

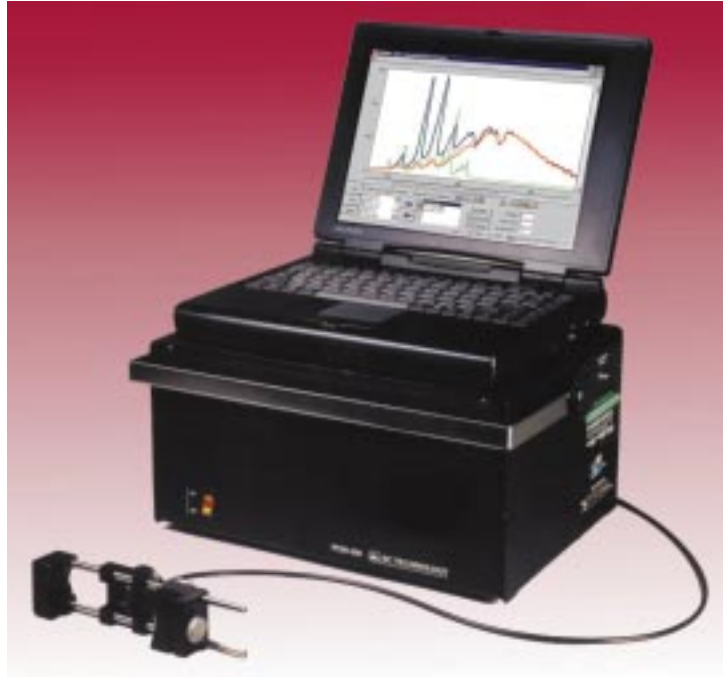


Optical Solutions from

SC TECHNOLOGY

PCM 3000

Instrumentation for Plasma Diagnostics and Color Measurement



The PCM 3000 is a versatile and affordable optical instrument for monitoring and control of processes involving light emission. Plasma endpoint, color measurement, lighting characterization and other applications are readily handled with this robust spectrograph.

The core of the system is a high throughput light analyzer connected to software that will acquire, calculate, control and organize the information for you. The PCM 3000 has the best of the two worlds, suited for industrial environments with the simple interface and features characteristic of lab instrumentation.

Some examples of the PCM 3000 applications are:

- Plasma etch endpoint detection and algorithm development
- Reactive sputtering control
- Process simulation and optimization
- General plasma diagnostics
- Chamber qualification, matching and troubleshooting
- Color determination
- Display screen quality control

Tell us about your specific problem, we can customize our product to your application.

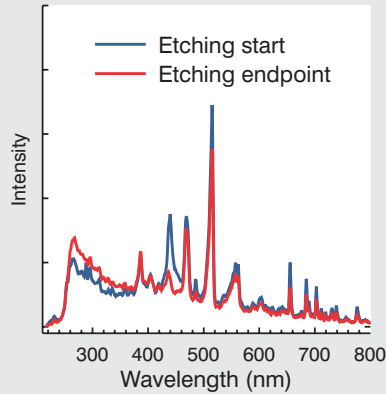
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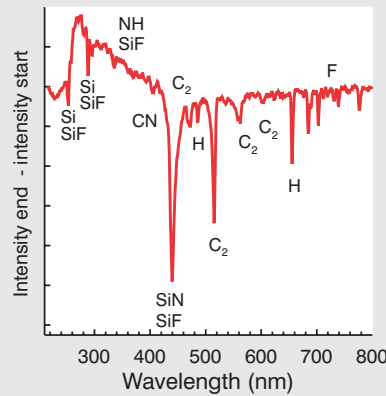
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Plasma Diagnostics/Endpoint/Colorimetry

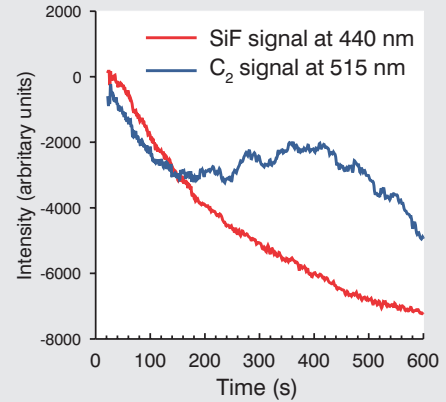
Determination of etching endpoint



The light emitted inside the chamber during the etching process is recorded by the PCM 3000 in a spectra time series at a rate up to 40 spectra per second. The figure above show the spectra recorded at the beginning and the end of the etch.



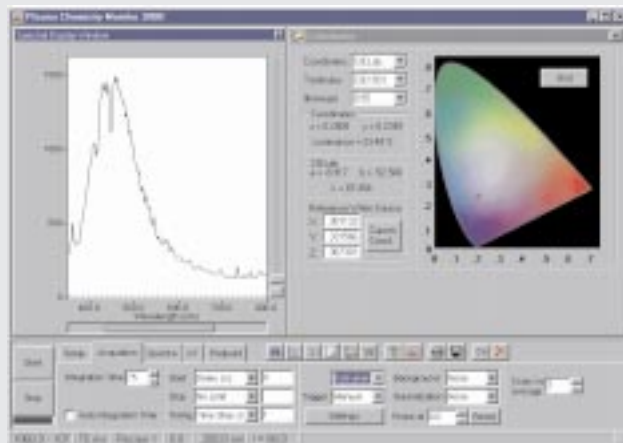
Intensity changes in spectral lines can be easily visualized by subtracting the first spectrum using the normalization option in the software. Although the composition of the chamber gas is not known, spectral lines are identified with the built-in database and are assigned to plasma species with little ambiguity. The presence of SiF, F, H, C₂ ... points out the possibility of a CF₄ + CF₃H plasma in the chamber.



Different species give information about distinct aspects of the etching process. Wavelength equations together with digital filters are used to determine the endpoint accurately, monitor plasma health and detect impurities. In the figure, the SiF time evolution is a good endpoint marker, the C₂ may be used to detect anomalies in etching a polymer layer on the silicon wafer.

Color Measurement

- Factory spectral response calibration of the PCM 3000 enables the instrument to measure emissive color accurately.
- Spectra are analyzed in real-time to provide color space numeric values XYZ, xyz, L*u*v*, L*a*b* and graphic representation of the chromaticity xy.
- Standard CIE illuminants and tristimulus CIE1931 and CIE1964 are available.

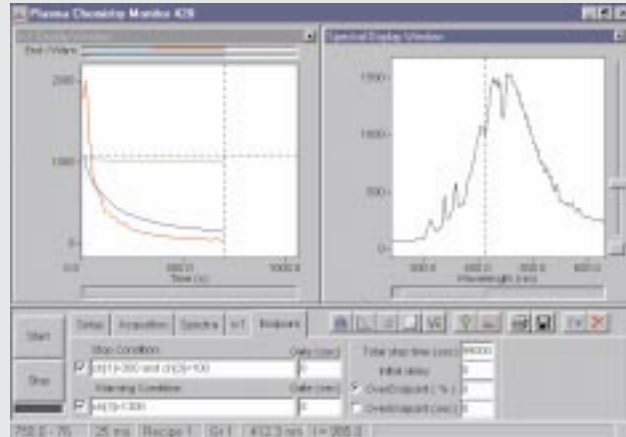


Software features

The PCM 3000 uses Windows 95/98 software optimized for plasma diagnostics and process control. The graphic user interface is remarkably simple and intuitive, ensuring a short learning curve. Even personnel with no previous knowledge of spectroscopy can use the instrument within a few hours of instruction.

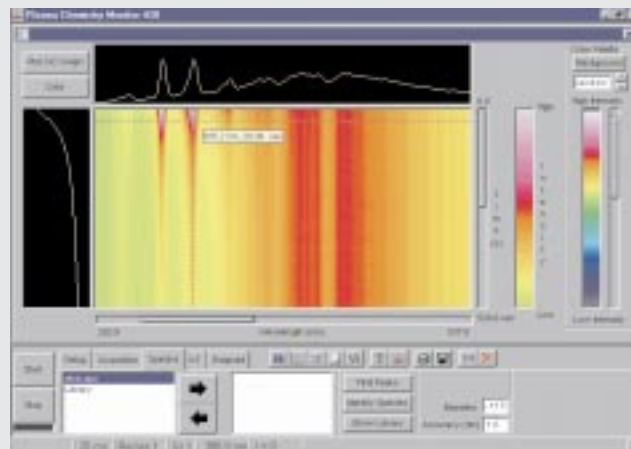
The **ProLight** software runs the hardware and basic data acquisition.

- Recording spectra is transparent for the user, and just a few instrument programmable settings have to be optimized to obtain the best data.
- Synchronization is easy using optical and electrical triggers. An optical trigger detects the process start point by checking light intensity variations in the chamber.
- Spectra are processed in 25 ms or less. Endpoint and intensity equations are evaluated at the same time data are acquired, ensuring correct and fast response by the PCM 3000. Real-time spectra normalization, background subtraction and FFT filtering are implemented as well.
- Warning situations and endpoints are communicated using the programmable digital and analog outputs. A new remote operation mode via RS-232 takes further the system automation and facilitates integration with other instruments.
- Automated wavelength calibration and detector linearization routines make possible reproducible high quality data every time.



The **PlasmaPak** module provides chemical analysis and endpoint processing

- Sophisticated spectra visualization is accomplished with several display modes: Overlaid spectra, color coded contour maps and movie-like playback for spectra time series. Those visualization tools permit the easy localization of changes in plasma emission.
- Automated identification of plasma species is possible using the patented PCM 3000 Spectral Library. Knowing the plasma species helps to develop sound endpoint algorithms and detect impurities during chamber qualification and troubleshooting.
- Endpoint algorithms and intensity functions are easily built in the equation editor. Wavelength functions support simple operators (*, +, -, /) and more complicated derivatives and areas. Endpoint algorithms include boolean logic as well. The combination of these operators, all available in a mouse click, generates powerful, intuitive and accurate equations. The equations output stability is optionally enhanced by digital filters.
- SQL compatible databases organize efficiently all the critical information related to the PCM 3000:
 - Instrument settings in single and multi-step recipes
 - Equations and endpoints algorithms
 - Endpoint results datalogging
 - Security access control if needed
- Fully featured data file manager: Spectra are saved in convenient file formats (binary or comma delimited text), easy to use across spreadsheets and presentation software.



PCM 3000 Advantages

- Portable, easy-to-use, turn-key hardware
- Automated identification of plasma species
- Sophisticated endpoint algorithms
- Automated color measurement
- Fast spectra acquisition and data processing rates for real-time measurements.
- Integrated Windows software for data acquisition, process development and control.

Specifications

Spectrometer Range 200 nm - 1000 nm
Detector 512 element PDA array
Linewidth <5 nm FWHM
Resolution per pixel 1.6 nm
Wavelength accuracy ± 0.5 nm
Detector linearity deviation <0.2%
Signal-to-noise ratio >2500:1
Measurement Rate 40 Hz - 0.5 Hz

Size 6-3/4" x 12 1/2" x 5"
Weight 12 lbs.

Computer Requirements:
Win95/98
Minimum CPU 233 MHz Pentium
High color SVGA display

Fiberoptics: Steel-jacketing is used to protect the plastic clad silica fibers. Standard fiber length is 10', with longer lengths available as an option (we have provided fiber runs as long as 150 feet). For ultra-violet applications, high-transmission silica clad silica fibers reduce UV transmission losses to a minimum.



Directional Probe attached to chamber using the Universal Mount

Options

- Custom Fiber Optic Cables
- Mounts: Directional, Universal, LAM, and Custom
- Probes: No lens, Standard, Elliptical, and Custom
- Laptop Computer
- Transportation Case