

PLASMA

CCD1 Spectrometer for Plasmalab Systems

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A CCD spectrometer is an extremely useful addition to any plasma tool, since it can provide not only a process endpointing capability, but also a large amount of plasma spectroscopy information - used for monitoring the species within the plasma.

The newly introduced CCD1 spectrometer provides a cost-effective route to general purpose endpointing and spectroscopy, without compromising on resolution or signal strength.



Figure 1. Endpointing using the CCD1.

Process endpointing is achieved via OIPT's front-end software. An example endpoint trace is given in Figure 1. Either a single intensity or a ratio of two intensities can be used for the endpoint signal. The intensities of up to three user-selectable wavelengths can be displayed and datalogged. The intensity and smoothing parameters of the CCD signal can be adjusted via the integration time, number of samples to average, and boxcar width settings. Typical integration times are 5-100msecs for ICP plasmas, and 100msecs to 1sec for RIE or PECVD plasmas, depending on power levels used and assuming a clean window and an unobstructed view of the plasma.

A spectrometer captures the light emitted from the plasma via a viewport (usually on the rear of the chamber), and provides information on the light intensity at each emission wavelength. The CCD1 is a UV/VIS CCD spectrometer that can monitor a wide range of plasma emissions - between the wavelengths 200nm-880nm. This allows the user to monitor all common plasma emission peaks in the UV and visible wavelengths. The CCD1 unit provides good wavelength resolution (<2nm FWHM), hence allowing closely grouped emission lines to be individually identified. A window protector is provided in the CCD1 kit to minimise window fogging or coating and hence allow more repeatable endpointing and spectroscopy analysis in aggressive or depositing processes. The kit also includes a quartz viewport assembly (to allow UV detection), silica fibre optic cable, a spectroscopy software package, and integration of the CCD1 unit to OIPT's front-end software to allow process endpointing.

The CCD1 unit can be used in one of two ways:

Endpoint detection

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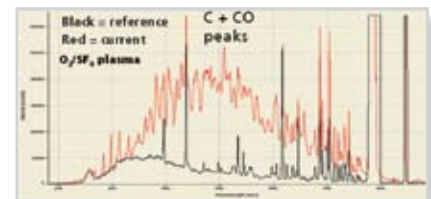


Figure 2. Effect of a contaminated chamber (polymer) on emission spectrum.

Viewing the emission spectrum

The plasma emission spectrum can be viewed and recorded using the provided spectroscopy software package. This allows the user to monitor the species present in the plasma, and hence to gain a greater understanding of the process and its performance. This can be very useful for process optimisation, chamber condition monitoring, and as a process/system health check.

The benefits of plasma spectroscopy can be most easily displayed by showing examples of potential causes of process fault conditions and their ease of detection via spectroscopy. In the following examples a reference spectrum was captured and then the process or system adjusted to simulate a process/system change (see Figures 2 and 3). In each case the change in spectra can be clearly seen and its cause determined.

The CCD1 spectrometer is now available as a system option on new **Plasmalab** tools, and can be offered as an upgrade to systems in the field, dependent on the system age, type, and configuration.

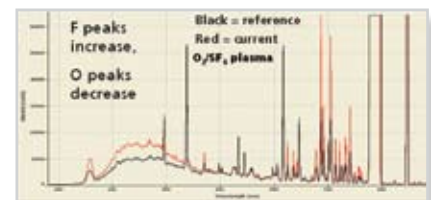


Figure 3. Effect of a gas flow error on emission spectrum.