineup includes the Optical NanoGauge for high-precision measurement of thin film thickness on the nanometer scale and the Optical MicroGauge for high-speed thickness measurement on the micrometer scale.

Optical NanoGauge film thickness measurement system C13027



Features

- Measurable film thickness: 10 nm to 100 µm (refractive index of 1.5)
- Connects to PLC sequencers
- Compact, space-saving design for easy mounting into equipment
- Capable of measuring samples coated on both sides

Optical NanoGauge film thickness measurement system C12562

Features

- Measures thin film thickness as well as total thickness
- Measurable film thickness: 0.5 µm to 300 µm (refractive index of 1.5)
- Capable of measuring samples coated on both sides
- Compact, space-saving design for easy mounting into equipment

Multipoint NanoGauge film thickness measurement system C11295

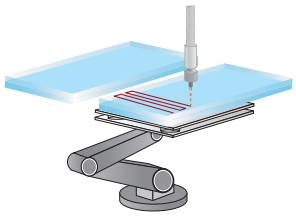
Features

- Simultaneous measurement up to 15 points
- Measurable film thickness: 20 nm to 100 µm (refractive index of 1.5)
- Remote communication with external device

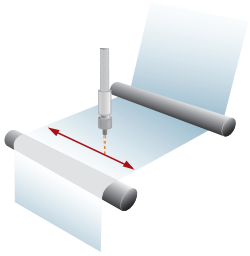
Optical MicroGauge thickness measurement system C11011

Features

- Measurable film thickness: 25 µm to 2900 µm (refractive index of 1.5)
- Compact, space-saving design for easy mounting into equipment
- Supports mapping function



FPD panel thickness measurement



Coating film thickness measurement

· Cell gap · Organic EL · Aligned film · TFT
· ITO, SIO, MgO and resist film for glass substrate · Polyimide
· Highly functional film for FPD · Color film · AR film
· Coating layers · Coating films · Vapor deposition films
· Highly functional films

Laser sealing for glass (frit welding)

LD heating light source (LD-HEATER)

L10060 series

L10060 series

The L10060 series is a family of high-performance spot heating light sources consisting of a fiber-output LD module, driver circuit, cooling system, and processing-point temperature monitor all assembled together into one compact unit. The lineup includes three models rated at 30 W, 70 W, and 200 W.

Features

- High reliability and high performance
- Energy saving and small footprint
- Real-time temperature monitoring
- Dedicated control unit (sold separately) available

Setting conditions for etching endpoint detection

Multiband plasma-process monitor

C10346

The C10346 allows wideband, real-time detection of plasma emissions during etching in the semiconductor process. This assists in simulating the endpoint analysis and setting optimal conditions (triggers) for detecting the endpoint.

Features

- Sets the conditions for detecting the etching and cleaning endpoints
- Estimates plasma species
- Monitors impurity contamination and abnormal discharges

Chromaticity measurement of backlight modules

PMA-12

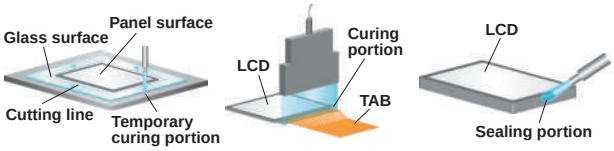
Photonic Multichannel Analyzer

The PMA-12 is a compact spectrum analyzer that integrates a spectrometer and photodetector into one unit. The PMA-12 can measure the chromaticity, color temperature, and color rendition during the inspection process for backlight modules.

Features

- White illuminance measurement
- Emission wavelength measurement
- Chromaticity measurement

UV bonding process for liquid crystal panels



Liquid crystal alignment | Moisture prevention by TAB | Sealing liquid crystal injection port

UV bonding using spot light source

UV-LED spot light source / Spot light source

LC-L1 V3 / LC8

These spot light sources emit light under conditions optimized for UV bonding. Two models of UV-LED and UV lamp are provided. Both models are designed to specifications that meet market needs and ensure efficient productivity.

Features (LC-L1V3)

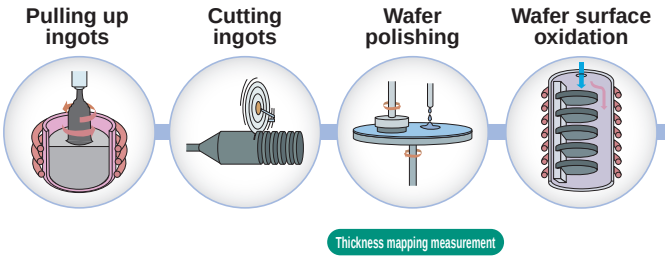
- Compact and lightweight
- Long service life
- High stability and high output
- Low power consumption: 25 W
- Key lock function prevents inadvertent operation

Semiconductor devices

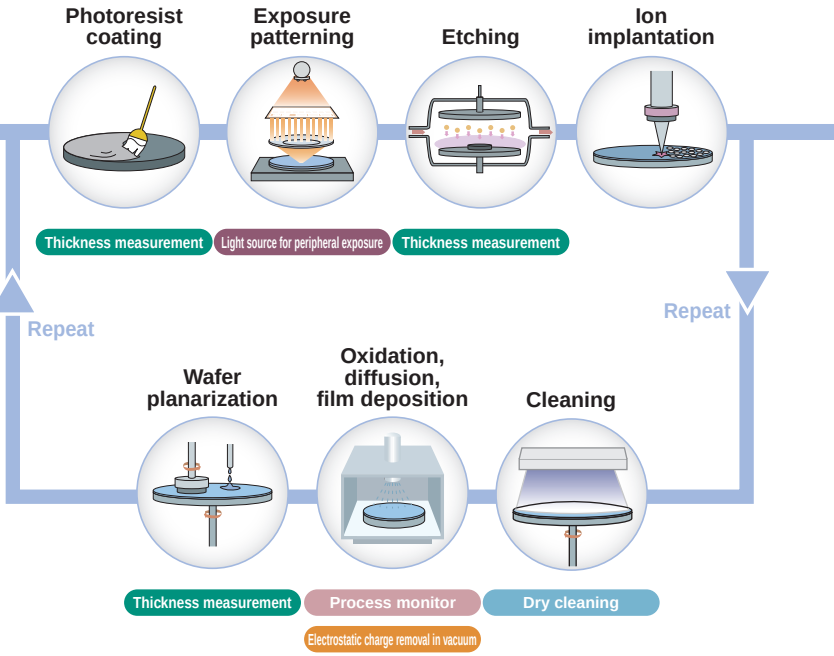
Electrostatic charge removal, thin film measurement, thickness mapping, dry cleaning, appearance inspection, peripheral exposure, laser bonding, etching endpoint detection

Semiconductor devices are becoming increasingly complex since they are designed with a larger number of metallization layers, have finer process geometries and must operate at lower voltages. Hamamatsu offers a wide range of products used in the semiconductor manufacturing processes that help improve production yield and shorten the process lead time.

Wafer manufacturing process



Pre-process



Electrostatic charge removal in a vacuum

High-brightness vacuum UV (VUV) H2D2 light source unit

L11798

The L11798 is an electrostatic charge remover that makes use of vacuum UV light. It neutralizes electrostatic charges under reduced pressure by directly ionizing residual molecules with vacuum UV light. The L11798 contains a lamp that emits vacuum UV light at a brightness 6 times higher than our conventional lamps. It generates ions smoothly and with high efficiency to neutralize electrostatic charges even faster.

Features

- Generates ions with high efficiency under reduced pressure
- Generates no dust and electromagnetic noise
- No overshoot (charging with opposite polarity)
- No air flow required to neutralize static charges

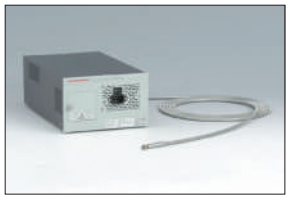
Film thickness distribution measurement after wet etching

Film thickness distribution measurement after CMP processing

Film thickness distribution measurement of photoresist

Optical NanoGauge film thickness measurement system (equipment mount type)

C13027



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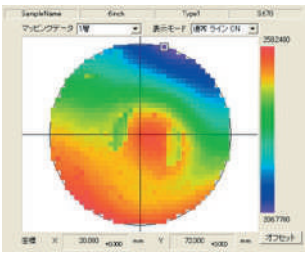
More compact than the conventional model, the C13027 is easier to integrate into manufacturing equipment.
It can measure film thicknesses from 10 nm to 100 µm at high speed (200 Hz).

Features

- Measurable thickness range: 10 nm to 100 µm (refractive index of 1.5)
- Connects to PLC sequencers
- Capable of measuring samples coated on both sides
- Stable against height variations (defocus dependence)
- Reference-free operation

Wafer thickness mapping measurement



Optical MicroGauge thickness measurement system

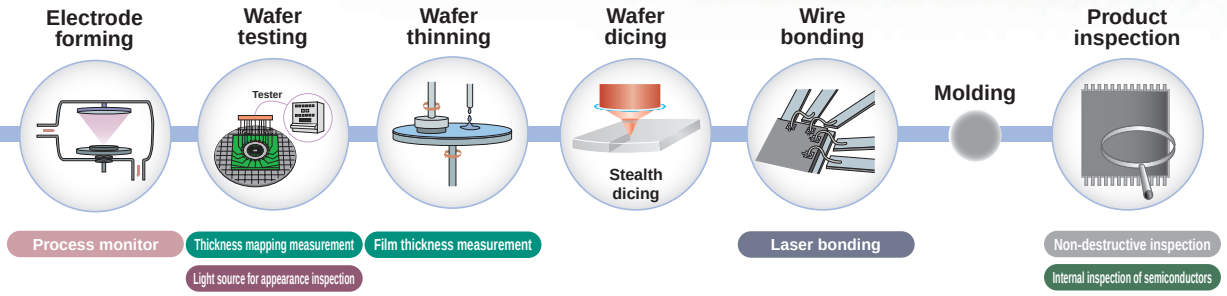
C11011-01, 01W

The Optical MicroGauge allows high-speed thickness measurement of wafers and glass substrates, and so supports in-line measurement in production sites. The Optical MicroGauge can also measure an in-plane thickness distribution (mapping) when used in combination with the C8126 mapping stage.

Features

- Measurable thickness range (silicon refractive index of 3.67): 10 µm to 1200 µm
- Measurable thickness range (SiO_2 refractive index of 1.5): 25 µm to 2900 µm
- Supports mapping function (option)
- Supports wafers with patterns and/or protective films
- Long working distance

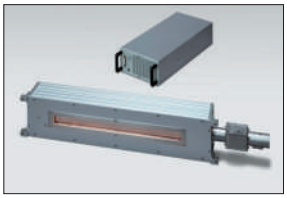
Post-processes



Dry cleaning by vacuum UV light

Excimer lamp light source FLAT EXCIMER

EX-400



Vacuum UV light emitted at 172 nm from an excimer lamp generates a large amount of active oxygen while at the same time breaking down the chemical bonds in organic matter. The broken organic contaminants are cleaned away when they react with active oxygen and ozone.

Features

- Uniform irradiation intensity over a large area
- Stable output with less flicker
- Monochromatic wavelength at 172 nm
- Instantaneous on/off operation

Real-time measurement during wet etching

Real-time measurement of residual silicon thickness

Optical NanoGauge film thickness measurement system (equipment mount type)

C12562

The Optical NanoGauge C12562 is a non-contact thickness measurement instrument. The semiconductor market requires precise measurement of Si thickness in the direction of through electrodes.
For the thin-film market where adhesive layers have become thinner, highly accurate measurement in the 1 µm to 300 µm range is necessary.
The C12562 measures Si or thin films in a wide range of thickness, from 0.5 µm to 300 µm, at high speed (100 Hz).

Features

- Measurable thickness range: 0.5 µm to 300 µm (refractive index of 3.67)
- Reference-free operation
- Compact, space-saving design for easy installation in equipment
- Stable against height variations (defocus dependence)
- External control available

High-power strobe light sources with high stability

Flash light sources LF1 and LF2

L10211, L10212, L11729, L11730

These flash light sources integrate a xenon flash lamp and a power supply into one unit. They can be made to produce different types of light by selecting particular optical components such as light guides. These light sources are ideal for use as strobe light sources and are easily controllable from a PC.

Features

- Long service life: 1×10^8 flashes
- High stability: ±5 %
- Instantaneous high output
- Continuous line spectrum from UV through infrared

Laser bonding

LD irradiation light source (SPOLD) **L11785, L12333 series**
LD heating light source (LD-HEATER) **L10060 series**

L11785 series

These light sources use a semiconductor laser optimized for heat processing applications. The SPOLD is a compact, lightweight spot laser light source designed for installation in equipment, and the LD-HEATER is a spot heating light source that includes a function to monitor the temperature at processing points.

Chamber cleaning & automatic detection of dry etching endpoint

Multiband plasma-process monitor

C10346

The C10346 allows wideband, real-time detection of plasma emissions during etching in the semiconductor process. This assists in simulating the endpoint analysis and setting optimal conditions (triggers) for detecting the endpoint.

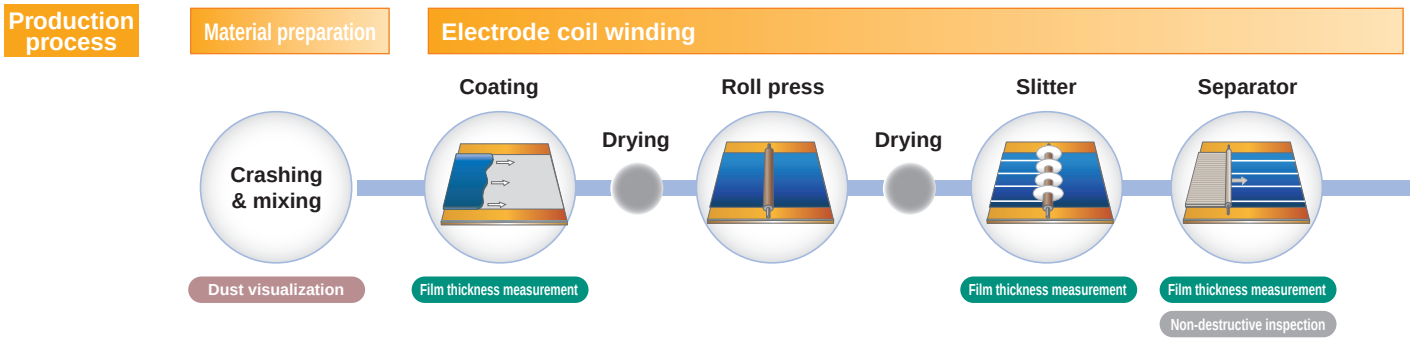
Features

- Sets the conditions for detecting the etching and cleaning endpoints
- Estimates plasma species
- Monitors impurity contamination and abnormal discharges

Secondary batteries

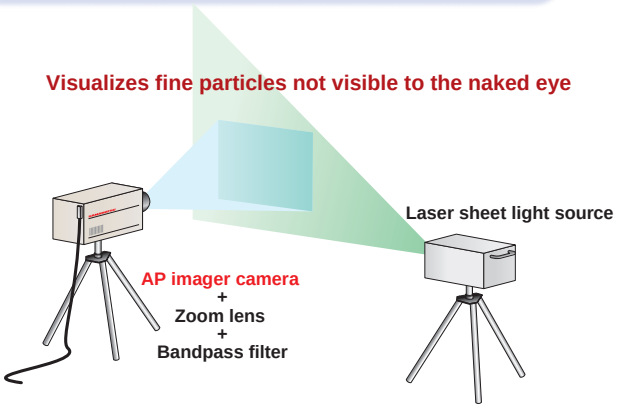
Dust visualization, film thickness measurements, non-destructive inspections

The demand for production of secondary batteries such as rechargeable lithium-ion batteries is rapidly growing not only because of use in PC and cell phones but also due to the spread of electric vehicles and hybrid electric vehicles. Currently, intensive R&D work is going on to develop even more efficient batteries. Hamamatsu offers various products usable in a wide range of manufacturing processes for secondary batteries to help customers shorten their production cycle time.

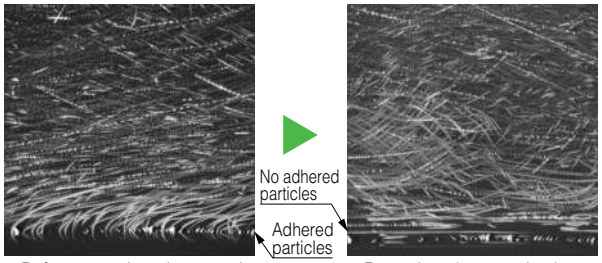


Dust visualization in process control

Visualizes fine particles not visible to the naked eye



Visualizes effect of electrostatic charge removal (silicon wafer)



▲Before removing electrostatic charge

▲Removing electrostatic charge

* Particle: Polystyrene latex standard particle (500 nm)

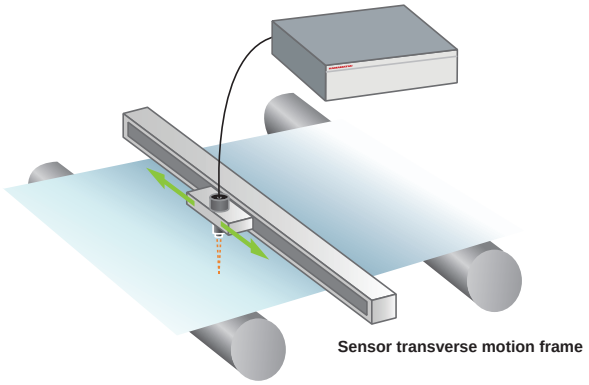
AP imager camera
C9720

The C9720 is a special monochrome camera that utilizes an AP imager employed as an imaging device in high-sensitivity broadcast cameras, etc. Its signal processing section includes a real-time differential processing function to detect low-contrast images that are difficult to capture by the naked eye and ordinary CCD cameras.

Features

- High sensitivity
- High-quality image
- Wide dynamic range
- Includes differential processing function
- Detects low-contrast images

Coating film and separator film thickness measurement



Thin film in-line inspection

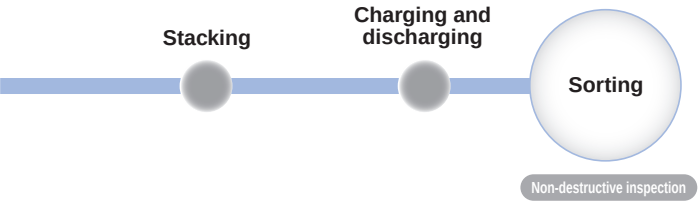
Optical MicroGauge thickness measurement system
C11011-01, 01W

The Optical MicroGauge makes high-speed measurements of total film thickness and so is the ideal support for in-line measurement in production sites. When used offline, the Optical MicroGauge can also measure thickness distributions (mapping) in combination with a mapping stage.

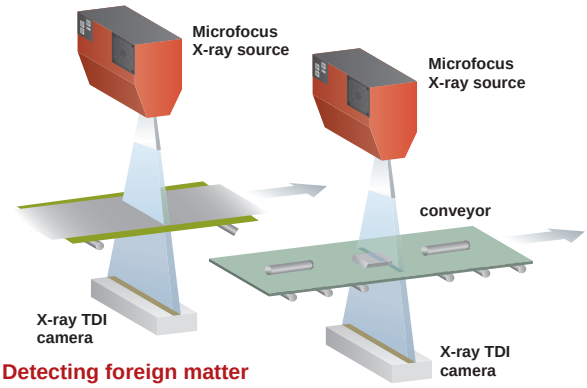
Features

- Measurable thickness range (silicon refractive index of 3.67): 10 µm to 1200 µm
- Measurable thickness range (SiO_2 refractive index of 1.5): 25 µm to 2900 µm
- Supports mapping function (option)
- Long working distance

Assembly process **Inspection process**



In-line non-destructive inspections



Detecting foreign matter in separators

Viewing internal shape of lithium-ion battery

X-ray TDI camera (compatible with in-line X-ray inspection)

C12200 series

The C12200 series captures clear, sharp X-ray images of a moving object with high sensitivity, high speed and high resolution by using TDI operation where the object is repeatedly exposed. This makes it possible to check soldered joints to see whether they contain bubbles and they are the correct solder quantity, which are difficult items to detect with ordinary line sensor cameras.

Features

- Maximum readout speed: 36.8 m/min
- Maximum detection width: 293 mm
- Number of horizontal pixels: 4608 pixels
- Real-time dark current correction and shading correction
- S/N: 12-bit output

Microfocus X-ray source

Microfocus X-ray sources are ideal for X-ray non-destructive inspection. Their small focal point prevents blurring of X-ray images and delivers sharp enlarged images. An RS-232C interface is included as standard for external control. These microfocus X-ray sources produce clear, sharp enlarged X-ray images even when observing 3D shapes.

90 kV L9421-02

100 kV L10101

110 kV L9631

150 kV L12161-07

Features

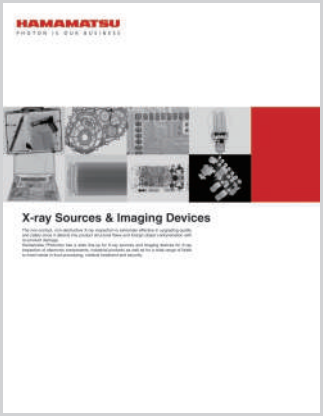
- High stability
- External control via RS-232C interface
- No high-voltage cable connection required: High voltage power supply integrated

Specifications

Type No.	L9421-02	L10101	L10321	L9631	L9181-02	L12161-07
Tube voltage (kV)	20 to 90	20 to 100		40 to 110	40 to 130	40 to 150
Tube current (μA)	10 to 200			10 to 800	10 to 300	10 to 500
Maximum output (W)	8	20		50	39	75
X-ray focal spot ① size (Min.) (μm)	5			15	5	
X-ray beam angle approx. (degree)	39	42	118	62	45	43
FOD ② approx. (mm)	9.5	6.8	7.3	16.8	13	17

NOTE: ①Nominal value ②Focus to object distance

Related catalog



X-ray sources and X-ray imaging devices

X-ray inspection is a very powerful means for improving product quality since it allows non-contact, non-destructive inspection to find tiny internal structural defects and intrusion of foreign objects. Hamamatsu provides a lineup of microfocus X-ray sources and X-ray imaging devices that are useful for inspection in a wide range of fields including inspection of electronic components, semiconductors, industrial products, food products, and academic research.

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