

Technical Note

Keywords

- Deep-UV spectroscopy
- Vacuum UV measurements a

Techniques

- Absorption spectroscopy
- Emission spectroscopy

Applications

- Semiconductor metrology
- Biologicals
- Authentication
- Counterfeit detection

Maya2000 Pro Deep UV Measurements to 153 nm

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Our Maya2000 Pro Spectrometer delivers high quantum efficiency and high dynamic range and is responsive in the deep UV (~185-300 nm). The Extra-Deep UV option extends spectral measurements to 153 nm.

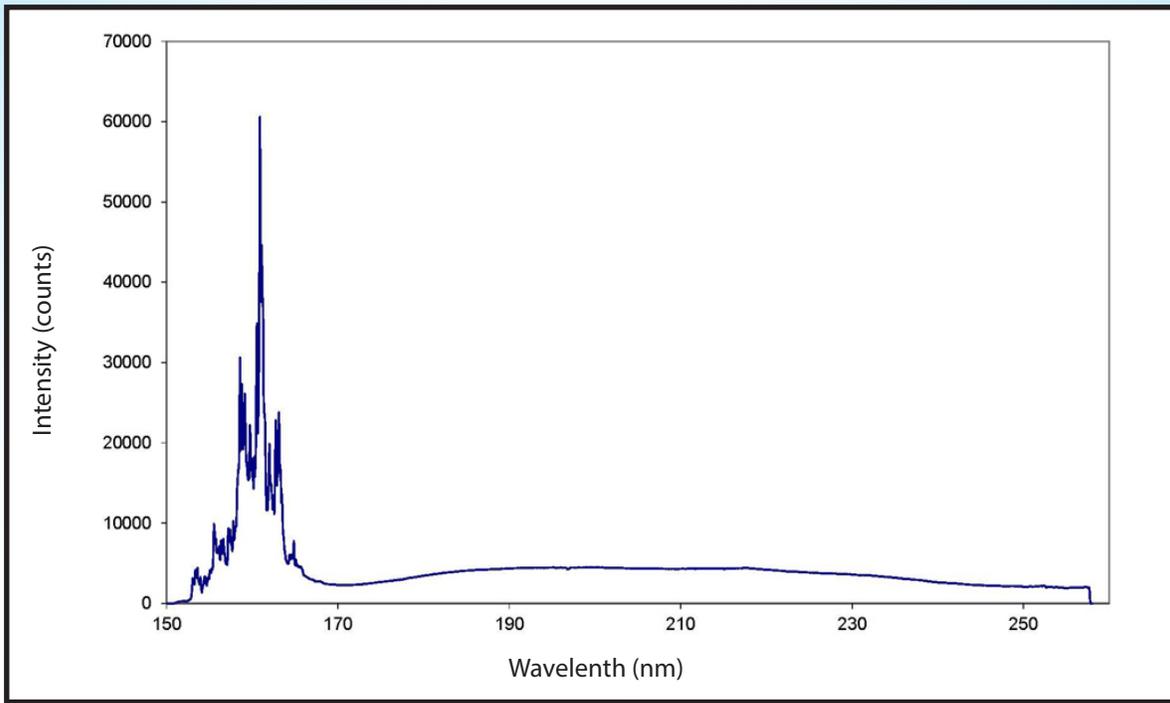
Spectral measurements down to 153 nm can be achieved easily and economically with the high-sensitivity Maya2000 Pro with the Extra-Deep UV option. A variety of materials have spectral signatures in the vacuum ultraviolet (VUV) spectral region (from 10 nm-200 nm); VUV spectroscopy is useful for applications ranging from biologicals to semiconductor metrology and quality control.



Because the spectral response of standard silicon charge coupled device (CCD) detectors drops off rapidly at wavelengths as long as 400 nm, and because oxygen and water absorb in the VUV, maintaining sufficient signal outside a vacuum is not possible.

Nitrogen purging of the spectrometer helps to displace water and oxygen, reducing their contribution to absorption in the VUV. Spectrometers with a vacuum purging feature require custom configuration and are often too expensive and unwieldy for many common applications.

The clever design of the Maya2000 Pro with the Extra-Deep UV option makes VUV measurements much more accessible. The spectrometer features a 101.6-mm focal length optical bench with a compact crossed Czerny-Turner design and a back-thinned CCD detector that offers superior UV and VUV performance. To minimize signal attenuation inside the optical path, the spectrometer bench is purged with nitrogen or other inert gas, achieving a robust signal for VUV experiments at wavelengths as low as 153 nm.



Deep UV spectrum of emission from VUV deuterium lamp.

Experimental Conditions

A Maya2000 Pro configured with a high resolution, UV-enhanced 2400 g/mm holographic diffraction grating and a 5 μm slit was used to demonstrate performance in the VUV. The back-thinned detector features a peak quantum efficiency of 75%, with UV quantum efficiencies as high as 50%. A custom magnesium Fluoride (MgF_2) window is placed over the detector for improved transmission in the VUV. The test sample for the experiment was a VUV deuterium lamp with a VUV-grade optical window, coupled directly to the spectrometer. We enclosed the source and spectrometer and purged the experimental setup with laboratory-grade dry nitrogen.

Integration time for the measurement was 50 ms. The resultant emission spectrum shows sharply defined peaks at wavelengths as low as 153 nm, with a strong central peak around 161 nm (see figure above). The system operated with a spectral resolution of 0.1 nm and a SNR of 450:1.

Conclusion

We have also used the the Maya2000 Pro to measure a solution containing carbon, hydrogen/deuterium, nitrogen, oxygen, sulfur, chlorine, bromine, silicon and fluorine chromatographically separated into a column and placed in a vacuum chamber with a helium plasma mixture. VUV spectral features were clearly apparent in the spectrum, suggesting a wide variety of short wavelength applications is achievable.

The results demonstrate that the reliable and economical Maya2000 Pro can be easily extended to VUV applications. If you have spectroscopy experiments or applications in the VUV, the Maya2000 Pro is the spectrometer of choice. 🌐

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