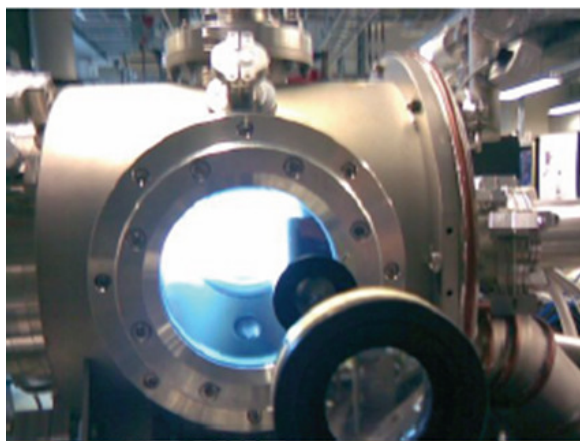


# Application Note:

## Optical Emission Spectroscopy (OES)



Plasma emission viewed through port in vacuum system

Avantes fiber optic spectrometers are frequently used in the measurement of plasma using a technique known as optical emission spectroscopy (OES).

Each atom's emission spectra is unique and by bringing these to lower energy states using an electrical arc it is possible to measure the spectra and identify the species present in a material. Plasma Physicists and Chemists use this technique for a variety of applications which have many applications across various industries.

In the electronics and semiconductor industry, OES is used to measure plasma etching of photo resist, a light sensitive material which is used to form a patterned coating on a surface. OES can facilitate the process of photo-resist removal through end point detection. UV wavelengths are monitored using an irradiance (intensity) calibrated spectrometer such that when a specific spectral end point is reached (threshold value met or exceeded), the process is terminated. OES may also be used to monitor the contamination of mirrors within lithography systems.

In energy research and development, OES can be used in fusion experiments by facilitating the monitoring of the repositioning of hydrocarbons from chamber wall elements. OES may also be used in the monitoring of co-deposition of deuterium and tritium.

OES is also used in the biomedical industry to monitor surface modifications using plasma etching to improve the biocompatibility of a material.

### Spectrometers

Avantes AvaSpec instrument line is exceptionally well suited to OES because of the resolution requirements of the application. Detection of many atomic lines requires resolution of 0.1 nm (FWHM) or better and this is not a problem for the AvaSpec line. The Avaspec-ULS2048-USB2 and AvaSpec-ULS3648-USB2 are both capable of meeting the needs of the application. The instruments can be configured with broadband grating (200-1100 nm) or narrow bandpass gratings with high groove density to allow for high resolution of a narrow range.

### Multi-Channel

Avantes unique multichannel fiber optic spectrometers provide an excellent alternative to more expensive traditional optical emission spectroscopy technologies. Avantes instruments can easily be configured in an array such that each instrument "channel" covers a short wavelength range with very high resolution. The array of instruments may cover 190-2500 nm with each spectrometer covering a 200-300 nm bandpass. Typical configurations offer resolution as low as 0.08 nm (FWHM) in the UV and all the instruments are converged together using fiber optic cables which terminate in a common connector which is positioned at the wall of the vacuum chamber. Fiber optic vacuum feed throughs may also be used to measure closer to the plasma within the chamber. The entire system is irradiance (intensity) calibrated against a NIST traceable source so as to facilitate comparability of data from one instrument to the next and enable variable integration times across the channels for optimal dynamic range. For more information about plasma measurements and optical emission spectroscopy contact an Avantes Sales Engineer at [infousa@avantes.com](mailto:infousa@avantes.com) in the Americas.



Avantes 10 channel rackmount spectrometer