**Plasma Chemistry Monitor**

Instrumentation for Plasma Diagnostics and Endpoint

**Spectral Overlay:** Different spectra can be loaded into the display window for quick comparison. Process repeatability can be checked by comparing the acquired spectrum to a known standard stored in the User Library. Spectra can be subtracted and normalized by other spectra, allowing for quantitative comparisons.

**Detectors:** The Model 110 Optical Endpoint System consists of two modules - a detector head and a remotely mounted variable gain amplifier/controller. The Detector Head contains a dual channel photodiode detector. Two large area photodiodes are coupled to highly sensitive JFET amplifiers with jumper selectable gain. The photodiodes are kept at a constant temperature with a closed loop controlled Thermo-Electric Cooling device. Separate 10nm bandpass filters, one for each photodiode detector, are mounted in an easily removed tray. Light collimating lenses precede the filters for enhanced sensitivity and broadband light rejection. A built in preamplifier ensures a strong noise-free signal will reach the remote variable gain amplifier.

The Variable Gain Amplifier/Controller contains two separate 0-40dB variable gain amplifiers - one for each photodiode detector. Independent control of these amplifiers is facilitated through two 0-10vdc analog inputs. In addition to the two 0-10vdc signal outputs, two chart recorder outputs are available on BNC connectors, one for each photodiode detector. The Amplifier/Controller contains the driver and control circuitry for the Thermo-Electric Cooler. The entire system is powered by +24 and +5vdc.

**Detector Head**

**Detectors:** Large area (33mm) UV enhanced silicon photodiodes.

**Filters:** 12mm dia., 10nm FWHM interference type (consult factory for wavelengths)

**Lenses:** 12mm dia., 19mm fl., fused silica plano-convex

**Temperature Stabilization:** 12.5w peltier type TEC with thermistor in closed loop control.

**Mechanical:** 2" x 3.5" x 3.5" approx. (WxDxH)

**Amplifier/Controller**

**Gain Control:** 1-40dB amplifier gain.

**Input Range:** 0-10vdc for each channel

**Output Range:** 0-10vdc amplitude out for each channel

**Chart Recorder Outputs:**
- 0-10vdc chart recorder out for each channel
- BNC, 0-10vdc, indicative of light intensity

**Fuses:**
- 500ma (24vdc), 3A (5vdc)
- +24vdc @ 300ma +5vdc @ 2A

**Mechanical:** 6" x 5" x 2" approx. (WxDxH)

**Spectral Library:** The software can automatically find and identify chemical species in the plasma. The peaks are first identified, and their wavelength is compared to our patented spectral library to identify the chemical species. Vacuum leaks as well as gas purity can easily be checked during chamber qualification and troubleshooting.

**Spectral Overlay:** Different spectra can be loaded into the display window for quick comparison. Process repeatability can be checked by comparing the acquired spectrum to a known standard stored in the User Library. Spectra can be subtracted and normalized by other spectra, allowing for quantitative comparisons.

**Software Features.** The PROLIGHT Software runs the hardware and basic data acquisition, and the applications module provide chemical analysis and endpoint processing. Normalization and background correction are done in real-time. Automatic detector linearization and spectral calibration provide for perfect data, every time. All of the systems include digital I/O and analog output that are software configurable. The use of a Graphical User Interface in the Windows XP environment facilitates system set-up and maximizes productivity. Multi-step recipes and product information can easily be entered and saved. Three levels of access and password protection (the Administrator may turn password protection off) ensure that recipes aren’t accidentally changed. Standard printers and network connections are supported.

**Versatile Instrumentation:** The PCM 420 is powerful optical tool for plasma monitoring and control. Typical applications include:

- Plasma etch endpoint detection and algorithm development
- Reactive sputtering control
- Process simulation and optimization
- Chamber gas purity control and chamber leak detection
- General plasma diagnostics
- Chamber qualification, matching and troubleshooting.

**PCM 420**

**20936 CABOT BLVD. HAYWARD, CA 94545, USA**

TEL 510-887-2225  FAX 510-887-2265  sales@telemark.com

www.telemark.com
High Sensitivity

Peltier-cooled Detector
Back-Thinned Back-Illuminated CCD with UV anti-reflective coating

Versatile & Portable
Dual Grating Spectrometer

With the USB interface and a laptop, equipment maintenance and field service have never been easier. Digital I/O (analog optional) can be used to control endpoint, and optical triggering can collect data unattended. Set up the system and do something else while the lot runs. Your data is collected and saved, even logged remotely if you are connected to a network! All while you do other tasks.

Specifications

- Double grating spectrograph
- Spectral resolution:
  - High resolution mode: 0.35 nm
  - Low resolution mode: 4 nm.
- Maximum wavelength error:
  - High resolution mode: 0.25 nm
  - Low resolution mode: 0.4 nm
- Detector: TE-Cooled Back illuminated CCD array 1024x256 pixels
- Detector Quantum efficiency: 90% @ 600 nm
- High sensitivity range: 200-1000 nm
- Data acquisition: 16 bit, maximum rate: 40 Hz
- Linearity: 99.8%
- Signal-to-noise ratio: 3000:1
- I/O ports: digital input/output, analog output (optional).
- Fiberoptic: high UV and Visible transmission silica fibers.

Typical Etch Endpoint Applications

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 assigned with the built-in database and are assigned to plasma species with little ambiguity. The presence of SiF, F, H, C_{2n}... points out the possibility of a CF_{3} + CF_{3}H plasma in the chamber.

A Choice of Probes

We offer three standard Optical Probes for efficient gathering of light. For Systems with bright, extended plasmas, we provide a probe with no lens. This gathers light from a cone with a 30 degree solid angle. For smaller open areas a probe with standard quartz optics (the Cylindrical Probe) is provided. For etchers with small anode to wafer distances, we have probes based on cylindrical lenses (the Elliptical Probe) to maximize collection efficiency.