Semiconductor/FPD Solutions

Analytical and evaluation instruments supporting R&D and QC

Materials analysis
Contaminant analysis
Quality control
Film thickness
Nanotechnology

Based on more than 40 years of experience with spectroscopic instrumentation, JASCO offers advanced solutions for semiconductor and Flat Panel Display (FPD) research with a variety of analytical and evaluation instruments supporting R&D as well as QC of semiconductor devices, LCD's, thin films, and many other key products.

JASCO's Semiconductor/FPD Solutions

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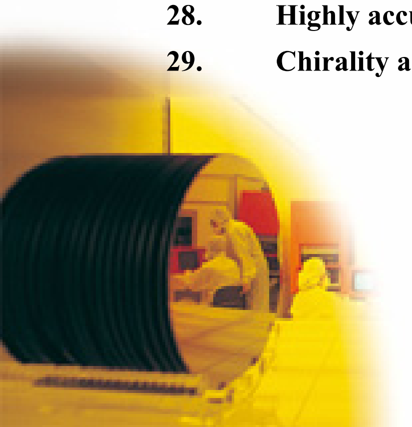
Materials Analysis



JASCO's Semiconductor/FPD Solutions

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JASCO's Semiconductor/FPD Solutions

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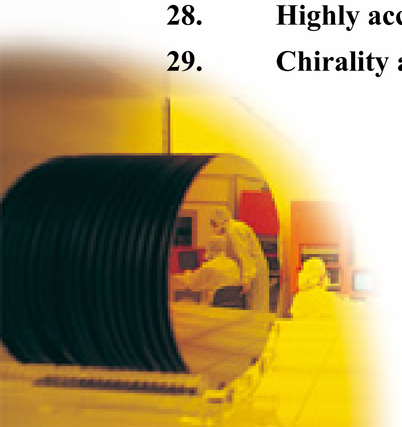
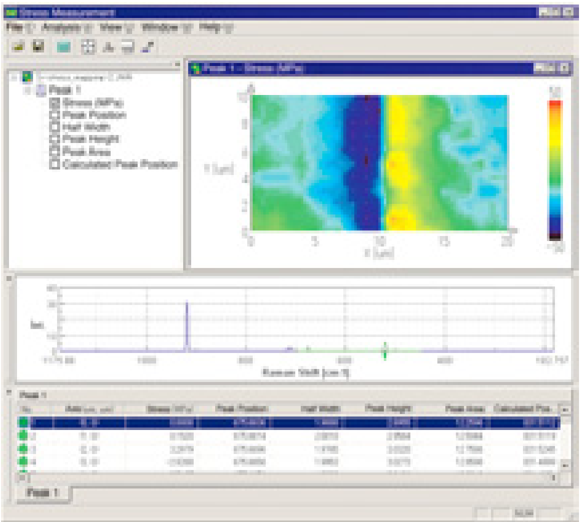


JASCO's Semiconductor/FPD Solutions

Materials Analysis

1. Semiconductor stress measurement

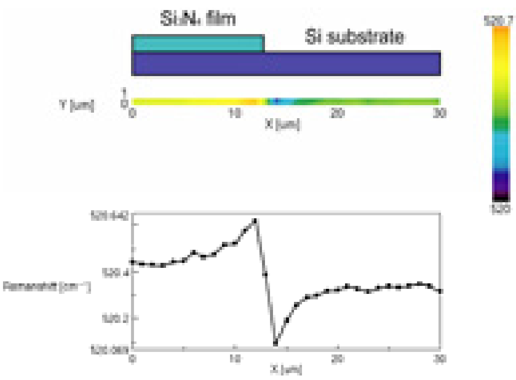
Raman Spectrometers

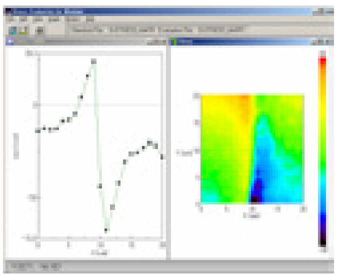


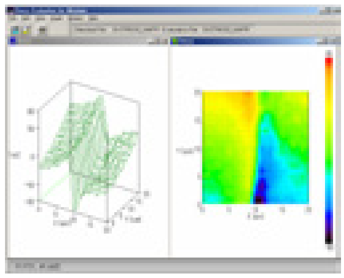
Stress evaluation of Silicon (Si)

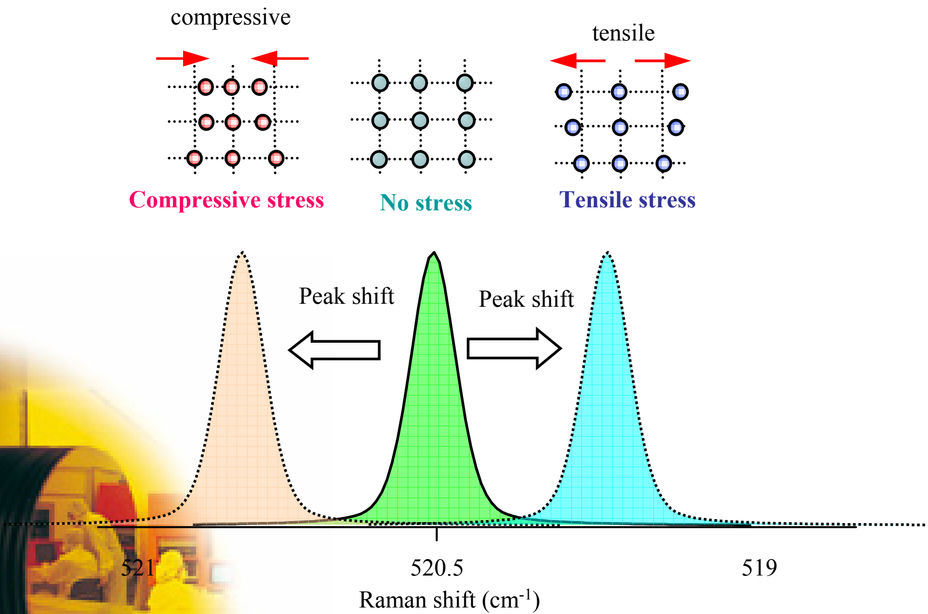
The evaluation of stress in silicon devices is extremely important in the development of next generation, high-precision, highly integrated devices. Since the Raman spectrum reflects the degree of pressure dependence on the sample's lattice vibration, it can detect stress in silicon and other semiconductors. The amount of stress is calculated from the Raman peak shift of Si. Stress-free Si has a sharp peak at around 520 cm^{-1}. If compression stress is exerted on the crystal lattice, the lattice constant decreases and the coupling strength increases. Accordingly, the lattice vibration energy increases and the peak will shift towards higher wavenumbers. When the compression is released, the peak will shift in the opposite direction to lower wavenumbers.

Stress distribution of a nitrided film









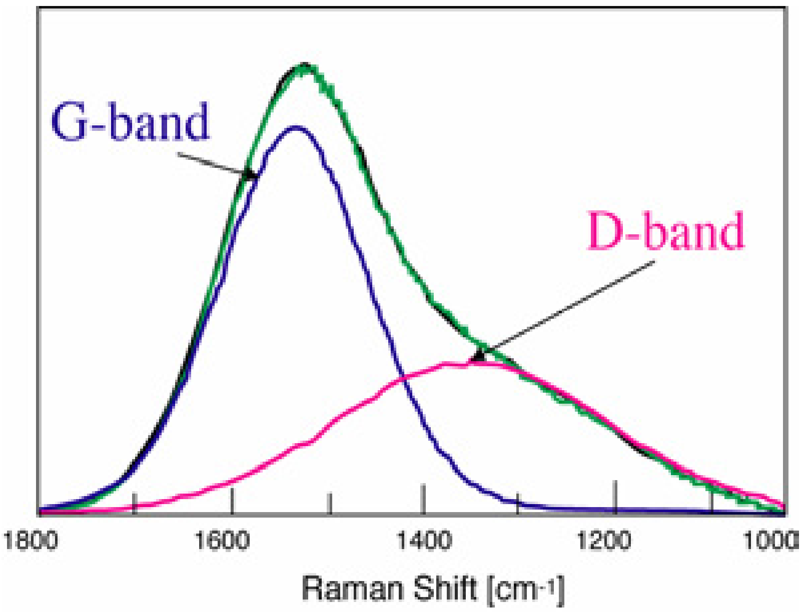
NRS-3000 Series
Raman Spectrometers

2. Evaluation of Diamond Like Carbon (DLC)

Raman Spectrometers

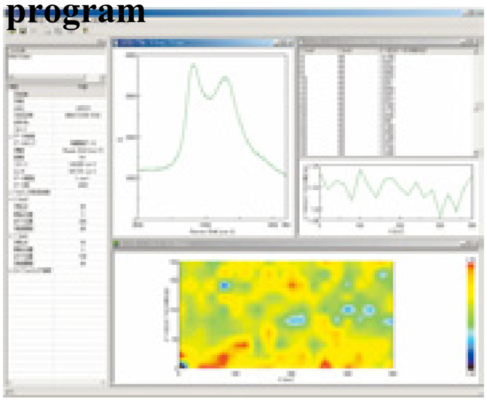
DLC layer 10 nm in thickness on a hard disc

Diamond Like Carbon (DLC) forms an amorphous (non-crystalline) carbon with about twice the hardness of ceramics, and is widely used as a protective film for hard disks and magnetic read heads. Raman spectra are sensitive to disorder changes in crystalline formation and structural modifications in a DLC film. The Raman spectrum of a DLC film consists of two peaks around 1335 cm^{-1} (D band) and 1550 cm^{-1} (G band). D band intensity is related to crystalline size, and the intensity ratio, ID/IG, is related to the grain size. The NRS-3000 series Raman spectrometer enables rapid DLC measurement with a high signal-to-noise ratio. The optional carbon analysis program simplifies the calculation of peak separation and peak ratio.



D-band at 1335cm^{-1} is related to crystallite size, and the intensity ratio of D-band and G-band at 1550cm^{-1} is related to grain size.

Carbon analysis program



The Raman spectrum of carbon may change significantly depending on the crystalline structure. In graphite, amorphous carbon, and DLC (diamond-like carbon), in particular, two peak ratios, half-value amplitudes, and other factors are used in sample evaluation to determine the degree of crystallization.

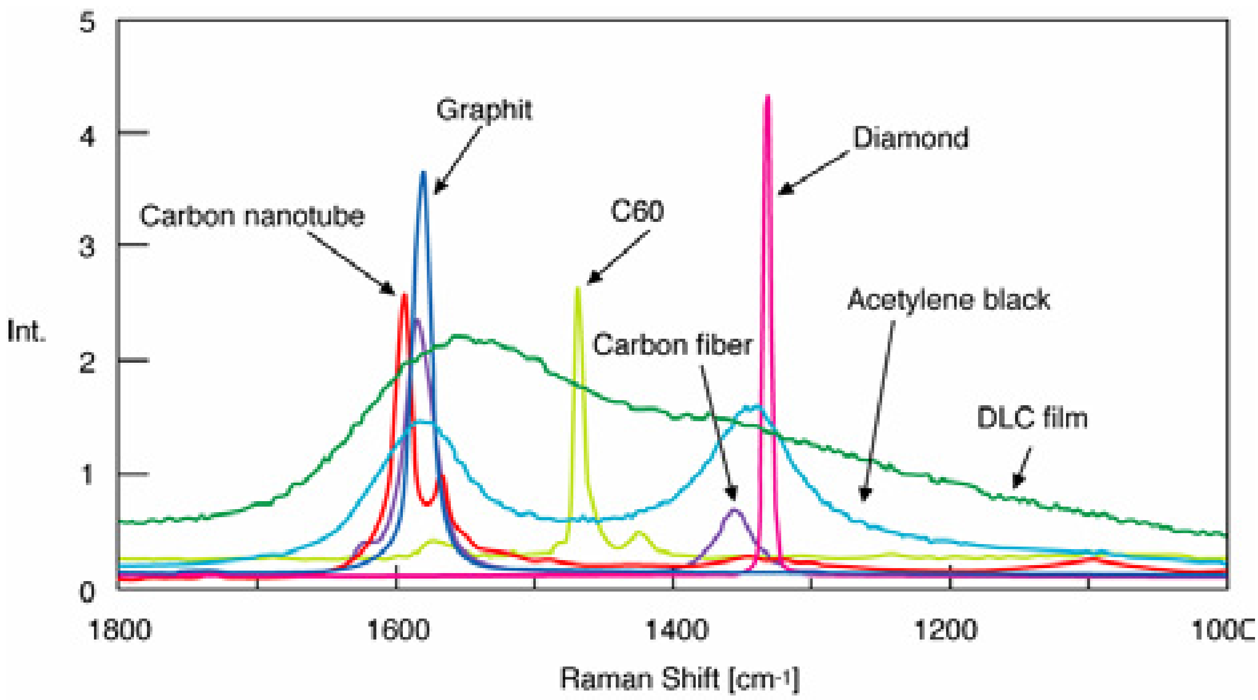
NRS-3000 Series
Raman Spectrometers

3. Evaluation of carbon materials

Raman Spectrometers

Raman Spectra of Carbon Materials

Raman spectroscopy is effective for the evaluation of carbon materials that have structures ranging from single crystals to amorphous films. It has a wide range of uses, from the evaluation of synthetic diamonds, graphite used for solar cells and crystallinity of carbon fibers, to the evaluation of Diamond-Like Carbon (DLC) films with an amorphous structure. It is also used in the evaluation of highly functional carbon materials, such as fullerenes like C60 materials and carbon nanotubes. Figure illustrates the Raman spectra of various carbon materials. DLC films, widely employed as protective coatings, is also used for other applications, such as quality control, because its band shape has a good correlation with film properties, including wear resistance.



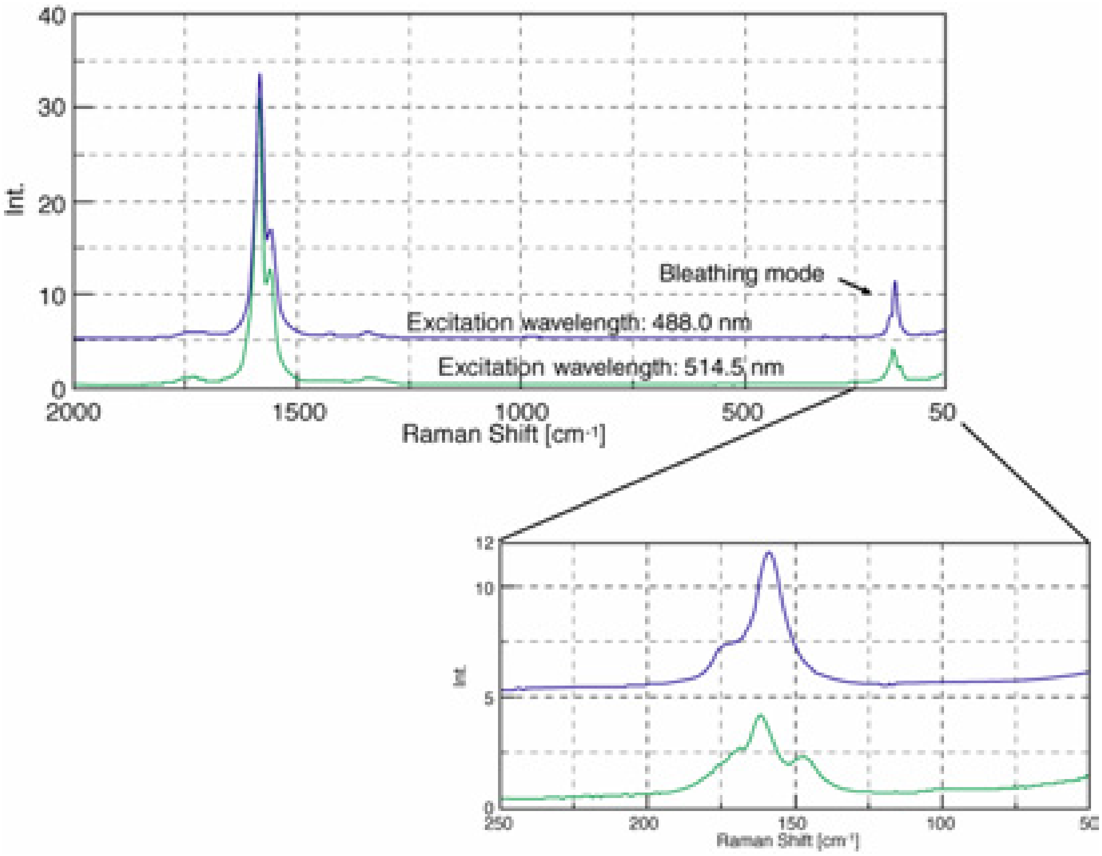
NRS-3000 Series
Raman Spectrometers

4. Single-layer carbon nanotube

Raman Spectrometers

Raman spectrum of carbon nanotubes

The figure outlines a measurement example for single-layer carbon nanotubes. For single-layer carbon nanotubes, the breathing mode, which depends on tube diameter, is observed in the low wavenumber region (up to 250 cm^{-1}). This mode exhibits an excitation wavelength dependence, enabling us to determine the nanotubes diameter by measuring the excitation wavelength dependence. Information on the crystallinity and its loss are obtained from the bands at ~ 1,600 cm^{-1} and near 1,350 cm^{-1}, which are attributed to the structure of graphite. Because measurement of these samples is easy with Raman spectroscopy, it is widely used to complement SEM and TEM measurements.

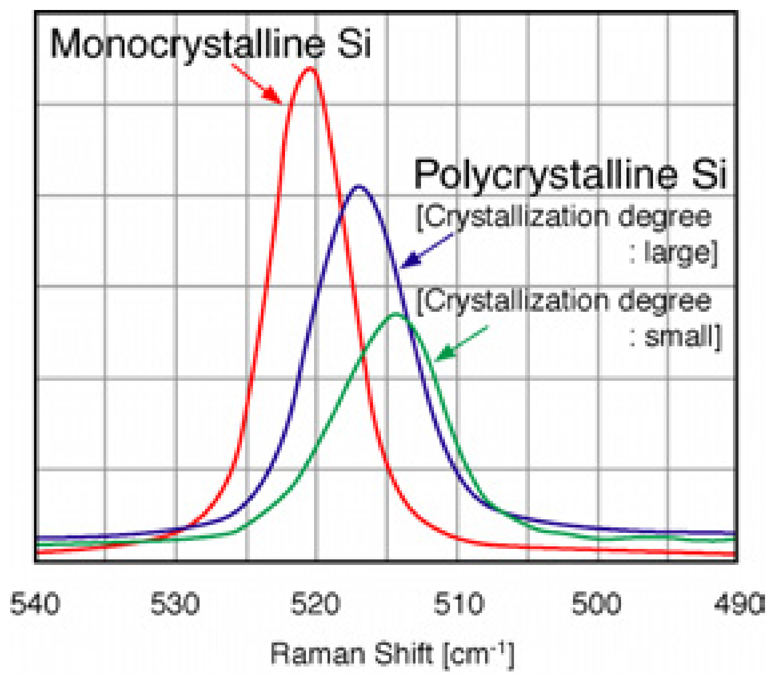


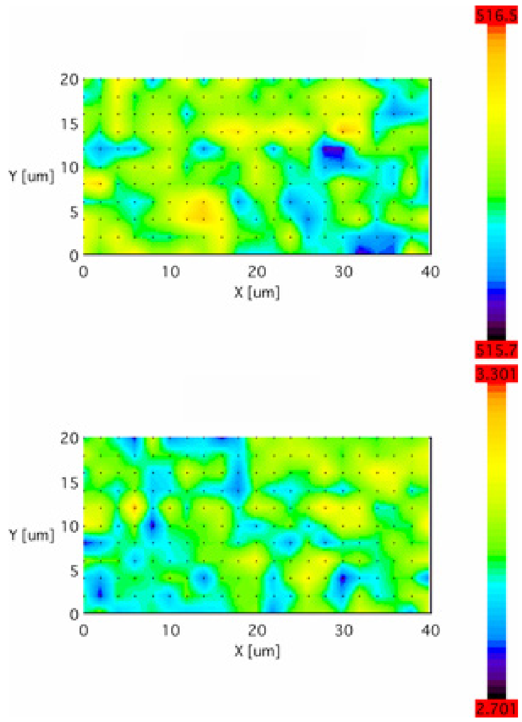
NRS-3000 Series
Raman Spectrometers

5. Evaluation of polysilicon

Raman Spectrometers

Raman spectroscopy is also effective in evaluating the crystallinity of polysilicon used in Thin Film Transistor (TFT) substrates in LCDs, solar cells and other devices. The peak position and half width analysis of the Raman bands demonstrate a correlation with crystallinity and particle size. The figure shows the results of mapping measurements for polysilicon on a glass substrate and then measuring the distribution of peak positions and half widths. Information on the crystallinity and the heterogeneity of particle size was obtained.





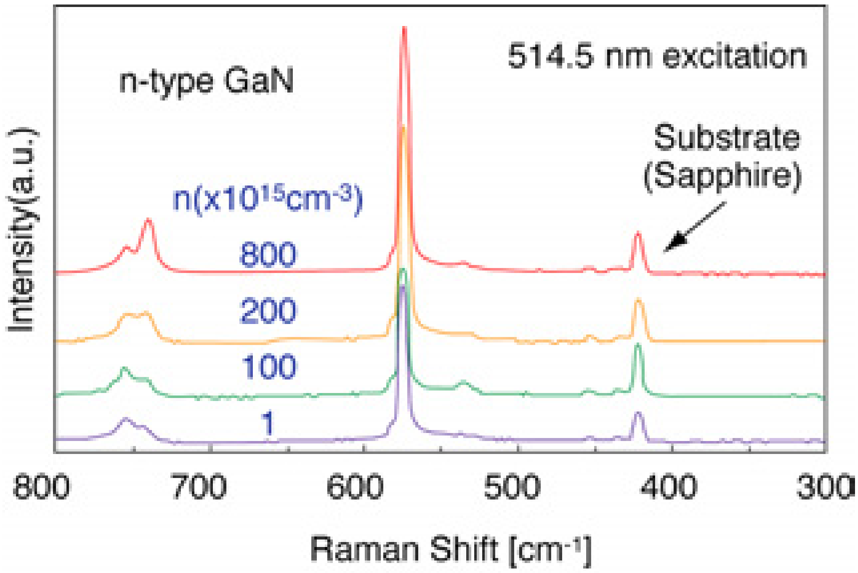
NRS-3000 Series
Raman Spectrometers

6. Evaluation of carrier concentrations in GaN

Raman Spectrometers

Gallium Nitride (GaN), which is one of a generation of promising light-emitting materials, can be analyzed by using 514.5 nm excitation to evaluate crystallization and carrier concentration. Using a Visible laser, surface analysis up to nm order in thickness can be performed.

Raman Spectrum of GaN



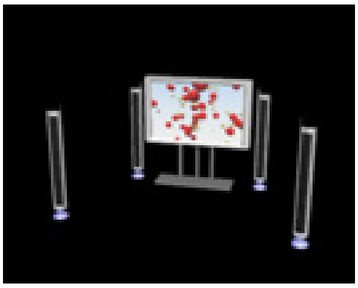
Until 1993, the only blue light-emitting devices commercially available were based on silicon carbide, which has an indirect bandgap, and so is not capable of sufficient brightness to be of wide interest.The development of the first high intensity GaN light-emitting diode (LED) by Shuji Nakamura, working for the Nichia company in Japan, completed the range of primary colors, and made possible applications such as daylight visible full-color LED displays, white LEDs and blue laser devices. GaN-based blue laser diodes are used in the Blu-ray disc technology as well as in devices such as the Sony PlayStation 3.The first GaN-based high intensity LEDs used a thin film of GaN deposited via MOCVD on sapphire. Other substrates used are zinc oxide, with a lattice constant mismatch of only 2%, and silicon carbide (SiC).
(WIKIPEDIA)

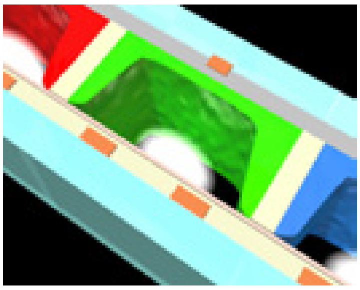
NRS-3000 Series
Raman Spectrometers

7. Development of new PDP phosphors

FLV-1000 VUV Fluorometer

The plasma display panel (PDP) is expected to dominate the flat panel display market due to an improved viewing angle, faster update speeds, and a crisper picture quality. Gas discharge excitation of Red-Green-Blue (RGB) photoluminescent phosphors is used by the plasma display panel to produce the displayed picture. However, there is still a need for improvement in display performance; the high power requirements and relatively high cost of manufacture restricting the viability of the PDP compared to other display alternatives. The JASCO FLV-1000 VUV Spectrofluorometer can be used for the development and characterization of new PDP phosphors or the inspection and control of PDP manufacturing processes.

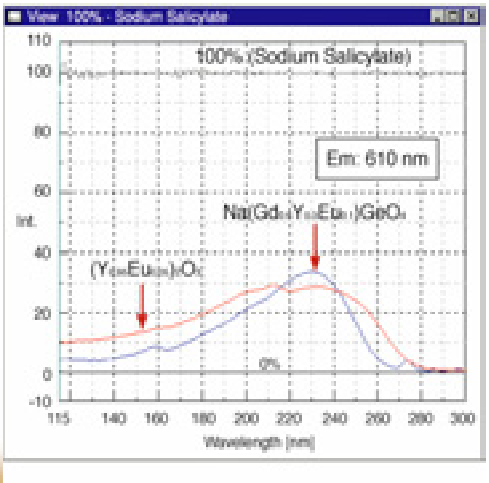




PDP's did not become widely popular until a few years ago due to their high cost but recently are being developed and marketed for home use. This has resulted in a surge of plasma display research and development in Japan and overseas. The screens of plasma displays comprise a lattice of many cells coated with phosphors in the three primary colors: Red (R), Green (G), and Blue (B). When a voltage is applied to a cell, a UV discharge results from the high-pressure gas within. The phosphors glow when exposed to this UV light.

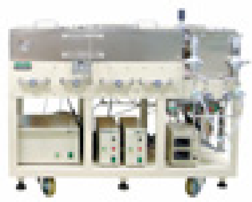
The wavelength of the discharge from the high-pressure gas is in the vacuum UV region (100 to 200 nm). This means that a system that measures vacuum UV excitation wavelengths is required to evaluate these phosphors. However, up to now, excitation spectra measurement systems that vary the wavelength of the vacuum UV excitation light (on the excitation light side, the wavelength is variable because a spectrometer is used, while on the fluorescent side, the wavelength is fixed) cannot operate successfully without a synchrotron radiation light source.

The FLV-1000 Vacuum Ultraviolet Excited Emission Spectrum Measurement System was developed to enable excitation spectra measurement in the vacuum UV region without the use of synchrotron radiation.



The figure demonstrates relative intensity compared to Sodium Salicylate at 100.
Note: Samples supplied by Professor Toda of Niigata Univ.; Faculty of Engineering.

FLV-1000
VUV Fluorometer



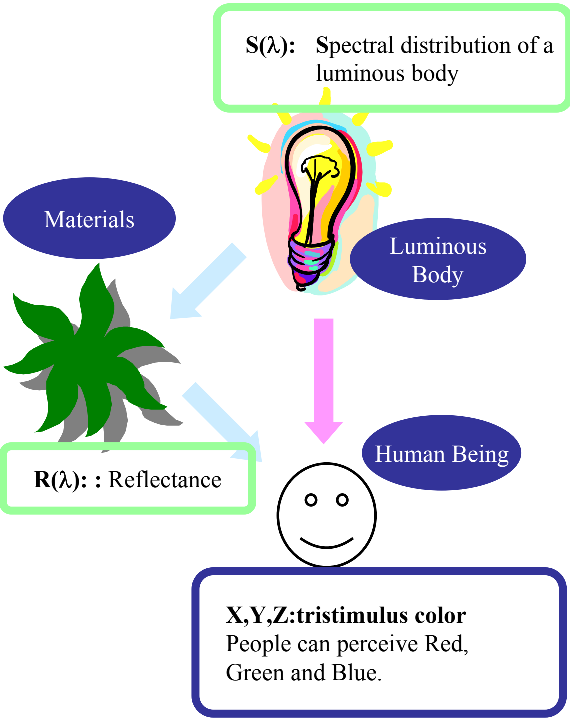
JASCO's Semiconductor/FPD Solutions

Materials Analysis

8. Luminescent color measurement

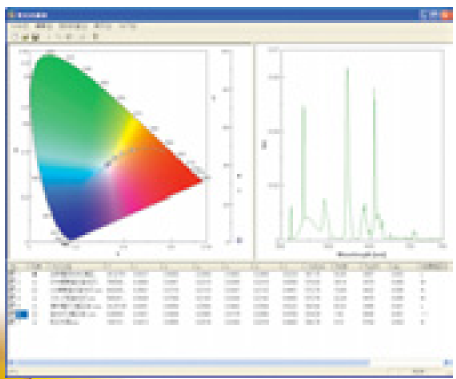
FP-6500/6600 Spectrofluorometer with integrating sphere

Fluorescence analysis is widely used in the analytical chemistry and the biochemistry field as the primary techniques for high sensitivity quantitative measurement and research for the excitation state of samples. Recently, it has been used for research in the field of photoelectronics such as an organic EL, a plasma display and a luminous body for white LED. It is expected that the efficiency of the luminous body and its color are evaluated quantitatively.



Photoelectronics
- ✓**Organic EL Display**
- ✓**Plasma Display**
- ✓**Fluorescent Substance of White LED**

A light source such as the sun or an electric bulb illuminates an object and the color of the object is normally determined from the tristimulus value of its reflectance light. The color of the luminescent body is obtained by the tristimulus value from the energy distribution of the illuminating source. The tristimulus value is the value corresponding to the red, green and blue colors which people recognize as colors.



After fluorescent measurements of solid or powder fluorescent bodies are captured, the luminescent color analysis program can calculate the tristimulus value XYZ, chromaticity coordinates xy, uv, u'v', dominant wavelength, stimulus purity, correlated color temperature and color rendering index.

FP-6500/6600 Spectrofluorometer with integrating sphere

9. Luminescence efficiency measurement

FP-6500/6600 Spectrofluorometer with integrating sphere

The fluorescence quantum efficiency is a value showing the luminescence efficiency of a fluorescent body. If the fluorescent body absorbs 100 photons, when expressed as a percentage, the value corresponds to how many fluorescence photons are emitted. There are two kinds of fluorescence quantum efficiencies; internal quantum efficiency and external quantum efficiency. The internal quantum efficiency corresponds to the luminescence efficiency when a fluorescent body is excited. The external quantum efficiency shows the luminescence efficiency when substance is irradiated by an excitation source.

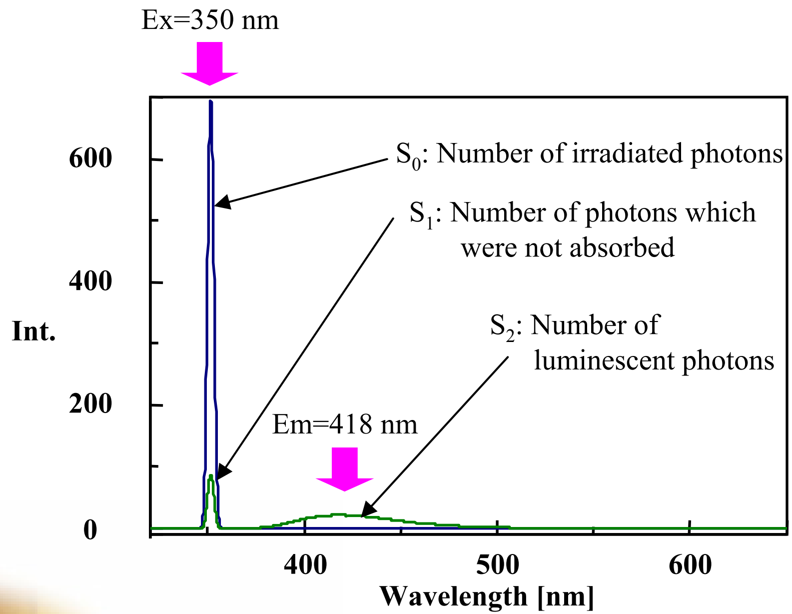
Internal Quantum Efficiency and External Quantum Efficiency

Internal Quantum Efficiency: This shows the number of the emitted photons relative to the number of the photons absorbed by the sample.

External Quantum Efficiency: This shows the number of the emitted photons relative to the number of the irradiating photons.

$$\Phi = \frac{\text{Photons Emitted}}{\text{Photons Absorbed}}$$

$$\text{Quantum Efficiency} = \frac{\text{Number of Emitted Photons}}{\text{Number of Absorbed Photons}} = \frac{S_2}{S_0 - S_1}$$



Measurement of Sodium Salicylate

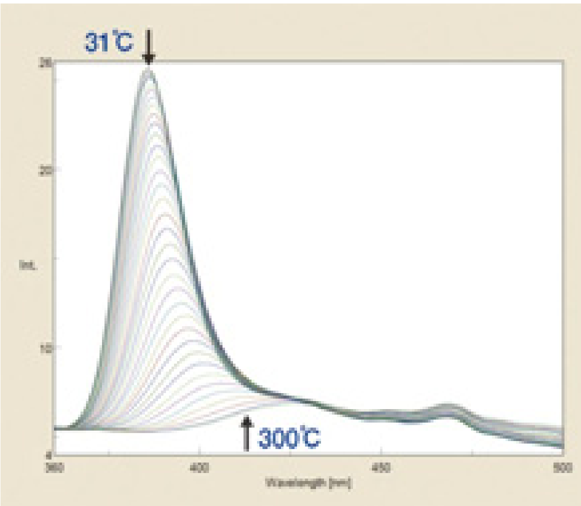
The figure illustrates the measurement data of Sodium Salicylate. Powered Sodium Salicylate was measured by using a powder sample holder. It is calculated as absorption of excitation light of 350nm, 84%, internal quantum efficiency, 44% and external quantum efficiency, 37%.

FP-6500/6600 Spectrofluorometer with integrating sphere

10. Evaluation of fluorescent materials at a high temperature

FP-6500/6600 Spectrofluorometer

The fluorescent components of plasma display panels and white LED's are generally maintained at high temperatures under actual working conditions. However, the evaluation of the characteristics of these materials is often evaluated at room temperature using a standard fluorescence spectrophotometer. The JASCO model FP-6500 with the HPC-503 high temperature sample accessory allows the examination of the fluorescence intensity of powders at temperatures up to 300ºC.



Emission spectra of ZnO powders against variation in temperature

HPC-503 High temperature powder sample accessory

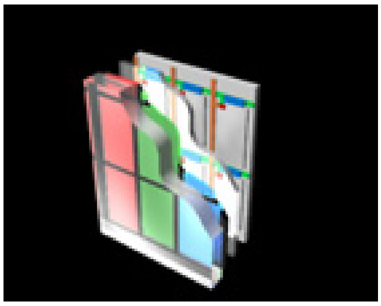
FP-6500/6600 Spectrofluorometer

JASCO's Semiconductor/FPD Solutions

Materials Analysis

11. Evaluation of organic EL materials

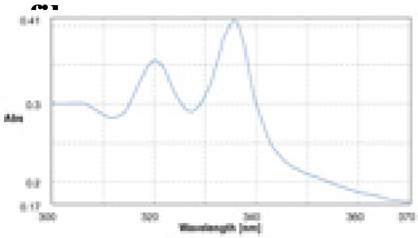
EMV-100 Electric Field Modulation Spectrophotometer



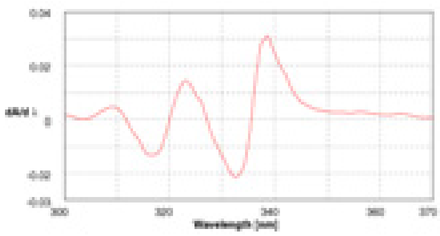
Molecular electronic elements using optically functional materials, including organic EL elements and organic optical conversion molecular elements, employ the luminescence accompanying light excitation in an electrical field and are the focus of next-generation display technology instead of LCD's and plasma displays. Elucidating the electronic structure, molecular structure and molecular alignment of these materials after light excitation in an electric field is extremely important in the development of new materials, such as organic EL elements. Techniques that are known to be effective for evaluating such materials are the change (AU) Δμ in dipole moment and the change (AU) Δα in polarizability. Δ μ and Δα are extremely important for elucidating the charge transfer in response to the transitions and electrical characteristics of chromophores, respectively.

JASCO developed the EMV-100 Electric Field Absorption Spectra Measurement System to apply an electric field to a sample and then measure the accompanying change in absorbance in the ultraviolet, visible light, and near-infrared regions. The system makes it possible to quantify Δμ and Δα, the characteristic parameters of absorption and fluorescent transitions.

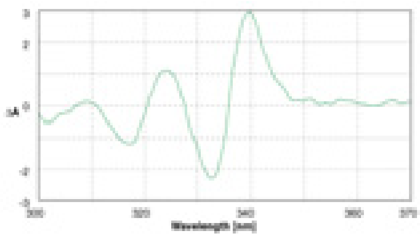
Pyrene doped on a PMMA (polymethylmethacrylate) fi



Absorption spectrum



The first derivative of absorption spectrum



Electric field absorption spectrum

As examples of the characteristic spectra indicating Stark shift, the figure above shows the absorption spectrum, first derivative of the absorption spectrum and the electrical field absorption spectrum of a pyrene-doped polymethylmethacrylate film. The electric field absorption spectrum has the same waveform as the first derivative of the absorption spectrum and the change in absorption intensity by the electric field suggests that it is due to a change in the molecular polarizability.

EMV-100

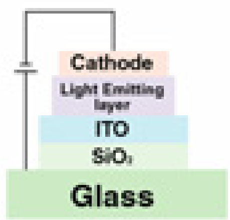
JASCO's Semiconductor/FPD Solutions

Materials Analysis

12. Evaluation of ITO films

Absolute Reflectance Measurement System

Indium oxide doped with tin oxide (ITO), is used to make transparent conductive coatings. Thin film layers can be deposited by electron-beam evaporation or sputtering. Typical applications of ITO-coated substrates include touch panel contacts, electrodes for LCD and electrochromic displays, energy conserving architectural windows, fog resistant aircraft and automobile windows, heat-reflecting coatings to increase light bulb efficiency, gas sensors, anti-static window coatings and wear resistant layers on glass, among numerous other applications.



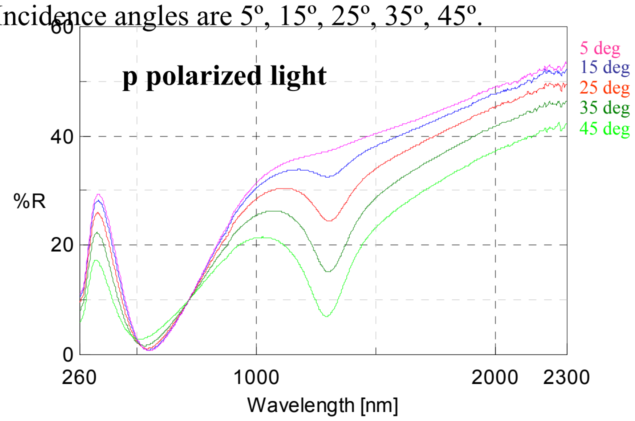
ITO films for organic EL displays

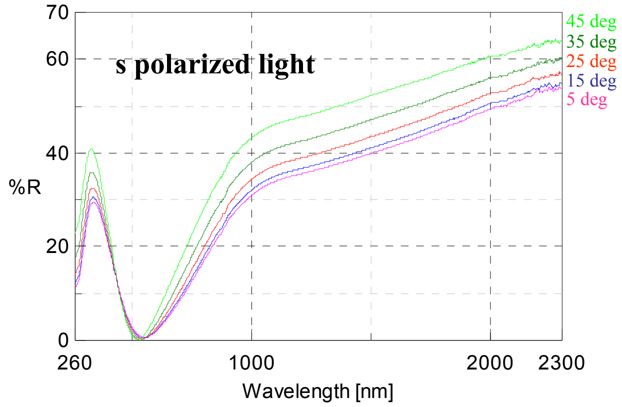
ITO films on glass substrate for Flat panel displays

ITO films on color filter for color LCDs

Absolute reflectance spectra of 50 nm ITO (indium tin oxide) on silicon substrate

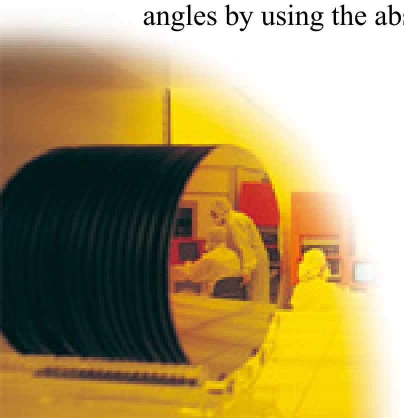
Incidence angles are 5º, 15º, 25º, 35º, 45º.





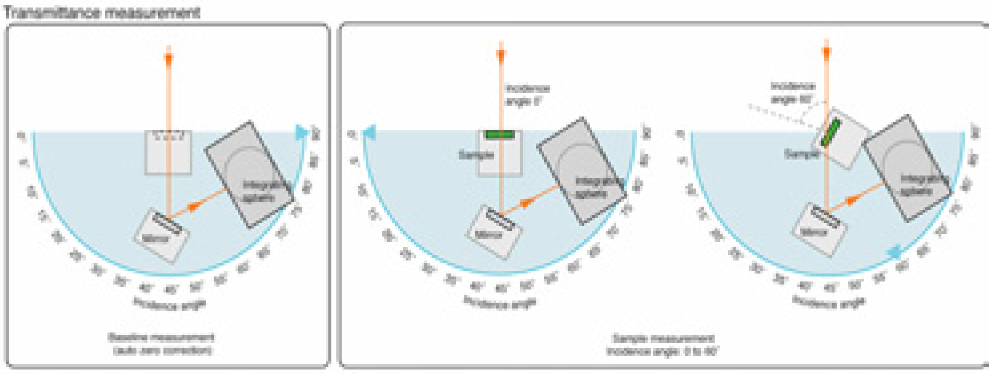
50 nm ITO film on silicon substrate was measured at several incidence angles by using the absolute reflectance measurement system.

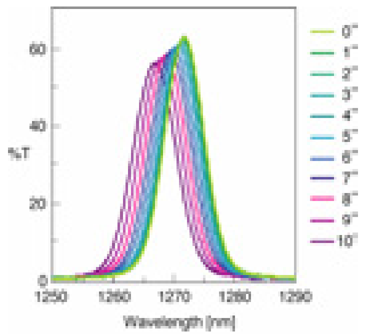
V-7000



13. Evaluation of filters and mirrors

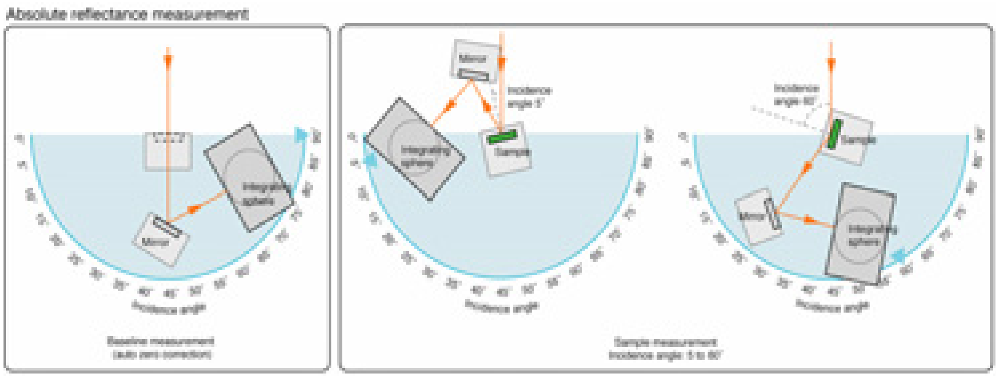
Absolute Reflectance Measurement System

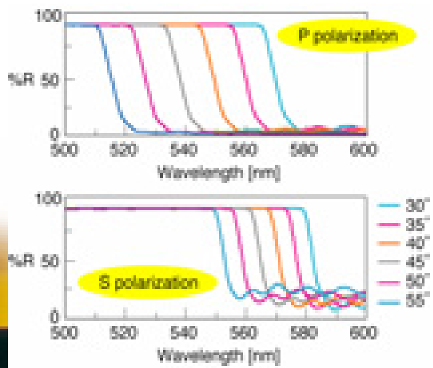




Transmittance profile of band pass filter

Optical bandpass filters are designed to transmit a specific wavelength. Composed of thin layers of dielectric materials, the different refractive indices produce constructive and destructive interference to the transmitted light, providing transmission of a specific wavelength. Varying the incidence angle, the transmittance characteristics of a band pass filter are measured. As shown, the transmittance of the band pass filter is shifted about 8 nm to the shorter wavelength as the incidence angle is changed from 0º to 10º.





Reflectance profile of a dichroic mirror

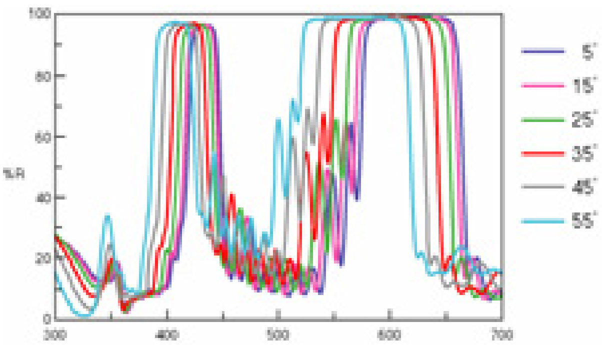
Dichroic mirrors are used to reflect light selectively according to wavelength with wavelength separation easily achieved by mirrors with dichroic coatings. Application examples include various laser optics, DVD players, DVD-ROM, DVD recorders, DVD combination players and TFT-LCD projectors. Varying the incidence angle, the reflectance characteristics of a dichroic mirror are analyzed using P and S polarization, demonstrating the selective reflectance characteristics of the dichroic coating.

14. Absolute reflectance measurements of a dichroic mirror

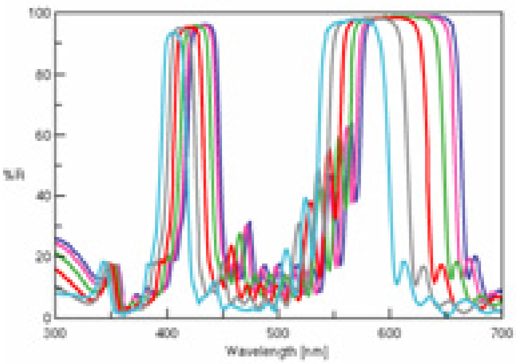
Automated Absolute Reflectance Measurement Accessory for the V-600 series

The automatic absolute reflectance measurement accessory can be used to measure the absolute reflectance or transmission of samples automatically. The sample is measured by selecting the angle of incidence of the source energy and setting the detector in the path of the reflected light (or transmitted light) from the sample. The sample stage, detector stage and polarizer are fully and automatically controlled by the PC. Optional programs such as the Absolute Reflectance Scan Angle Measurement program and the Phase Difference Measurement program can be used to evaluate various characteristics of the sample.

Absolute reflectance spectra of a dichroic mirror



S polarization



P polarization

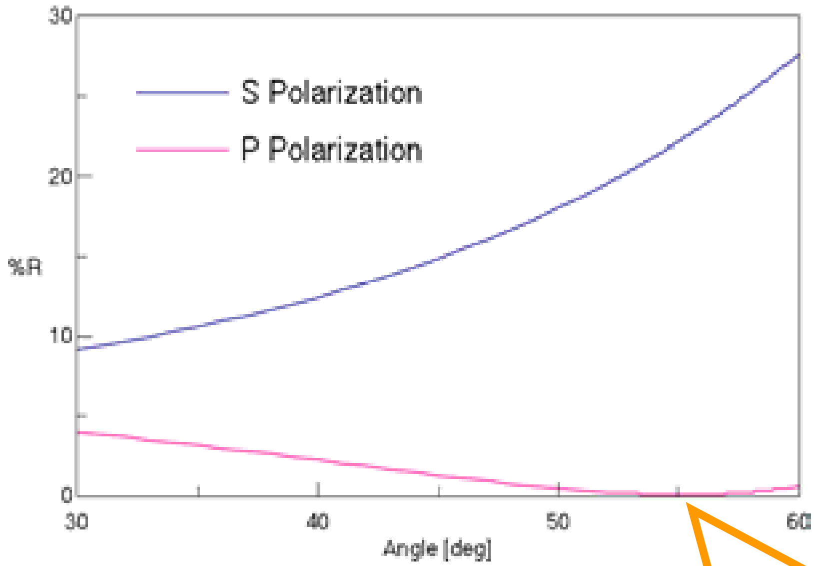
Dichroic mirrors are used to reflect light selectively according to wavelength with wavelength separation easily achieved by mirrors with dichroic coatings. Application examples include various laser optics, DVD players, DVD-ROM, DVD recorders, DVD combination players and TFT-LCD projectors. Varying the incidence angle, the reflectance characteristics of a dichroic mirror are analyzed using P and S polarization, demonstrating the selective reflectance characteristics of the dichroic coating.

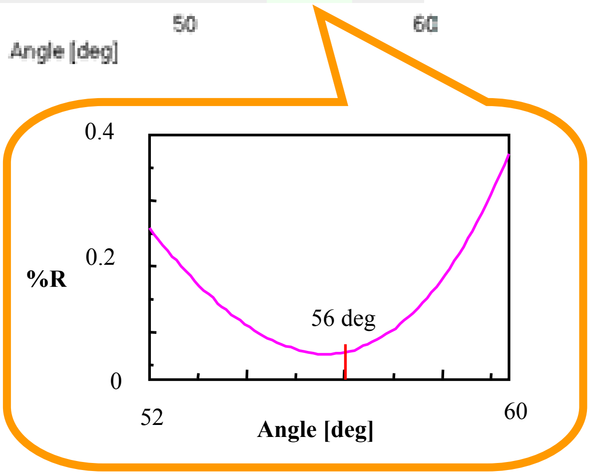
V-600 with the Absolute Reflectance Accessory

15. Absolute reflectance measurements of SiO_2

Automated Absolute Reflectance Measurement Accessory for the V-600 series

Absolute reflectance spectra of SiO_2





Varying the incidence angle, the absolute reflectance characteristics of SiO_2 are analyzed using P and S polarization, to detect Brewster's angle. The reflectance using P polarization becomes a minimum at 56º.

V-600 with the Absolute Reflectance Accessory

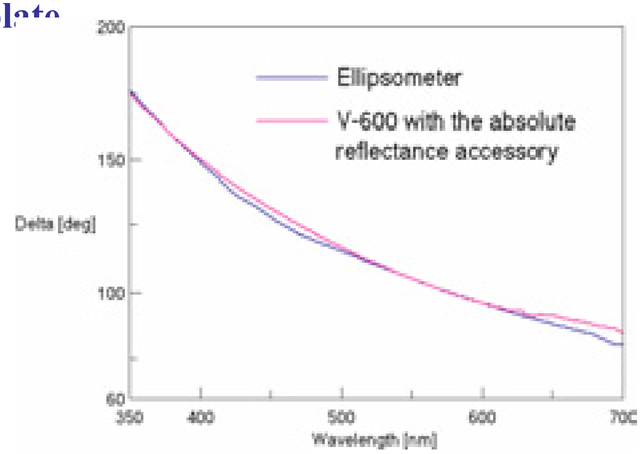
16. Phase difference measurements

Automated Absolute Reflectance Measurement Accessory for the V-600 series

By using an optional angle selective analyzer, measurements of the phase difference of metal films can be provided. The system is more compact and simpler than a spectroscopic ellipsometer, while maintaining high precision. It is useful for routine measurement of semiconductors, optical devices and other new materials. Quarter-wave plates for evaluation of optical disks can also be inspected.

Optional angle selective analyzer (Birefringent Polarizing Prism)

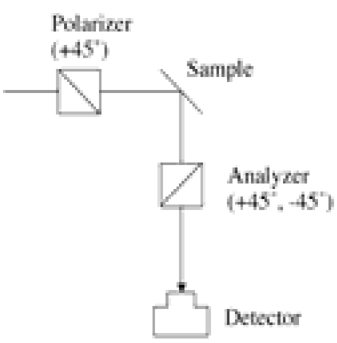
Phase difference spectra of a quarter-wave plate



Phase difference (△) is calculated from the intensity ratio of reflected light, I-45/I+45 when the polarizer is set to +45º.

I-45: Intensity when the analyzer is set to -45º

I+45: Intensity when the analyzer is set to +45º

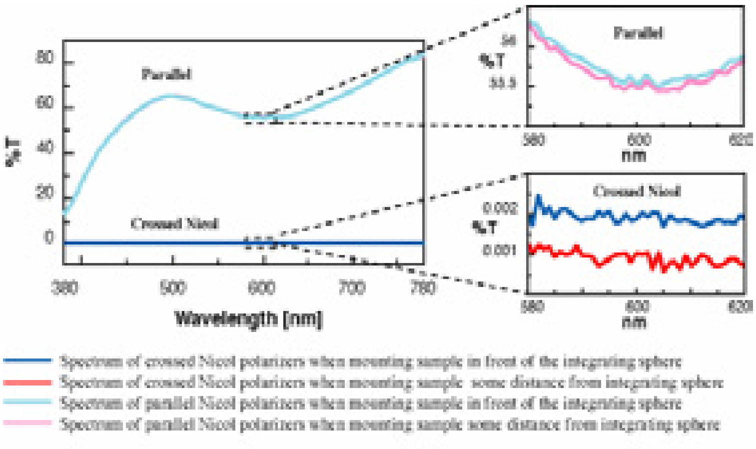


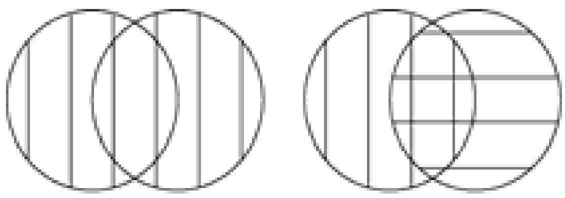
V-600 with the Absolute Reflectance Accessory

17. Evaluation of polarizers for FPDs

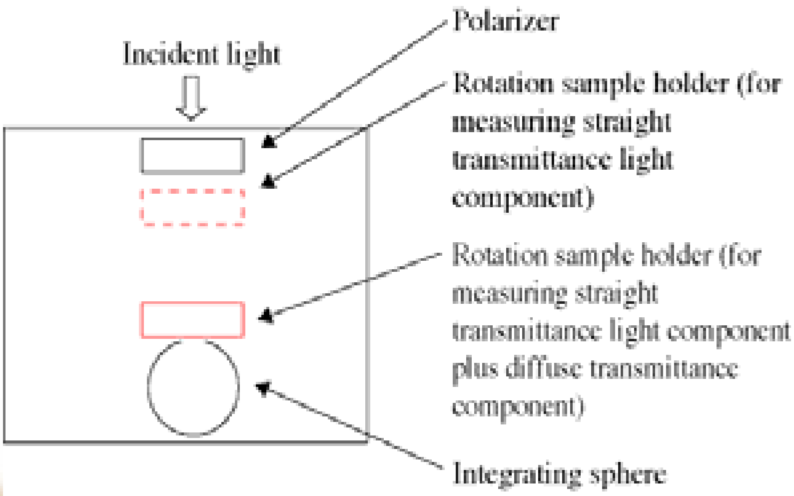
Automated evaluation system using the V-7000 Series

For advanced flat panel displays (FPD), a high quality polarizer is required for optimum performance of the display. These polarizers require measurement using an instrument with superior performance specifications for photometric range and accuracy. The V-7000 series automated instrument system provides measurements for the detection of the crossed Nicol position, transmittance of both crossed and parallel positions and dedicated calculations of polarizer efficiency. The figure illustrates the measurement results of a dichroic polarizer plate with a S/N ratio of less than 0.0003% at a transmittance of 0.001%.

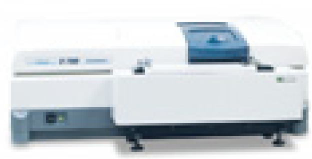




Parallel position   Crossed Nicol position



V-7000



18. Evaluation of micro optics

MSV-300 Series UV/Vis/NIR Microspectrophotometer

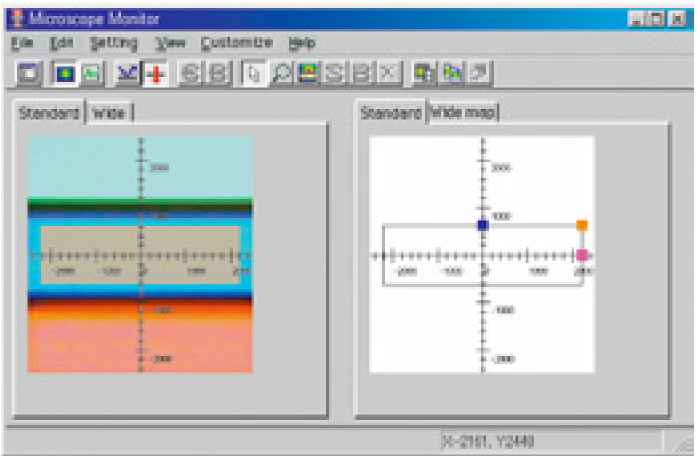
The MSV-300 series is a microspectroscopy system providing transmittance and reflectance measurements of microscopic sample sites for a wide range of wavelengths from the ultraviolet to the near infrared. Conventional measurements require samples with dimensions comparable to a millimeter-sized optical beam. The MSV-300 series can provide measurements of the color, film thickness, and other spectral properties of a microscopic area for either large or small samples. The optional, automated X-Y-Z stage provides multi-point measurements and surface analysis mapping capabilities.

Applications

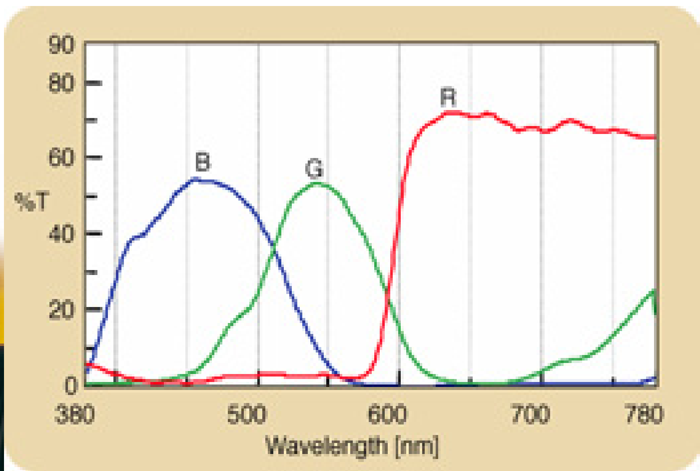
- Optical property of crystals
- Band-gap measurement and film thickness
- Characteristics of micro filters and mirrors

RGB filter on LCD panel

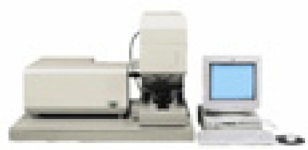
70 x 240 µm aperture set for a blue filter from an LCD panel



Transmission Spectra of Color Filter



MSV-300 Series
UV/Vis/NIR
Microspectrophotometer



19. Measurement of the transition process of a semiconductor

NFS-200/300TR Near Field Time-resolved Spectrometer

Emission or absorption time course measurements enable us to observe excitation electrons or energy dynamics and to understand how the place of observation or the environment influences the semiconductor transitions. Figure 1 illustrates the emission spectrum of a semiconductor substrate InP. Two peaks appear and they demonstrate the differences in the transition process from the excitation state to the ground state. Figure 2 demonstrates the data from a time resolved measurement of the two peaks. The attenuation time of the peak of the lower energy side (longer wavelength) was longer than that of the higher energy side (shorter wavelength). Most likely, the peak due to the lower wavelength was trapped by a donor receptor during the transition process.

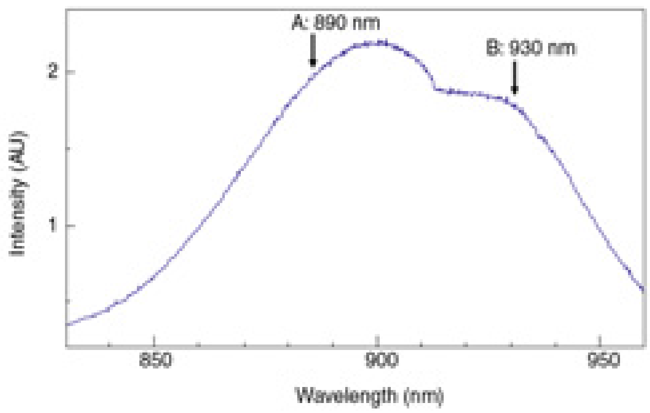


Fig.1 Emission spectrum of a semiconductor substrate InP

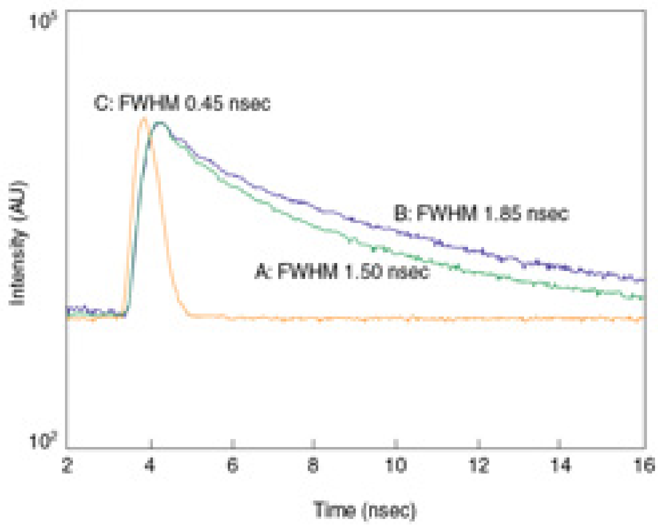


Fig. 2 Time-resolved measurement of the two transition peaks

NFS-200/300TR

20. Nanometer scale characterization of a GaAsP semiconductor

NFS-200/300 Near Field Spectrometer

The NFS Series of scanning near-field optical microspectrometers have been optimized as a new solution for nanotechnology applications. Traditionally, characterization methods on the nanometer scale consist of topography observation using an electron or scanning probe microscope or elemental analysis using an x-ray microanalyzer. These methods deliver images with high spatial resolution but they cannot obtain chemical information from a sample surface. On the other hand, traditional FT-IR, photoluminescence, or Raman microspectroscopy instruments can provide chemical data for a sample, but the spatial resolution is determined by the diffraction limit of light, limited to the wavelength of the light used. Scanning near-field microspectrometers allow characterization at the extreme nano level range exceeding the diffraction limit of light. Introducing light into a fiber probe with an aperture of a hundred to several hundred nm produces near-field light of the same size as the probe aperture. Bringing the sample close to the probe aperture (within 100 nm) allows spectroscopic observations with a spatial resolution of several hundred nm as a result of the interaction of the near-field light with the sample surface.

Sample characterization with submicron spatial resolution is critical because impurities on the nanometer scale can have a major impact on the electrical properties of semiconductors. For instance, the compositional ratio of GaAs and GaP in a GaAsP material can be estimated from the emission spectra of the sample surface. Conventional near-field microscopes that do not provide spectroscopic data cannot produce this compositional information. With the NFS series, however, observation of minute peak shifts from the emission spectra can easily be performed for multiple sample sites. Figure 1 is the topographical image of a sample surface for a 6 x 6 μm area. Figure 2 illustrates the peak shift distribution of the GaAsP substrate, the green portions denoting a long wavelength shift, indicating that the GaP concentration is slightly higher than the surrounding area.

Figure 1: Topography of GaAsP

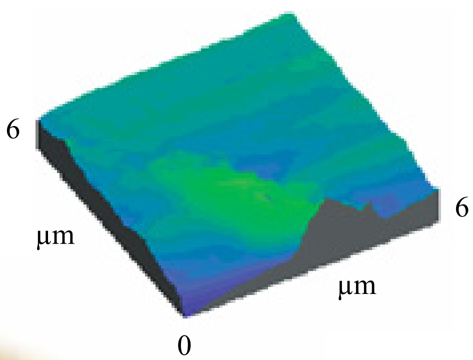
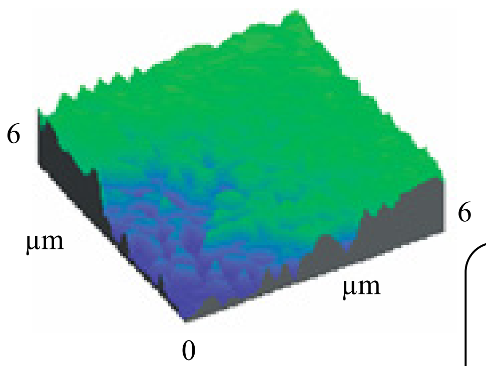


Figure 2: Peak Shift Distribution of GaAsP Photoluminescence



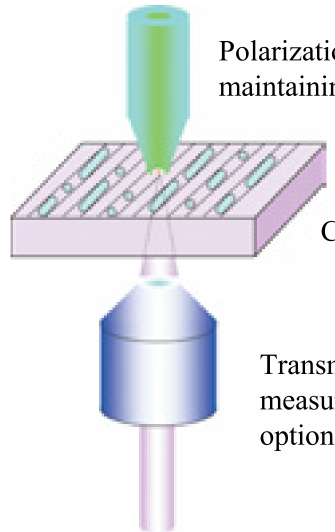
NFS-200/300

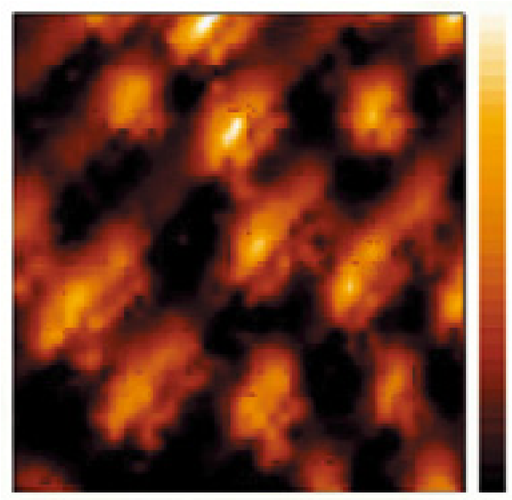
21. Optical Evaluation of Write Spots in a CD-R by Transmittance Measurement

NFS-200/300 Near Field Spectrometer with an NPP Polarized Near-Field Probe

Crystal anisotropy of materials, optical rotatory power, and dynamics under a magnetic field are known to affect polarization of transmitted light through certain materials. In practical applications, they are used for high-density recording and display devices. Combining a polarization maintaining fiber probe and the transmission option of the JASCO Near-Field system, a sample was irradiated by a linear polarized beam or a circularly polarized beam and the polarization state of the transmitted light was analyzed. The anisotropy for the sample observed in the nano-scale.

Imaging of write spots in a CD-R sample





5 µm x 5 µm

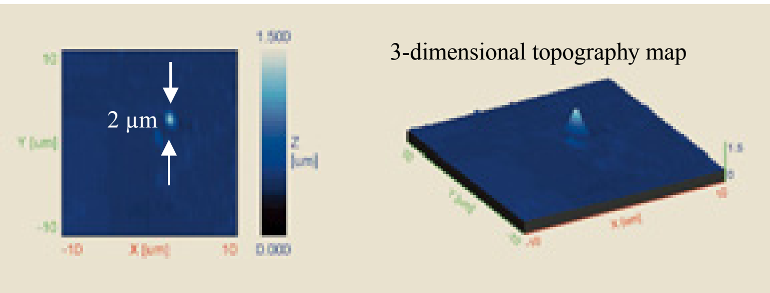
NFS-200/300

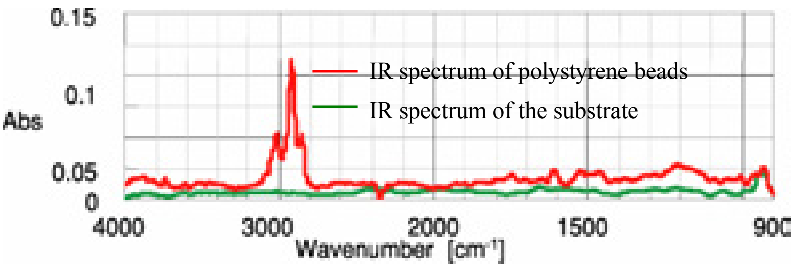
22. Infrared measurements with 1 μm spatial resolution

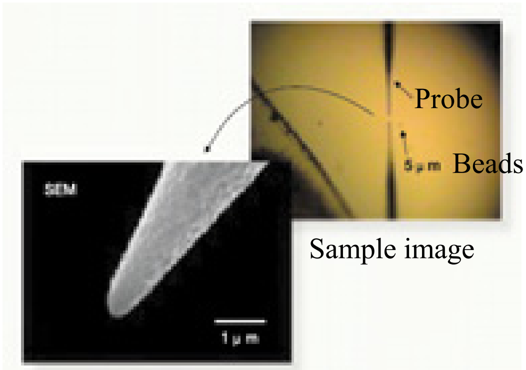
NFIR - Infrared Near-Field Microspectroscopy System

Combining near-field microscopy with infrared spectroscopy, the spatial resolution of infrared measurements are dramatically increased while maintaining the same powerful qualitative analysis capabilities of FT-IR spectroscopy. The measurement range of 4000 to 1000 cm^{-1} provides the majority of the mid-IR region. This system enables simultaneous measurements of the infrared spectrum and the 3-dimensional topography map. The figures below illustrate the measurement results for polystyrene beads on an aluminum (Al) mirror and an inorganic particle of ODS Silicon on a GaAs substrate.

Polystyrene beads on an Al mirror

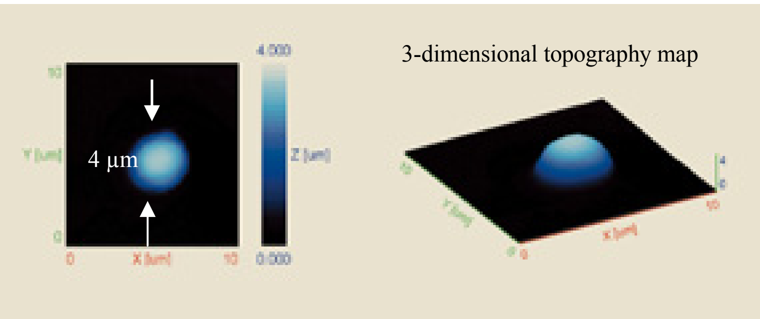


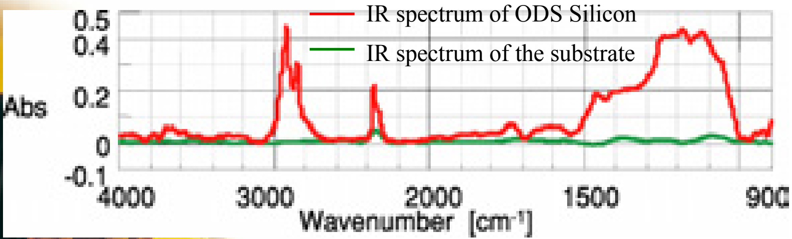




Top of the probe

Inorganic particle of ODS Silicon on a GaAs substrate





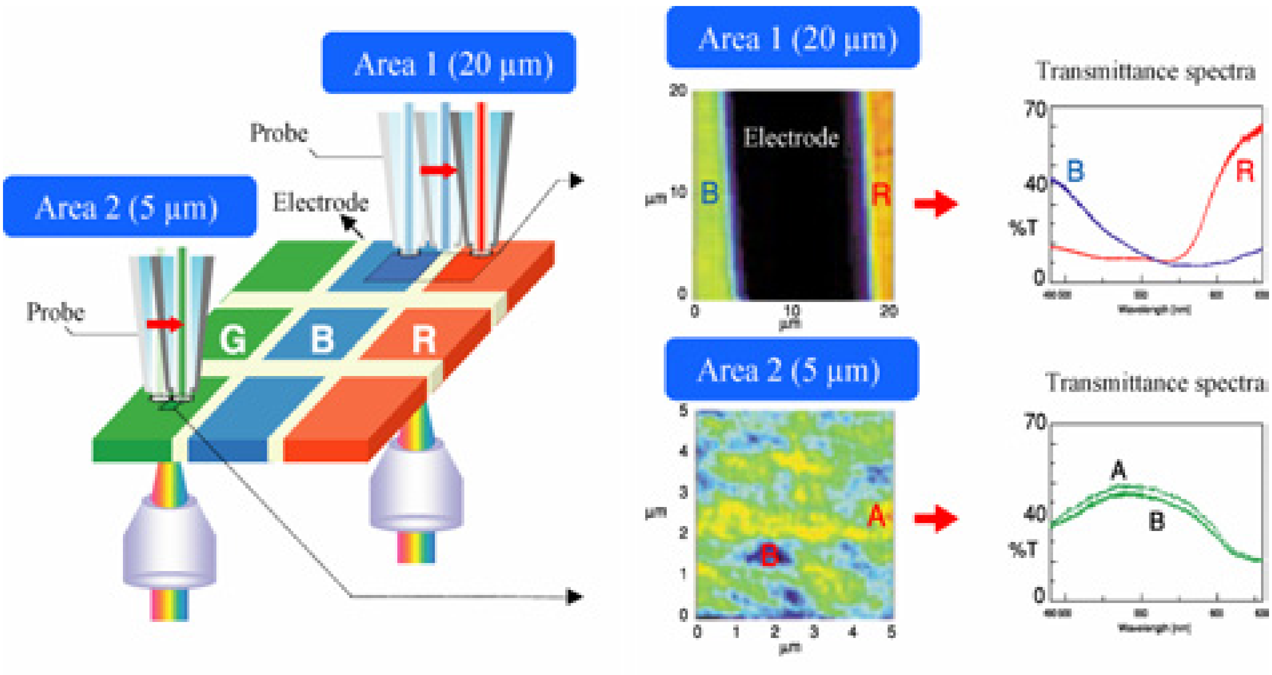
NFIR Series

23. Transmittance measurements in the UV-Vis/NIR range at 100 nm to 1 µm spatial resolution

NFS-200 series UV-Vis Near-field Microspectroscopy System

The NFS-230 enables transmittance measurements in the UV-Vis/NIR range with extremely high spatial resolution, variable from 100 nm to 1 micron using various near-field probes. Nanoscale image mapping and transmittance polarization analysis are also possible. The near-field microspectroscopy system can be applied to the analysis of image sensor elements, DVD recording marks, liquid crystal distribution, and polarization filters. The figure below illustrates a 5 µm × 5 µm mapping result and the spectra of RGB color filters on an LCD panel using near-field transmittance measurements with the NFS-230.

Near-field transmitance measurement of RGB color filters in an LCD panel



NFS-200 Series

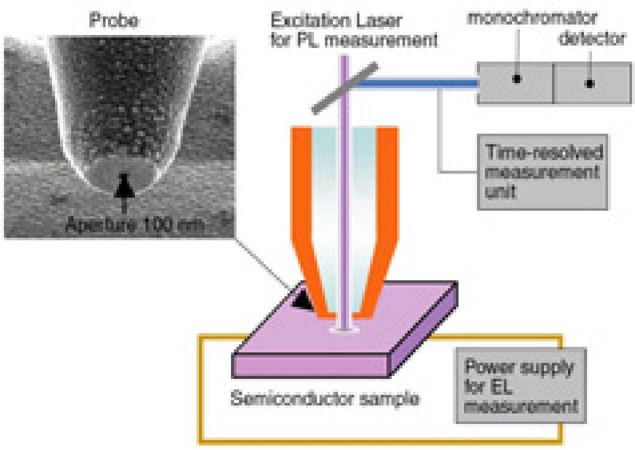
24. Evaluation of a luminescent semiconductor on the nanometer scale

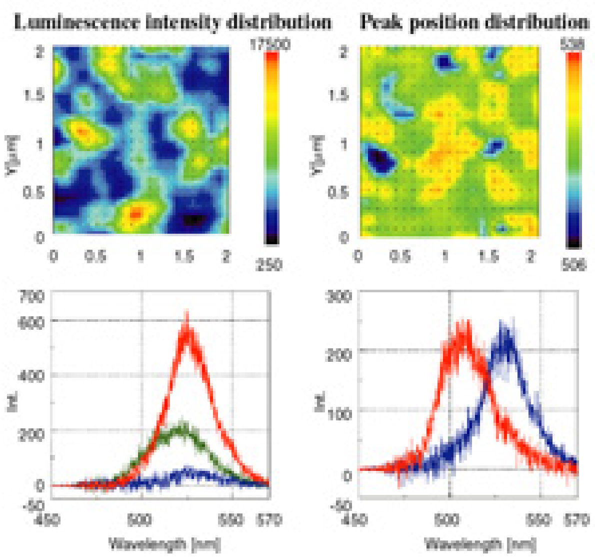
NFS Series Near-field Microspectroscopy System

Photoluminescence (PL) and electroluminescence (EL) measurements are standard techniques for evaluation of the crystallinity, functionality and luminescent mechanism of semiconductors. For these samples, near-field optical microscopy is the only effective method for characterization of the composition and distribution of luminescent centers on the nanometer scale.

In combination with a superconductive magnetic field, luminescent spectral measurements of the sample surface can be accomplished with nano-scale spatial resolution while applying temperatures as low as 7K and magnetic fields as high as 4 Tesla.

Luminescent Measurement of InGaN by NFS Series Scanning Near-Field Optical Microspectrometer



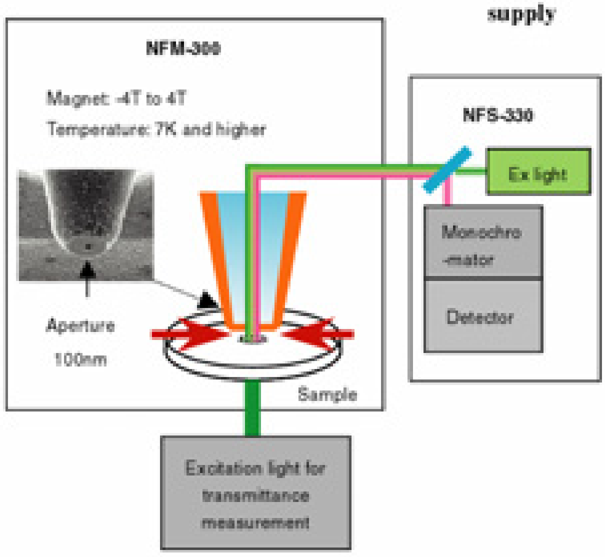


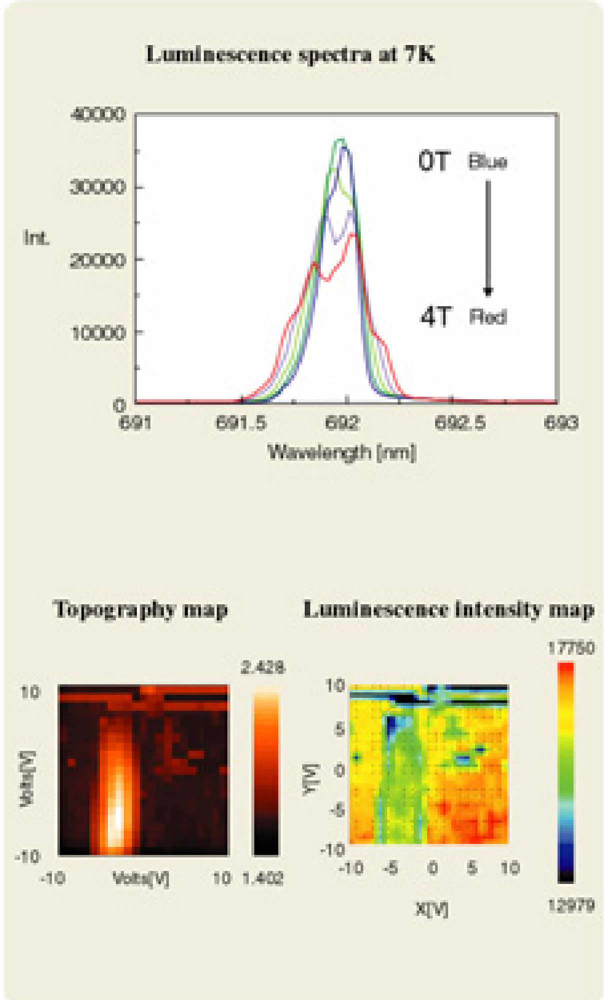
NFS Series

25. Evaluation of a luminescent semiconductor on the nanometer scale

NFS Series Near-field Microspectroscopy System

Luminescent measurement of a Ruby crystal using low temperatures and magnetic fields





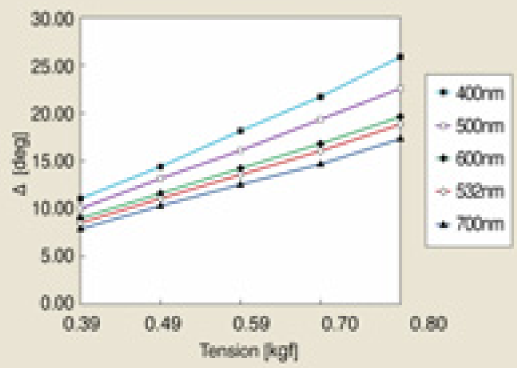
NFS Series

26. Photoelastic constant measurements

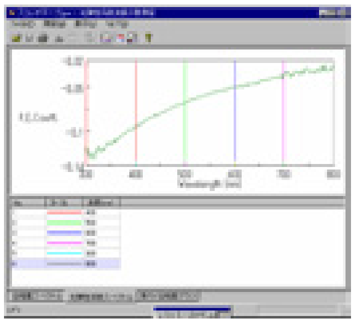
M-200 Spectroscopic Ellipsometer

The JASCO M-200 is a highly adaptable ellipsometer, allowing for a variety of sample configurations, optical arrangements, and light sources, easily the first choice for a wide range of research requirements. Both reflection and transmission measurements are accommodated by the large, easily accessed sample chamber. The various sample holders can be quickly attached or removed by the operator. Sensitive spectroscopic measurements are carried out in a lightproof environment. Both a spectroscope and up to two laser light sources can be used (a He-Ne laser is the standard source). A photo-multiplier detector is also used. Spectral range options from ultra-violet to infrared are available. The instrument is supplied with a bench and is controlled by a separate PC data system.

Setting up the M-200 series at an incidence angle of 90° allows use of the unit as a transmission ellipsometer, making possible photoelastic constant measurements. Applying tension to a film sample evens out the axis of orientation of the macromolecules forming the film, and the amount of retardation varies in proportion to the strength applied. By measuring the strength applied and the amount of retardation, it is possible to find the photoelastic constant from the relationship between those two values. Measurement uses a transmission stage for photoelastic measurement and a photoelastic constant measurement program.



	Wavelength [nm]				
Tension [kgf]	400	500	600	632	700
0.39	10.89	9.96	8.87	8.56	7.96
0.49	14.36	13.05	11.56	11.13	10.28
0.59	17.99	16.07	14.10	13.55	12.48
0.70	21.70	19.16	16.70	16.02	14.71
0.80	25.66	22.45	19.51	18.70	17.14
Δ / Tension	35.62	30.03	25.50	24.32	22.01
Photoelastic constant	40.35E-13	42.53E-13	43.33E-13	43.53E-13	43.63E-13



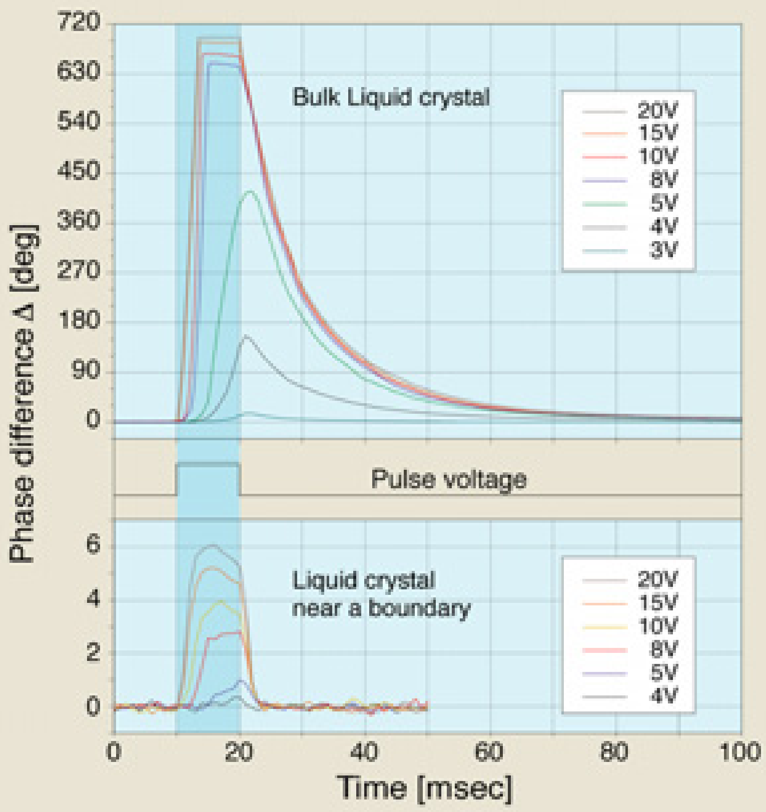
M-200
Spectroscopic Ellipsometer

27. Time-resolved measurements of liquid crystals

M-200 Spectroscopic Ellipsometer

Generally, the behavior of liquid crystal molecules in the vicinity of an orienting layer is different from the behavior of bulk liquid crystal. It is said to be influenced by an anchoring effect that works between the orientation film and liquid crystal molecules. Measuring the electric field response of the liquid crystals is indispensable to understanding this orientation mechanism.

The M-200 series enables time-resolved analysis of liquid crystals using the high-speed data acquisition of the PEM dual lock-in system. The figure shows an example of the dynamic electric field response of a nematic liquid crystal in bulk and crystals near the boundary. The measurement used a 5CB liquid crystal cell (orientation: parallel: cell thickness: 8.17 µm) doped with 6 wt% p-dimethylaminoazobenzene. First the bulk liquid crystal's electric field response in a transmission configuration is measured at a wavelength (698 nm) where the dye is transparent, and then the electric field response of the liquid crystal near the boundary is measured in a reflective configuration (dye-doped reflection method*) at the DAB absorption peak wavelength (419 nm). Comparing the time-resolved measurement results for the bulk liquid crystal and the liquid crystal near the boundary as shown in the figure, one can observe that their electric field responses are quite different.



Dynamic electric field response of bulk liquid crystal and liquid crystal near the boundary

* The dye-doped reflection method makes it possible to suppress the light reflected from a liquid crystal cell's back surface and then measure the electric field response of the liquid crystal near the anchoring interface by doping dye in the liquid crystal cell and then applying the reflection ellipsometry at the absorption wavelength. [1-3]

1)Tadokoro, Fukazawa, and Toriumi. Preliminary Draft of the 22nd Draft of the 44th Spring Term Applied Physics Society, 30a-SNL-11 (1997).
3)Tadokoro, Akao, Kimura, Akabane, Ono, and Toriumi. Preliminary D Panel Discussions on Liquid Crystals, 1AO6 (1996).
2)Ono, Akabane, Kimura, Tadokoro, Akao, and Toriumi. Preliminary draft of the 44th Spring Term Applied Physics Society, 30a-SNL-12 (1997).

M-200
Spectroscopic Ellipsometer

JASCO's Semiconductor/FPD Solutions

Materials Analysis

28. Highly accurate measurements in the vacuum UV range

V-1000 Vacuum UV Spectrophotometer

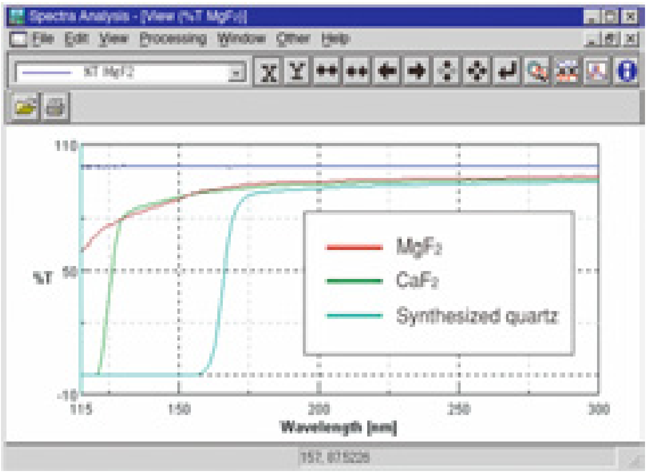
The V-1000 was designed to evaluate optical properties in the wavelength range between 115 and 300 nm. Typically, instrument optical paths for analyses in this range are evacuated due to the strong absorption of oxygen. The V-1000 provides rapid sample measurements without evacuation of the entire instrument by using a nitrogen purge. Superior photometric reproducibility is achieved by using a double monochromator for elimination of stray light and a reference stabilized double-beam system to maintain baseline stability. These features enables analyses of liquid samples in addition to solid samples.

Applications

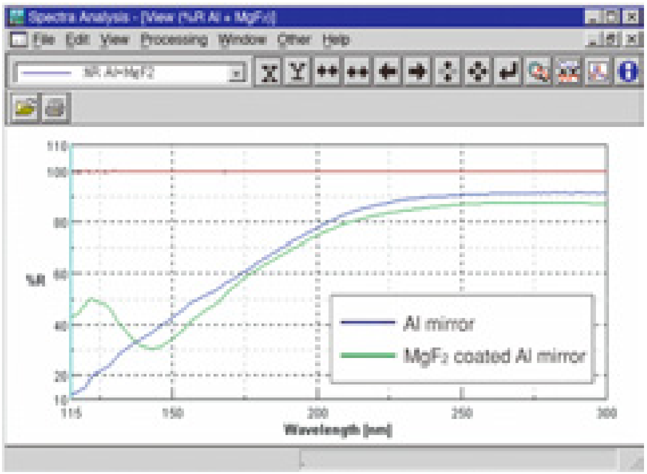
Research in Optics & Material Science

· Lens
· Transparent material in VUV(MgF_2, CaF_2)
· Anti-reflection coatings in VUV
· New Material for VUV (Fluorine-doped quartz)
· Mirrors for VUV
· Quartz windows

%T Transmission measurement



%R Reflection measurement



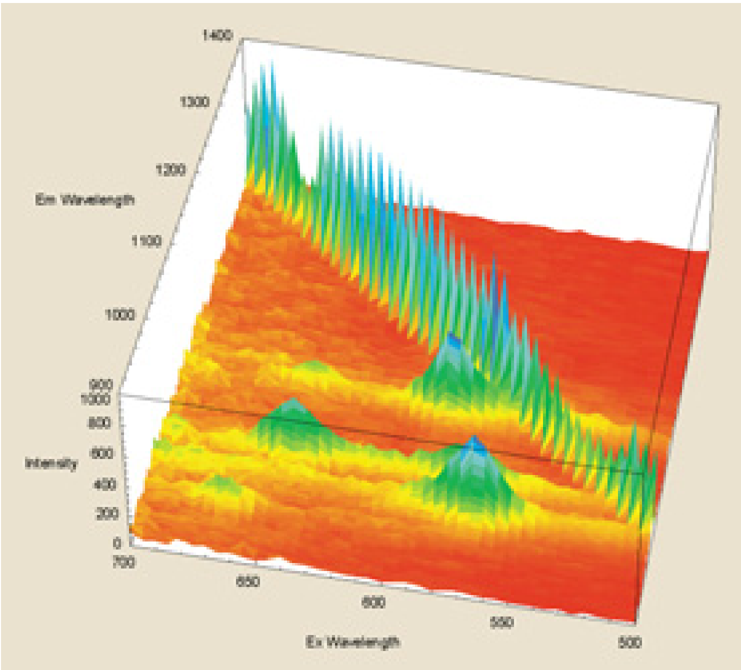
V-1000 Vacuum UV Spectrometer

29. Chirality analysis of carbon nanotubes

FP-6000 series Near Infrared (NIR) Spectrofluorometer

By modification of the standard FP-6600, a Near-Infrared (NIR) spectrofluorometer can be constructed to measure materials that have strong fluorescence in the NIR region, such as rare-earth elements or carbon nanotubes. Carbon nanotube characteristics change drastically according to the tube diameter or chiral angle. A NIR spectrofluorometer is a very powerful tool for their evaluation, using 3-dimensional measurements that scan both excitation and emission wavelengths.

NIR 3-D Fluorescence spectra of Single-Walled Carbon Nanotube (SWCNT)



Data is supplied by Mr. Yoshiyuki Suda,Graduate School of Information Science and Technology, Hokkaido University

Near Infrared Spectrofluorometer

Near Infrared Spectrofluorometer

Contaminant Analysis

JASCO's Semiconductor/FPD Solutions

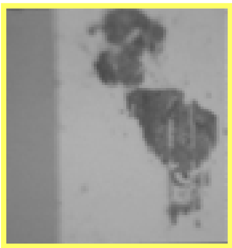
Contaminant Analysis

1. **Contaminants on silicon wafers**
2. **IR Imaging of a patterned silicon wafer**
3. **Portable instrument system for micro FT-IR on-site analysis**
4. **Contaminant analysis by using an FT-IR microscope**
5. **Analysis of impurities in polymers using a non-destructive measurement method**
6. **Contaminant in a film**
7. **Contaminant identification on circuit boards using a Near-field IR spectrometer**

1. Qualitative analysis of semiconductor contaminants

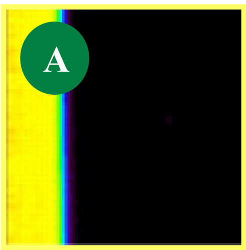
High-speed IR Imaging using the IMV-4000 Multi-channel IR Microscope

JASCO's IR imaging system couples the rapid scanning FT/IR-6000 series with the IMV-4000 multi-channel IR microscope incorporating a linear array MCT and auto stage. Measurement times are reduced from hours to only a few minutes. The IMV-4000 maps samples by a combination of mirror scanning and an auto-stage, enabling measurement of the sample much more rapidly than conventional IR Imaging systems that only map samples by moving the stage. ATR Imaging and polarization measurement capabilities are available options.

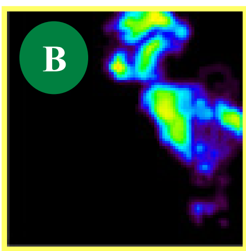


Sample image (600 x 600 µm)

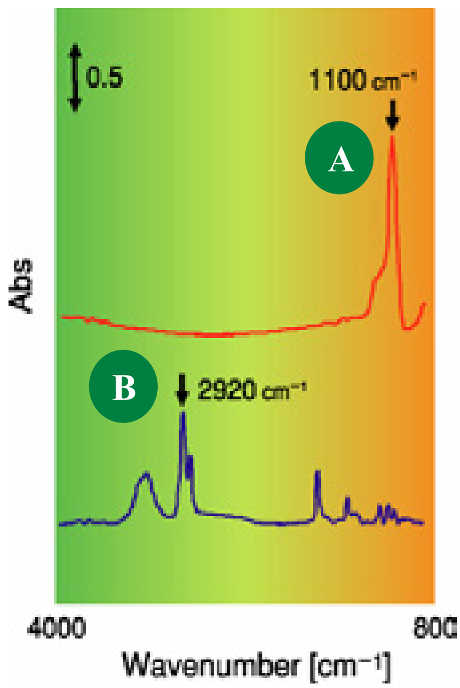
Measurement area: 600 x 600 µm
Number of measurement points: 48 x 48
Spatial resolution: 12.5 x 12.5 µm
Resolution: 16 cm^{-1}
Accumulations: 16
Collection time: Approx. 4 minutes



Peak height at 1100 cm^{-1}



Peak height at 2920 cm^{-1}



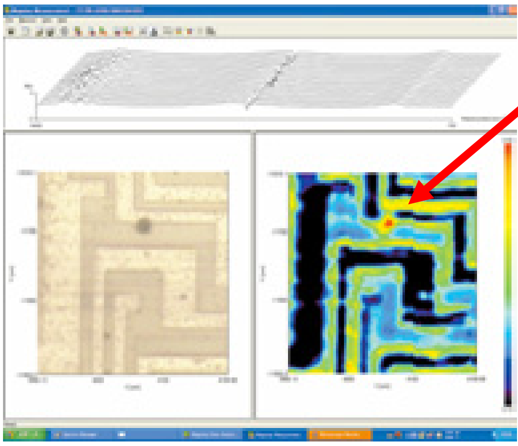
Contaminants on a silicon wafer were measured by the IMV-4000 Multi-channel IR Microscope. Colored map A of the peak height at 1100 cm^{-1} represents the thickness of the silicon wafer. Colored map B of the peak height at 2920 cm^{-1} shows the distribution of the contaminant. The contaminant was found to be a triglyceride fat from the IR spectrum.

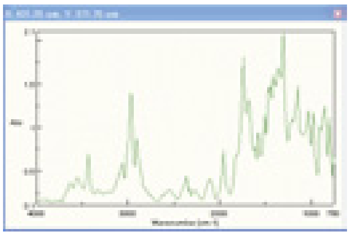
IMV-4000 with FT/IR-6000

2. Qualitative analysis of semiconductor contaminants

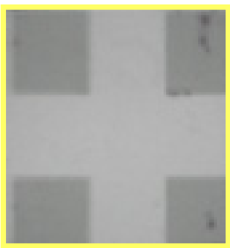
High speed IR imaging using the IMV-4000 Multi-channel FT-IR microscope

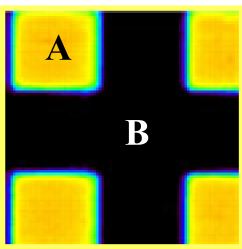
The JASCO IMV-4000 Infrared Multichannel Viewer can be easily interfaced with either the FT/IR-4000 or FT/IR-6000 instruments offering an advanced infrared (IR) imaging system. The IMV-4000 allows IR imaging with extremely high spatial resolution and excellent sensitivity using a linear array MCT detector. The IMV-4000 rapid scanning mechanism accomplishes the IR imaging of a 100 x 100 µm area in just 1.6 seconds. In addition, a single MCT element is included as a standard detector for point measurements to be used for maximum sensitivity. This system is a very powerful tool to detect a contaminant on a silicon wafer, providing a spectral signature of the contaminant.

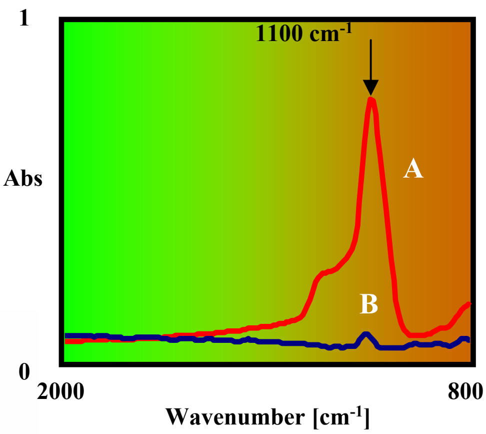




IR Imaging of a Patterned Silicon Wafer







Measurement area: 600 x 600 µm
Number of measurement points: 48 x 48
Spatial resolution: 12.5 x 12.5 µm
Resolution: $16\ cm^{-1}$
Accumulations: 16
Collection time: Approx. 4 minutes

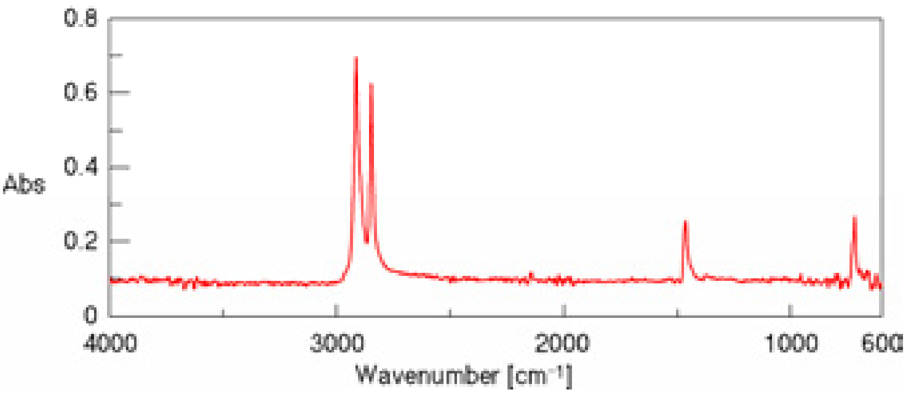
IMV-4000 with FT/IR-4000

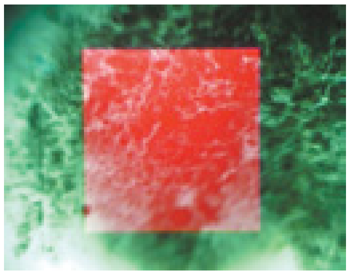
3. Portable instrument system for micro FT-IR on-site analysis

Portable FT-IR Microscopy System (VIR-9000 series with the IRT-1000VIR)

A portable FT/IR microscopy system has been designed by coupling the VIR-9000 series portable FT-IR spectrometer with the IRT-1000VIR sample compartment microscope. This analysis system is compact and lightweight for field operations. Rather than taking the samples from the field to the lab for analysis, this system enables micro-FT-IR analyses on-site, wherever the sample may be located. Optional ATR objectives allow rapid and simple measurements without extensive sample preparation. Three types of ATR objectives, ZnSe, Ge, and Diamond ATR elements make it possible to measure a wide variety of samples, such as hard solid samples and/or high refractive index substances including carbon filled compounds.

Contaminant analysis in the field





The figure shows a contaminant analysis in the field by using the VIR-9000 series portable FT-IR spectrometer with the IRT-1000VIR compact IR microscope using a diamond ATR objective. The contaminant is Polyethylene.

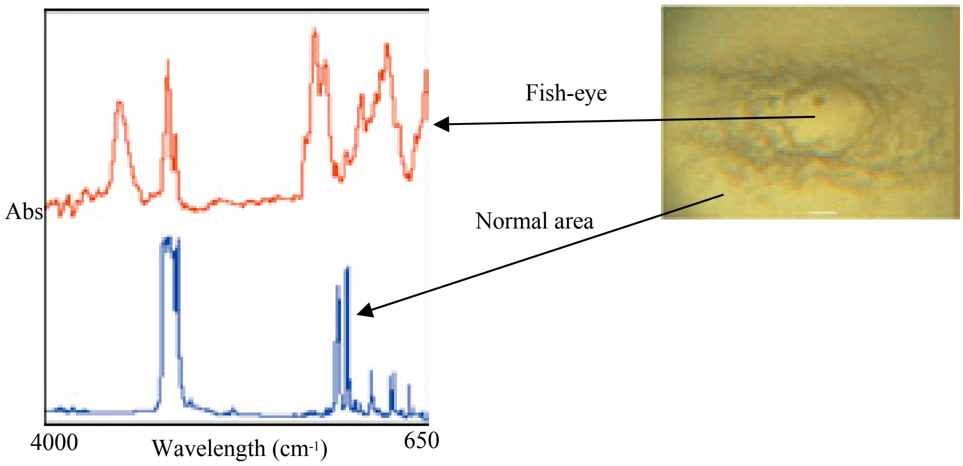
VIR-9000 Series portable FT-IR system with IRT-1000VIR compact IR microscope

4. Contaminant analysis by using IR microscope

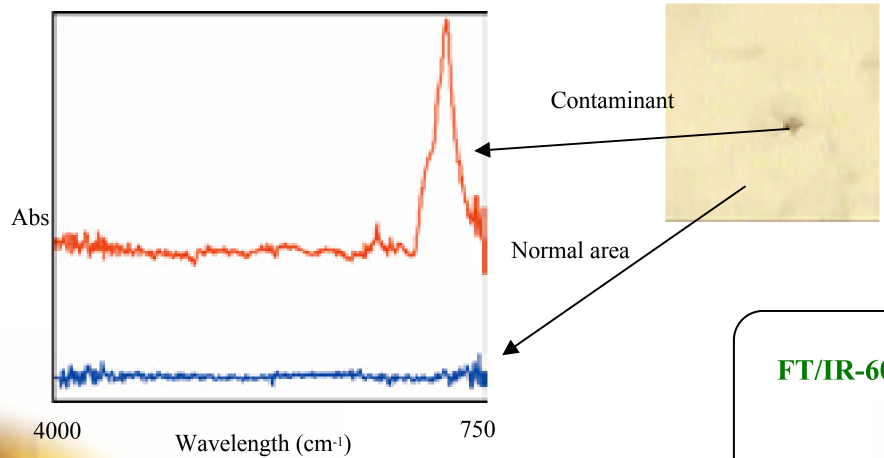
IRT-3000 Research-grade FT-IR Microscope

The IRT-3000 is an FT-IR microscope system capable of spatial resolution of several microns with an excellent signal-to-noise ratio capable of simultaneously viewing the full sample image. The fully automated X-Y-Z stage facilitates either mapping or multi-point measurements. In addition to standard transmittance and reflectance measurements, optional ATR and grazing-angle reflection objectives expands the capability of the microscope system. The figures below illustrate contaminant analyses, fish-eyes in a polymer film and a contaminant (5 microns) on the surface of an optical element.

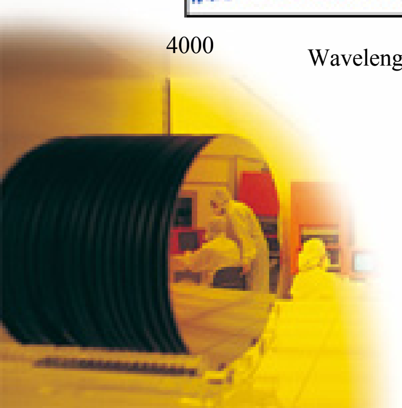
Fish-eyes in a polymer film



Contaminant (5 microns) on the surface of an optical element



FT/IR-6000 with ITR-3000 FT-IR Microscope



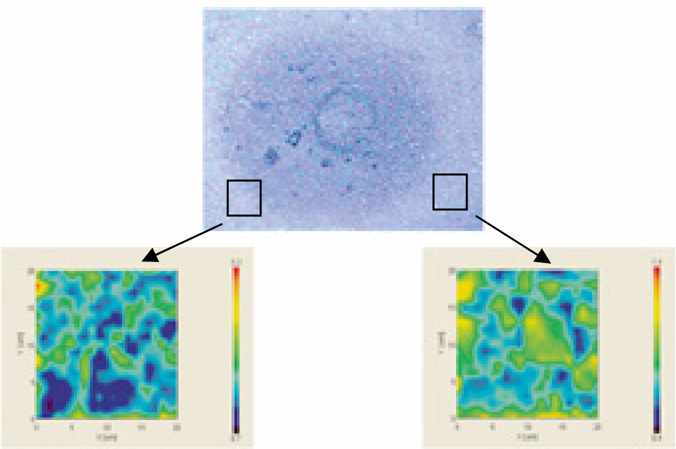
5. Analysis of impurities in polymers using a non-destructive measurement method

NRS-3000 series Dispersive Raman Spectrometer

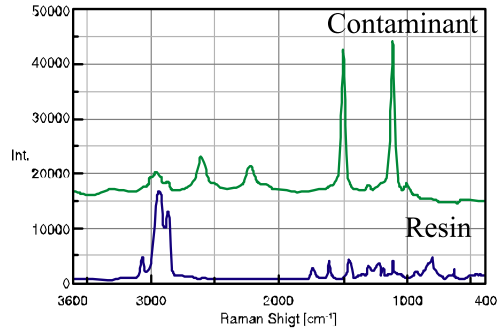
Raman spectroscopy provides a non-destructive method for the analysis of an impurity embedded inside a polymer resin. By contrast, infrared spectroscopy requires removal of the impurity for proper analysis. The figure demonstrates the measurement of the impurity by the NRS-3200 Dispersive Raman Spectrometer. The spectrum of the impurity is quite different from the spectrum of the resin. Utilizing two Raman bands of the obtained spectrum, the distribution of the impurity was visualized by mapping measurements. The results illustrate that the impurity was detected even in an area where it was not identified by visible observation.

Contaminant analysis of the polymer resin

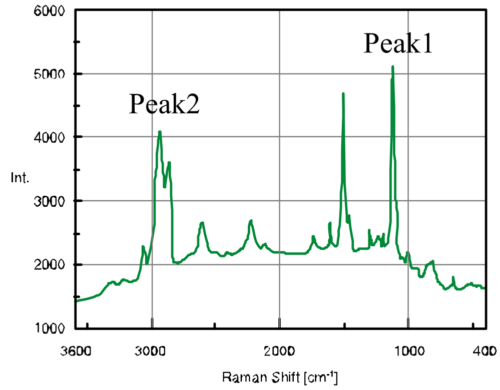
Distribution of the impurity (Peak1/Peak2)



Raman spectra of the impurity and the resin



Raman spectrum at the position of the impurity



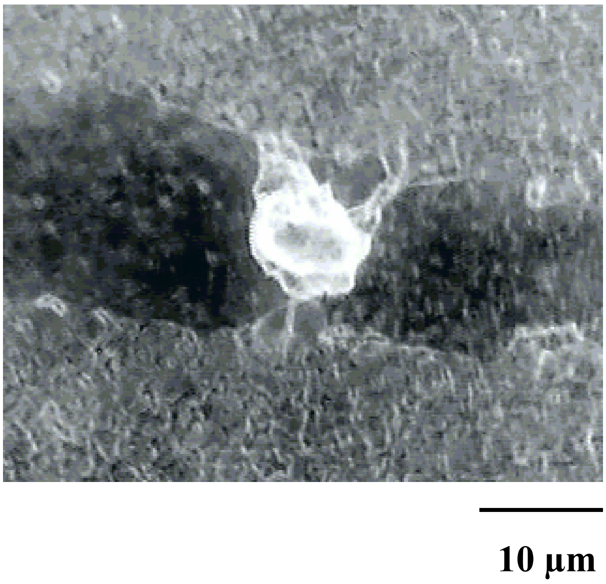
NRS-3000 Series Raman Spectrometers

6. Contaminant in a film

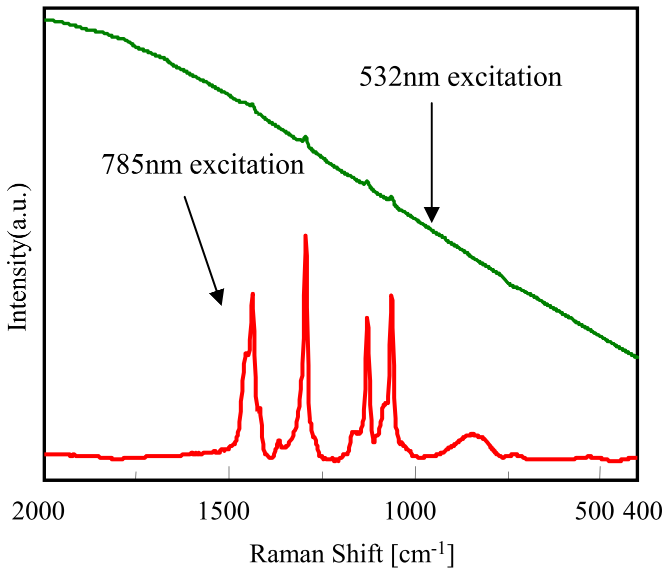
NRS-3000 series Dispersive Raman Spectrometer

Fluorescence is a major barrier to Raman measurement and varieties of techniques for avoiding it have been attempted. One of them, a technique that excites using a long wavelength laser that does not induce fluorescence, is both practical and effective. Recently, demand for micron-order impurity analysis (of fluorescent materials), which cannot be performed using infrared light, has been increasing. The NRS-3000 series enables measurement of fluorescent samples with greater sensitivity by supporting a 785 nm semiconductor laser and optimizing optical elements, such as the beam splitter, to the near-infrared region. The figure illustrates a measurement example for 785 nm excitation of a fluorescent sample. The strong background observed with the green laser obscures the Raman signal, whereas the 785 nm excitation is outside of the fluorescence range, enabling the Raman spectrum to be detected.

Contaminant in a film



Raman spectra of a contaminant



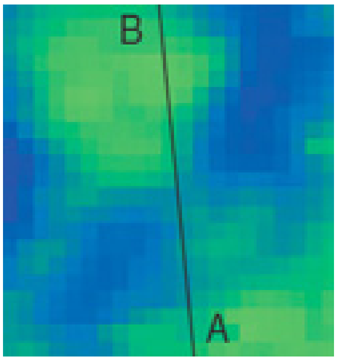
NRS-3000 Series
Raman Spectrometers

7. Contaminant identification on circuit boards using a Near-field IR spectrometer

NFIR-200 Near-field IR Spectrometer

Qualitative analysis for particles plays a major role in decreasing spacing is off - please try to fix manufacturing processes. Integrating near-field technology with IR spectroscopy makes it possible to identify organic particles of a few µm in size. Pinpointing the particle position by topography measurements (Fig.1) and measuring by near-field IR spectroscopy (Fig.2) shows that the particle in the mixture consists of polyacrylamide and silicon resin. The sectional view (Fig.3) illustrates the resolution performance.

Fig.1 Topography measurement



10 µm x 10 µm

Fig.2 Near Field IR spectrum

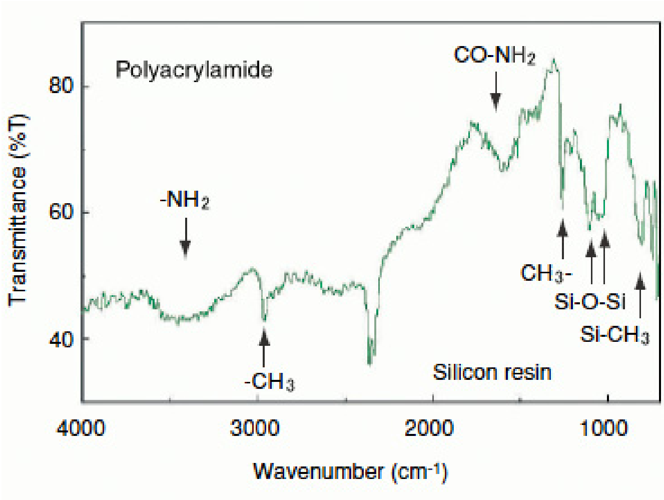
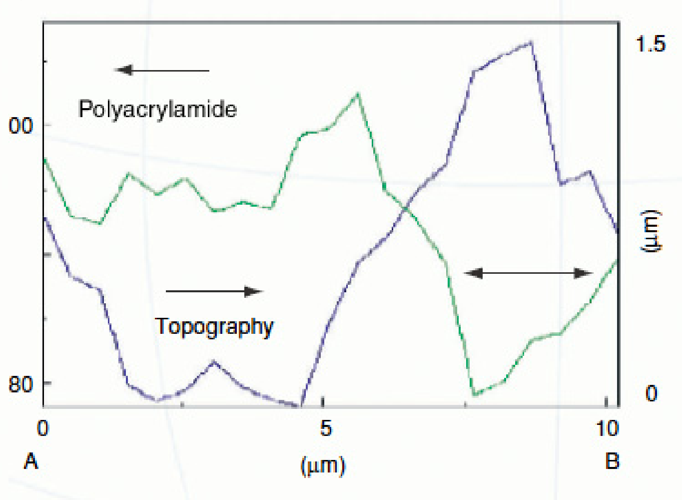


Fig.3 Sectional view



NFIR-200 Series

Quality Control

Quality Control Analysis

1. Amorphous silicon layer of a solar cell
2. On-line monitoring for quality control
3. Monitoring of polysilicon crystallization using a laser
4. Color analyses of fluorescent materials for FPD
5. In-situ monitoring for CVD
6. On-line monitoring by using optical fiber
7. Analysis of gases or vapors with high measurement sensitivity
8. Polymer state analysis during an injection molding process

JASCO's Semiconductor/FPD Solutions

Quality Control

1. On-line monitoring for quality control

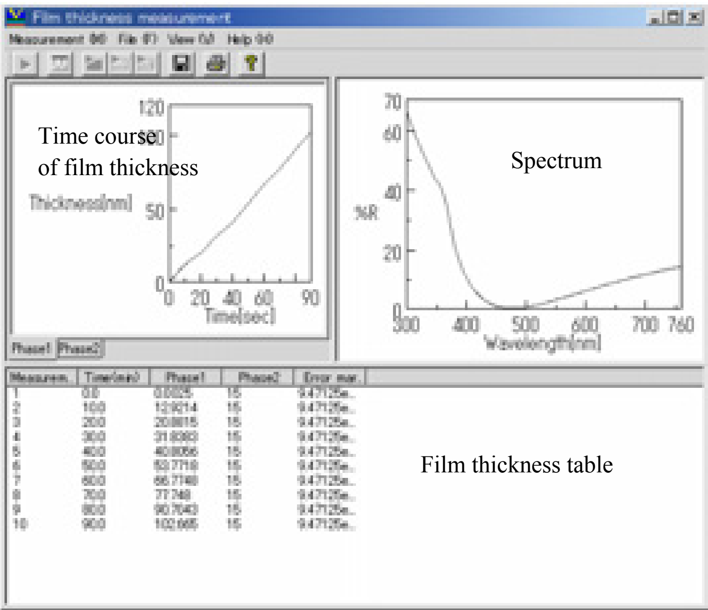
MV-2000 Portable Multichannel Spectrophotometer

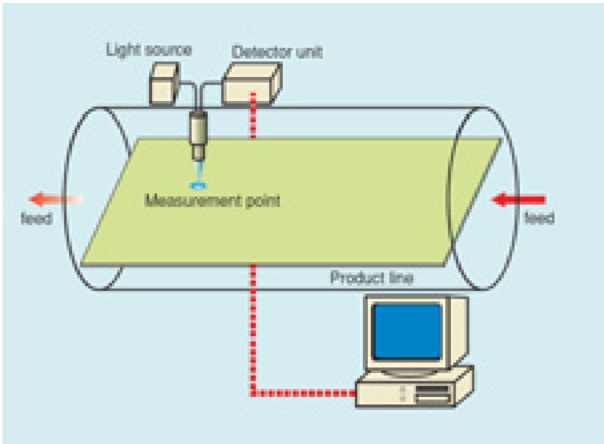
On-line monitoring offers the ability to observe a fabrication process while ensuring quality on a constant basis. Offering excellent performance for a variety of applications, the MV-2000 Series UV/Vis/NIR spectrometers can be configured for the desired sample analysis. With the ability to perform transmission or reflection measurements, the MV-2000 Series can monitor chemical or physical vapor deposition, film thickness and polishing processes. With a multi-wavelength diode array detector, the MV-2000 Series supports a wide range of measurements including use as a special purpose instrument for at-line monitoring.

Applications

- Process monitoring
- Physical or Chemical Vapor Deposition
- Chemical/Mechanical Polishing
- Chemical Crystallization
- Final product inspection
- Optical materials Research & Development

On-line monitoring of the amorphous silicon layer of a solar cell



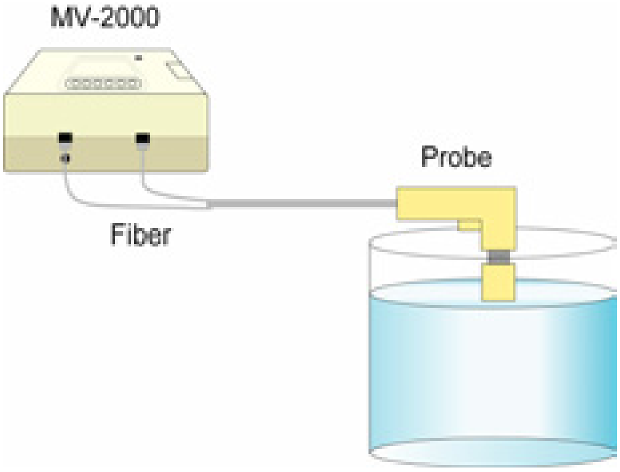


MV-2000 Series
Portable UV/Vis/NIR
Spectrophotometer

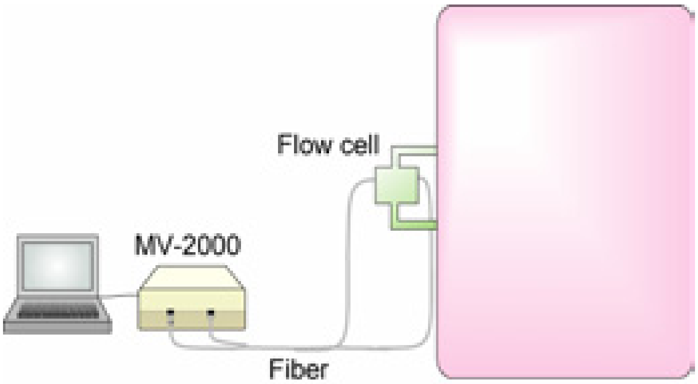
2. On-line monitoring for quality control

MV-2000 Portable Multichannel Spectrophotometer

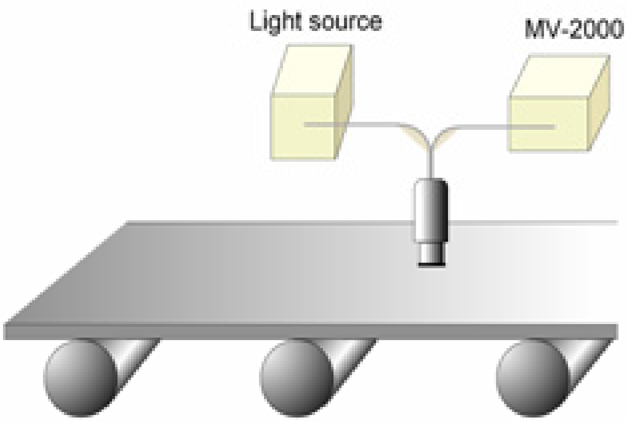
Final product inspection



Remote at-line monitoring



Process monitoring

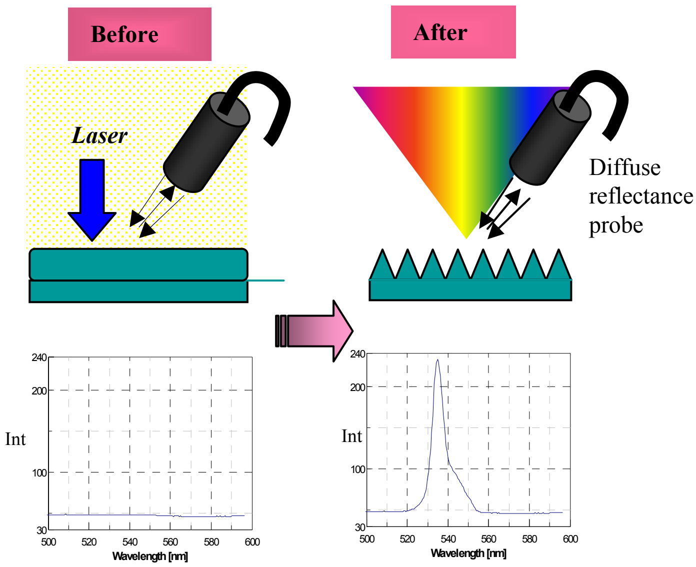


MV-2000 Series
Portable UV/Vis/NIR
Spectrophotometer

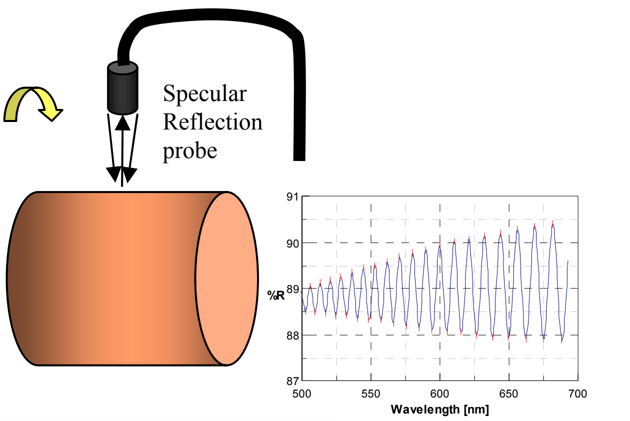
3. On-line monitoring for quality control

MV-2000 Portable Multichannel Spectrophotometer

Monitoring of Poly silicon crystallization using a laser



Monitoring of coating thickness on a printing drum



Thickness calculation by classical interferometry

MV-2000 Series
Portable UV/Vis/NIR
Spectrophotometer

JASCO's Semiconductor/FPD Solutions

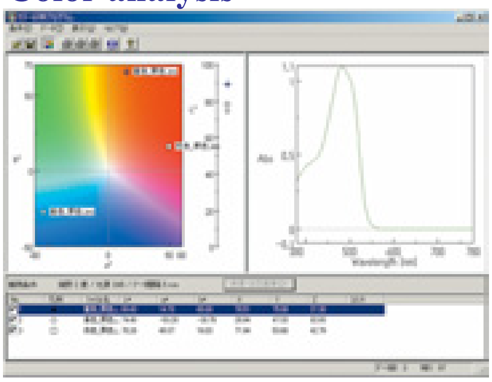
Quality Control

4. Color analyses of fluorescent materials for FPD

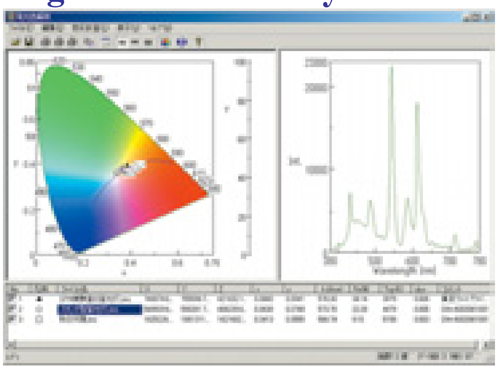
MV-2000 Portable Diode Array Spectrophotometer

The MV-2000 series is a range of portable spectrophotometers which employs a diode array detector. Three models allow non-destructive measurements with a wide variety of fiber probes, and provide a process monitoring system that can perform on-line management, such as measuring concentrations of multi-component samples and product film thickness. They are recommended for use in applications requiring continuous, high-speed measurements and for management of production lines by using optical fiber coupling, allowing the measurement system itself to be freely positioned.

Color analysis



Light emission analysis



**MV-2000 Series
Portable UV/Vis/NIR
Spectrophotometer**

JASCO's Semiconductor/FPD Solutions

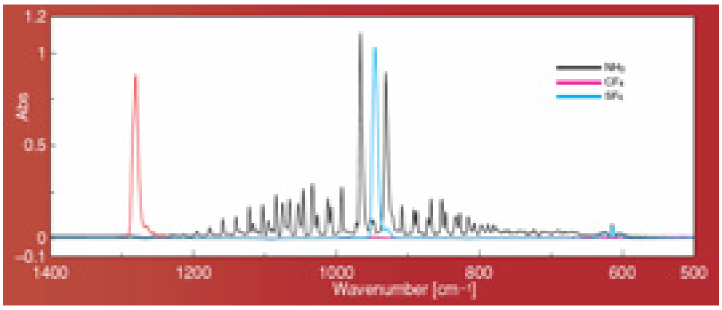
Quality Control

5. In-situ monitoring for Chemical Vapor Deposition (CVD)

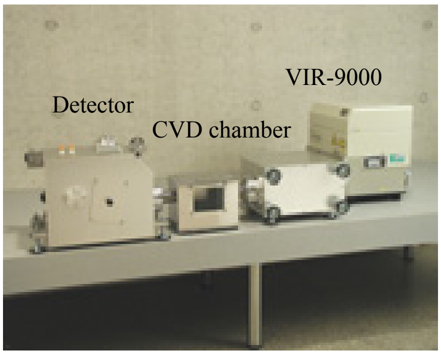
VIR-9000 Series Portable FT-IR System

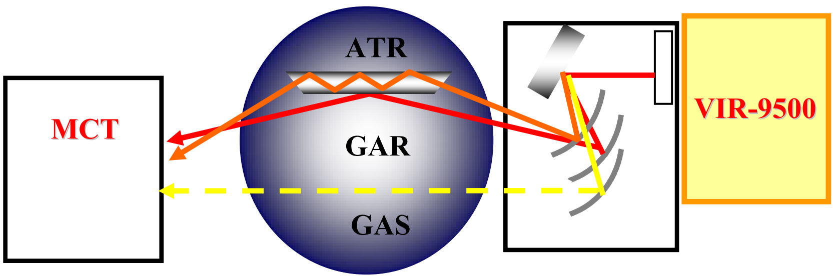
Monitoring of the chemical vapors during vapor deposition assures proper mixtures for consistent film growth. FT-IR monitoring of the chemical vapors can provide instant feedback ensuring proper film composition. With a small footprint, high sensitivity and flexible optical configuration, the VIR-9000 can be used for monitoring the chemical vapor deposition process. The VIR-9000 series also includes a comprehensive software package for identification and quantitation of the chemical vapor composition.

Monitoring of chemical vapors



Spectra of NH_3, SF_6 and CF_4 Gases





ATR: Attenuated total reflection method to monitor the sample surface
GAR: Grazing angle reflection method to monitor the sample surface
GAS: Transmittance method to monitor gas

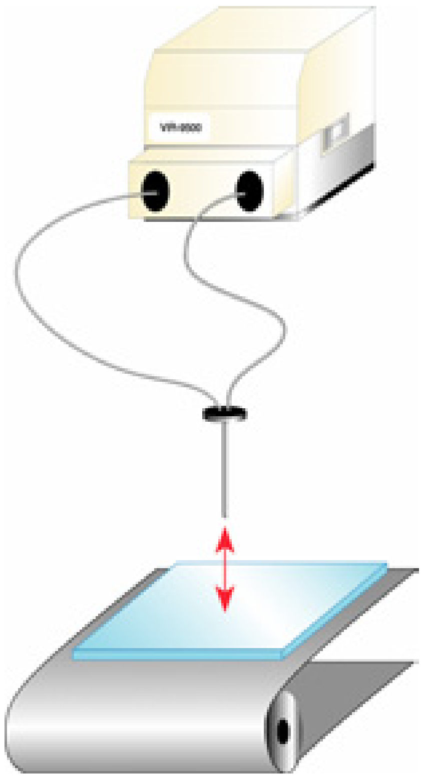
VIR-9000 Series portable FT-IR system

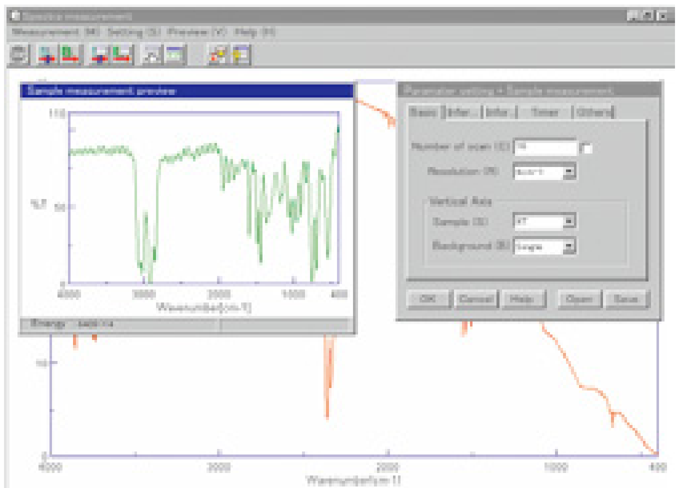
6. On-line monitoring by using an optical fiber

VIR-9000 Series Portable FT-IR System

The VIR-9000 series is a compact, lightweight, flexible FT-IR system. Collimated entrance and exit ports provide flexibility to operate in numerous configurations with a variety of sampling accessories for any application. The standard instrument includes a sealed interferometer, DLATGS detector, corner-cube interferometer for superior stability, a high intensity source, and automated alignment. Optional spectral ranges including NIR are available, and the system can be configured to use battery power for field operation. An optional fiber interface provides in-line monitoring capability for remote reaction vessels or manufacturing lines.

On-line monitoring by using an optical fiber





VIR-9000 Series
portable FT-IR system

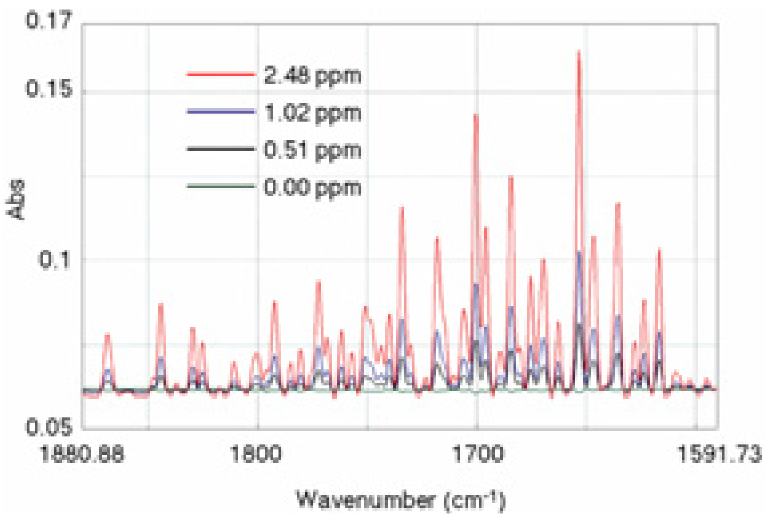
Quality Control

7. Analysis of gases or vapors with high measurement sensitivity

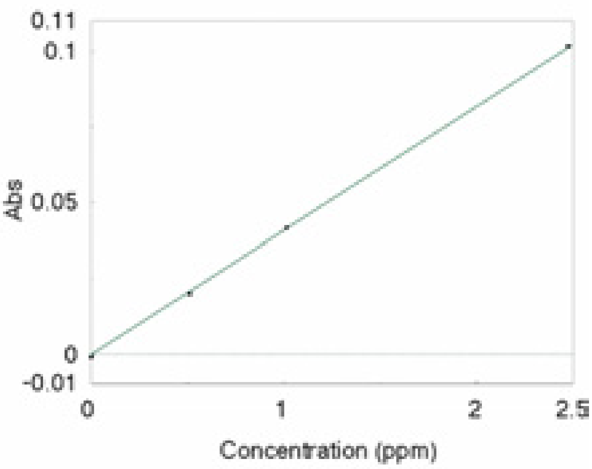
FT/IR-6000 Full Vacuum FT-IR Based Gas Measurement System

In order to measure low concentrations of gases with optimized sensitivity, it may be necessary to remove atmospheric CO_2 and H_2O from the instrument system as well as use a long path gas cell. JASCO offers a high sensitivity, full-vacuum gas measurement system. This system offers the selection of two internal instrument detectors; a wide spectral range DLATGS detector or a high sensitivity MCT detector.

Quantitative analysis of small amount of H_2O in N_2 gas



H_2O calibration curve



FT/IR-6000 Full-vacuum System

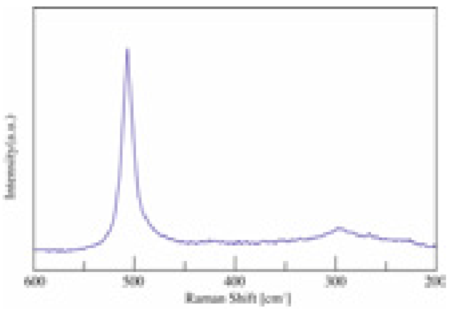
8. Polymer state analysis during an injection molding process

RMP-210 Fiber Probe Raman System

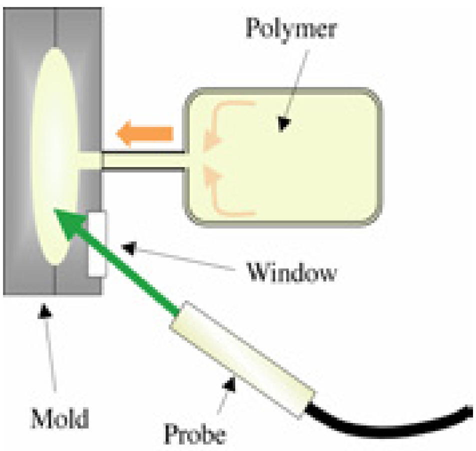
The RMP-210 is a portable Raman Spectrometer system consisting of a probe head and monochromator, which are connected by optical fibers. Since the system does not require water or other cooling utilities, it is portable and allows measurements almost anywhere. The probe head is extremely flexible, making remote measurements convenient as the analysis probe can be brought directly to the sample. The CCD camera located in the probe head enables the user to view the targeted sample image.

Optical fiber

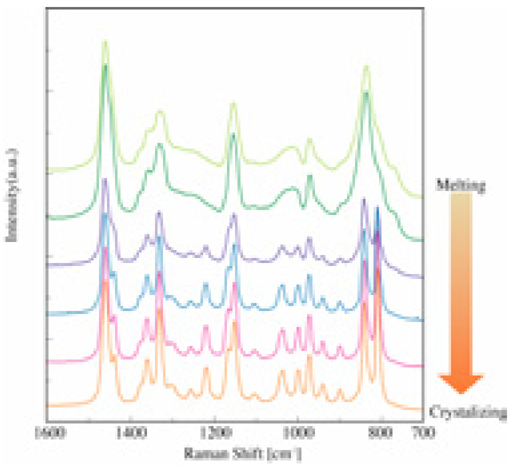
Polycrystalline Si spectrum on a glass substrate



Monitoring of injection molding process



Polymer state analysis during an injection molding process



RMP-210

Film Thickness

Film Thickness Measurement

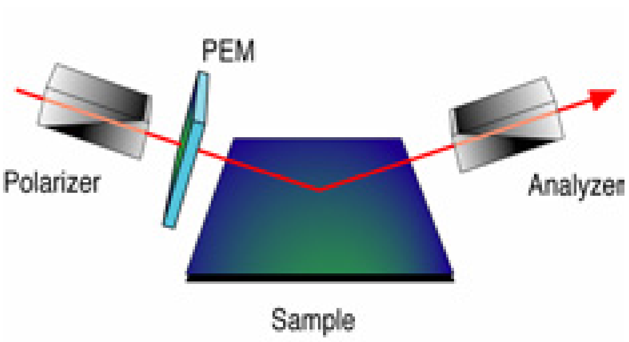
1. Thickness distribution of thin films
2. Multi-layer film analysis
3. Non-contact, non-destructive film thickness measurements in the IR or NIR regions
4. SiO_2 layer thickness measurement

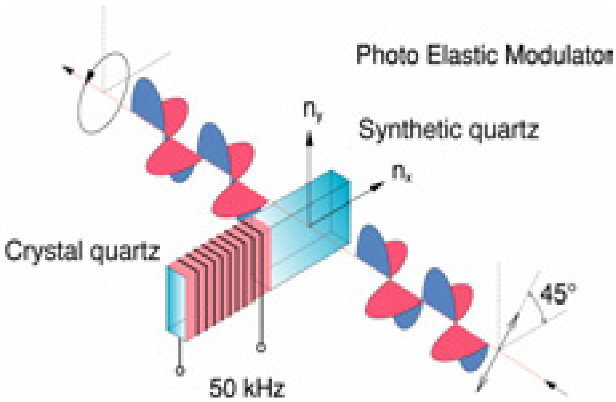
1. Thickness distribution of thin films

M-500 Spectroscopic Ellipsometer

The M-500 is a Spectroscopic Ellipsometer with Photo Elastic Modulator (PEM) optics and a patented optical servo for reference control. The M-500 is specifically designed for use in a semiconductor clean room or fabrication facility, using a horizontal sample introduction system. Coupled with a robotic wafer handling system, high throughput automated measurements are easily conducted. An automatic sample stage with a sample mapping program can measure the thickness distribution of thin films on a wafer. The integrated software includes various options such as multi-layer analysis, wavelength dispersion measurements of optical constants and other optional analysis programs.

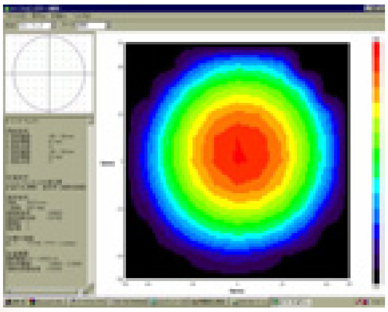
Diagram of PEM Principle

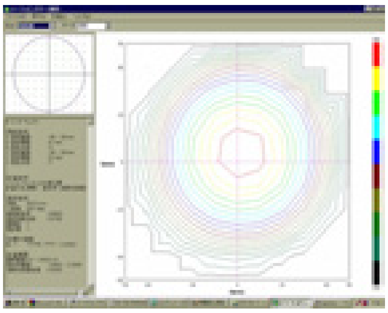




Mapping measurement

The mapping measurement takes advantage of the PEM system's high speed to enable film thickness and refractivity distribution measurement within a maximum of an 8 inch diameter of the sample surface. The mapping measurement program offers display features including 3-D representation, contour map, and color map. The figure shows the thickness distribution of silicon oxide on a four-inch substrate. An average film thickness and average refractive index of 902Å and 2.01, respectively, is obtained. The film is thicker towards the center and thinner towards the edge of the wafer.





Si_3N_4 Film on Si

M-500
Spectroscopic Ellipsometer

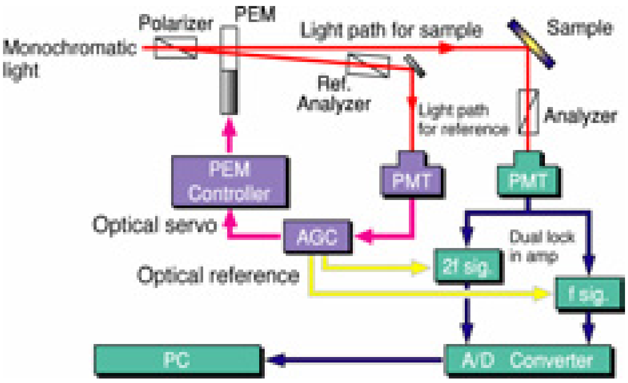
JASCO's Semiconductor/FPD Solutions

Film Thickness

2. Multi-layer film analysis

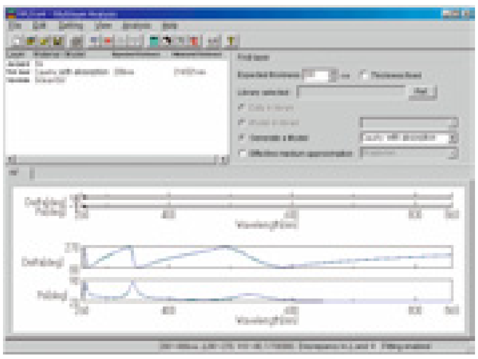
M-500 Spectroscopic Ellipsometer

Ellipsometry is a method for determining the refractive index and extinction coefficients of a sample by measuring the change in polarization state of surface reflected light. Film thickness and optical constants of an adsorption layer or oxide film on a substrate surface can be determined with exceptional sensitivity. Conventional interference spectroscopy utilizes light passed through separate optical paths, while ellipsometry is a form of interferometry that uses two vibrational components with the same optical path, providing measurements with excellent accuracy and sensitivity.

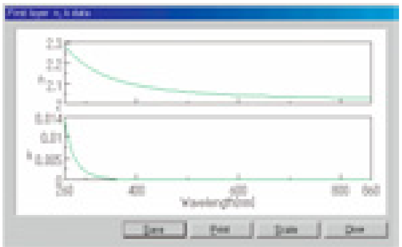


Mapping measurement

JASCO developed a special program for calculating the film thickness and optical constants for each layer of a multi-layer film based on the ellipsometric dispersion parameters (Δ, ψ) λ for the material. A multi-layer film model is developed for the sample, the film thickness and optical constants are optimized to minimize the error for the measured values.



SiN film (~200 nm) on Si



SiN film (~200 nm) on Si

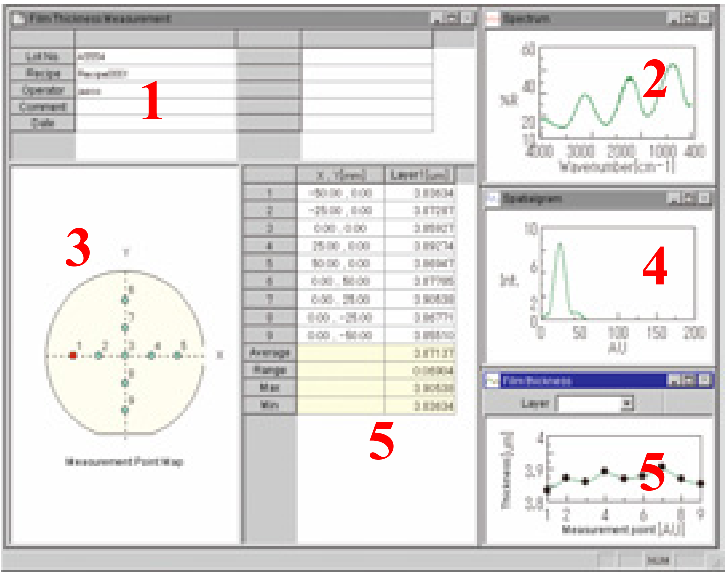
M-500
Spectroscopic Ellipsometer

3. Non-contact, non-destructive film thickness measurements in the IR or NIR region

UTS-200 Film-thickness Measurement System

The thickness of the epitaxial layer, substrate, etching (residual layer), liquid crystal cell gap, and other semiconductor layers dramatically impacts semiconductor device performance. Management of layer thickness during the manufacturing process is extremely crucial for the production of large yields of stable devices.

JASCO's film-thickness measurement system is a non-destructive, non-contact, non-contact analysis method using the latest interferometric technology to provide rapid film thickness measurements. Utilizing a proprietary frequency analysis method, the sample interference spectrum is converted to a spatialgram and the film thickness is calculated with a high degree of accuracy. This integrated system offers the film thickness measurements required for the exacting standards of the semiconductor industry, including: high-speed sample mapping, a wide thickness measurement range; and a refined operating environment, supporting a wide range of analysis requirements from process use to R&D. JASCO offers near-infrared and mid-infrared models according to the thickness measurements desired.



1 Measurement information
Input information for an analysis.

2 Fringe spectrum
The cycle of the interference spectrum changes according to film thickness.

3 Point map
Displays the measurement positions.

4 Spatialgram
Calculates accurate film thickness from the peak position

5 Film thickness distribution graph

UTS-200 Film Thickness Measurement System

JASCO's Semiconductor/FPD Solutions

Film Thickness

4. SiO2 layer thickness measurement

MSV-300 Series UV/Vis/NIR Microspectrophotometer

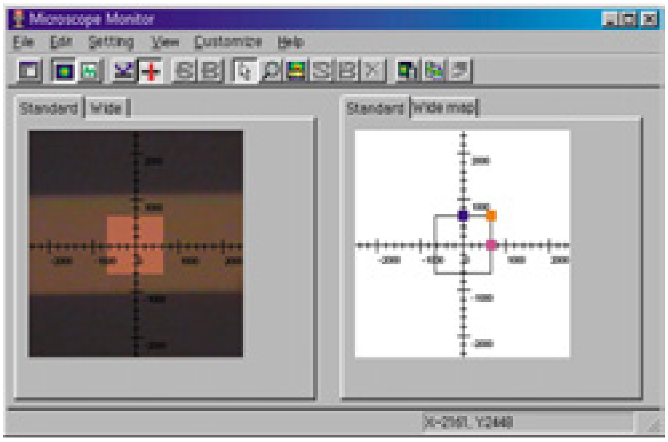
The MSV-300 series is a microspectroscopy system providing transmittance and reflectance measurements of microscopic sample sites for a wide range of wavelengths from ultraviolet to near infrared. Conventional measurements require samples with dimensions comparable to a millimeter-sized optical beam. The MSV-300 series can measure color, film thickness, and other spectral properties of a microscopic area for either large or small samples. The optional automated X-Y-Z stage provides multi-point measurements and surface analysis mapping capabilities.

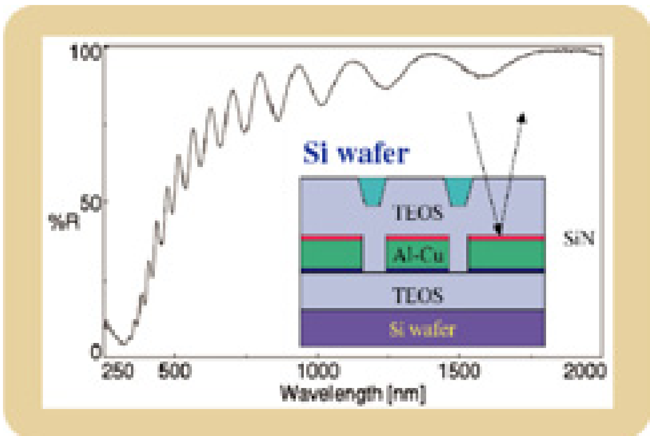
Applications

- Optical property of crystals
- Band-gap measurement and film thickness
- Characteristics of micro filters and mirrors

SiO_2 layer thickness measurement

Measurement of SiO_2 on Si wafer (Sampling area: 30 x 30 µm)

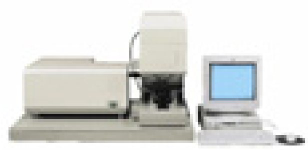




Reflection Spectrum of a Si Wafer

The film thickness was calculated as 1.98 μm

MSV-300 Series UV/Vis/NIR Microspectrophotometer



COMPARISON PROVEN

● Specifications are subject to change without notice.

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