Manufacturing process support products

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

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.

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

**Film manufacture pre-processing**
- Dissolving raw materials
- Flow casting
- Stretching
- Thermal treatment, winding and unwinding

**Film manufacture post-processing**
- Pre-coating processing
- Coating
- Drying and hardening
- Cutting and roll-up

**Easy electrostatic charge removal set-up adapts to production line**

**PhotolonBar electrostatic charge remover using photoionization L12536**
- The PhotolonBar 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

**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 (SiO2 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

**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)
- Supports mapping function (option)
- Supports wafers with patterns and/or protective films
- Long working distance

**Pinhole inspection for transparent films**

**Optical pinhole inspection unit C12760**
- This pinhole inspection unit is designed to detect pinholes in various materials such as transparent or semi-transparent films and metal foils. Since non-contact optical detection is used, the samples being inspected are not exposed to stress from liquid or special environments such as electric fields, magnetic fields, and electrolytic solution.

**Features**
- Detection pinhole size: 50 µm diameter minimum
- Compact unit
- Inspects various types of workpieces
- Non-contact detection applies no stress or impact to workpiece
- Pinhole determination based on threshold (any value)
**Linear irradiation type UV-LED unit LC-L5G**

The LC-L5G 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.

**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-L5G**

The LC-L5G 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. 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**

**Coating film thickness measurement**

- Optical NanoGauge film thickness measurement system C11295

**Electrostatic charge removal from films**

- Electrostatic charge remover using photoionization PhotolonBar L12536

**Electrostatic charge removal**

- Film thickness measurement

**Film deposition measurement**

- Optical NanoGauge film thickness measurement system C13027/C12562

**Detection of foreign matter in films**

- Appearance inspection TDI camera C10000 series

**Wide area UV irradiation by high power UV-LED**

**UV coating curing**

- UV coating curing

**Coating preprocessing**

- Film thickness measurement

**Coating**

- Surface modification

**Unwinding**

- Electrostatic charge removal
- Film thickness measurement

**Cutting and roll-up**

- Film thickness measurement

**Coating**

- Surface modification

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

**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 thickness measurement**

- Film thickness measurement

**In-line inspection of thin film layers**

- Optical NanoGauge film thickness measurement system C11295

**Flange**

- Transmittance can also be measured

**Flange**

- Transmittance can also be measured

**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.

**Post-processing in film manufacture**

- Coating film thickness measurement

- Electrostatic charge removal from films
- Electrostatic charge remover using photoionization PhotolonBar L12536

**Electrostatic charge removal**

- Film thickness measurement

**Electrostatic charge remover**

- Surface modification

**Surface modification**

- Film thickness measurement

**Excimer lamp light source FLAT EXCIMER EX-400**

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

**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

**Vacuum chamber**

- Transmittance can also be measured

**Flange**

- Transmittance can also be measured

**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.

**Film deposition measurement in vacuum environments**

- 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**

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)**

<table>
<thead>
<tr>
<th>Substrate receiving</th>
<th>ITO patterning</th>
<th>Etching</th>
<th>Fabricating peripheral circuits</th>
<th>Backside ITO patterning</th>
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</thead>
<tbody>
<tr>
<td>Electrostatic charge removal</td>
<td>Electrostatic charge removal</td>
<td>Electrostatic charge removal</td>
<td>Electrostatic charge removal</td>
<td>Electrostatic charge removal</td>
</tr>
<tr>
<td>Thickness measurement</td>
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<td>Thickness measurement</td>
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<tr>
<td>Transmittance &amp; reflectance measurement</td>
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<td>Transmittance &amp; reflectance measurement</td>
</tr>
</tbody>
</table>

**UV coating curing & film lamination**

**Linear irradiation type UV-LED unit**

**LC-L5G**

The LC-L5G 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

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

**UV light intensity measuring device**

**UV power meter**

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/cm²)
- Less deterioration in sensitivity against exposure to UV light

**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)

**Easy electrostatic charge removal set-up adapts to production line**

**PhotolonBar electrostatic charge remover using photoionization**

**L12536**

The PhotolonBar 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
Product manufacturing process (capacitive type)

- Fabricating peripheral circuits
- Etching
- Electrostatic charge removal
- Thickness measurement
- Laser welding
- Electrostatic charge removal
- UV curing
- Thickness measurement
- Laser welding
- Surface modification
- Flexible printed circuit board
- Heat sealing
- Cover glass bonding
- Inspection

Glass substrate manufacturing process

- Protective cover
- Electric field
- Electrode pattern layer
- Glass substrate
- Transparent electrode layer (X)
- Transparent electrode layer (Y)

Projected 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 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)

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

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

L11785-61M, L12333-x11M 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 L11785-61M, L12333-x11M 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

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 (SiO2 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
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**

### Array process
- Glass substrate
- Cleaning
- Film deposition
- Resist coating
- Exposure
- Development
- Etching
- Resist stripping
- Inspection and repair

### Color filter process
- Color filter substrate production
- Aligned film coating
- Rubbing
- Thickness measurement

### Cell process
- Aligned film coating
- Rubbing
- Sealing material coating
- Transfer forming
- Spacer spraying
- Bonding
- Liquid crystal injection
- Sealing
- Bonding polarizer plates
- Liquid crystal cell finishing

### Module process
- TCP mounting
- Mounting parts on printed circuit boards
- Liquid crystal module finishing
- Frame mounting
- Lighting inspections

**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)

**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
Liquid crystal alignment
Sealing liquid crystal injection port

Moisture prevention by TAB
Sealing portion
LCDCuring portion
TAB LCD
Glass surface
Panel surface

Cutting line Temporary curing portion
Liquid crystal alignment
Curing portion
Moisture prevention by TAB
Sealing liquid crystal injection port

UV bonding using spot light source
UV-LED spot light source / Spot light source LC-L1V3 / 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

UV bonding process for liquid crystal panels
Laser sealing for glass (frit welding)

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
C12552
Features
- Measures thin film thickness as well as total thickness
- Measurable film thickness: 0.5 µm to 300 µm (refractive index of 1.5)
- 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

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
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

1. **Pulling up ingots**
2. **Cutting ingots**
3. **Wafer polishing**
4. **Wafer surface oxidation**
5. **Photoresist coating**
6. **Exposure patterning**
7. **Etching**
8. **Ion implantation**
9. **Wafer planarization**
10. **Cleaning**

### Pre-process

1. **Thickness mapping measurement**
2. **Electrostatic charge removal**
3. **Thickness measurement**
4. **Process monitor**
5. **Dry cleaning**
6. **Optical MicroGauge thickness measurement system**

#### 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**
- **after CMP processing**
- **of photoresist**

### Optical MicroGauge thickness measurement system C11011-01, 01W

The Optical MicroGauge allows high-speed thickness measurement of wafers and glass substrates, and 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 (SiO2 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
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

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

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)

Real-time measurement of residual silicon thickness

Optical NanoGauge film thickness measurement system (equipment mount type) C12562

The optical NanoGauge film thickness measurement system (equipment mount type) C12562 is a highly precise measurement system designed for semiconductor applications. It is capable of measuring the thickness of thin films in the 1 μm to 300 μm range with high accuracy.

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

Real-time measurement during wet etching

Laser bonding

LD irradiation light source (SPOLD®) L11785, L12333 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.

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)

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

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.

### Pinhole inspection, film thickness measurements, non-destructive inspections

**Production process**
- [Material preparation](#)
- **Electrode coil winding**
  - Crashing & mixing
  - Coating
  - Drying
  - Roll press
  - Drying
  - Slitter
  - Separator

**Pinhole inspection**
- **Film in-line pinhole inspection**
  - **Optical pinhole inspection unit**
    - C12190 series
      - Since non-contact optical detection is used, the samples being inspected are not exposed to stress from liquid or special environments such as electric fields, magnetic fields, and electrolytic solution.
      - **Features**
        - Wide dynamic range (30 μm to 2 mm)
        - Detection speed: 600 m/min
        - Compact unit
        - Selectable inspection width of the light source and detection unit to match the workpiece size
        - Lineup includes 6 types: 300 mm, 600 mm, 900 mm, 1200 mm, 1500 mm, 1800 mm
        - Pinhole determination based on threshold (any value) for each channel

<table>
<thead>
<tr>
<th>Type No.</th>
<th>Workpiece type</th>
<th>Detection pinhole size</th>
</tr>
</thead>
<tbody>
<tr>
<td>C12190</td>
<td>Aluminum laminate films</td>
<td>30 μm to 2 mm</td>
</tr>
<tr>
<td></td>
<td>Metal foils</td>
<td></td>
</tr>
<tr>
<td>C11750</td>
<td>Aluminum laminate film molding</td>
<td>5 μm</td>
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<td></td>
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<td>C12570</td>
<td>Aluminum laminate films</td>
<td>2 μm</td>
</tr>
<tr>
<td></td>
<td>Metal foils</td>
<td></td>
</tr>
</tbody>
</table>

**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 (SiO2 refractive index of 1.5): 25 μm to 2900 μm
      - Supports mapping function (option)
      - Long working distance
In-line non-destructive inspections

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

Specifications

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

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.

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

Specifications

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</table>

NOTE: ① Nominal value ② Focus to object distance
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.

Please contact our sales office or representative for a copy of this catalog.