

McPherson VUV Phosphor Systems

1.) Vacuum excited QC Phosphor Test Station (vEx PTS)

This system uses a VUV Deuterium Lamp with excitation filters for 147 nm, 172 nm or 193 nm excitation (other available). The sample chamber contains a wheel for 20 samples, 1" diameter or powders. This system is particularly useful for quality control measurement due to ability to hold many samples. It allows the emission spectra to be measured in the VUV through the visible.

2.) Vacuum Excited Optimized Phosphor System

This system measures both the Excitation and Emission Spectra. The system can be provided with a variety of source/spectrometer combinations to provide excitation from the x-ray to the visible. The Sample chamber holds up to 5 samples in a vertical holder, with a cup sample holder with a window to allow powders and small samples to be measured. The emission side of this instrument can be provided with VUV or Atmospheric Spectrometer to allow emission spectra from the VUV to the IR. The emission spectrometers can be provided with either single channel or CCD camera. This system allows flexibility for research requirements.

3.) VUVAS 1000 + PL Spectrophotometer System with a Phosphorescence/Florescence Option.

The VUVAS 1000 is an established spectrophotometer that allows Transmission or Reflectance to be measured from 120 to 380 nm with the possible expansion in the visible. With the addition of the Phosphorescence/Fluorescence Option, Emission Spectra can be run in the UV/Vis/NIR. The sample chamber for the VUVAS 1000 can also be supplied with Cryostat. The addition of the Phosphorescence/Florescence Option makes this a versatile system for testing the optical properties of material.

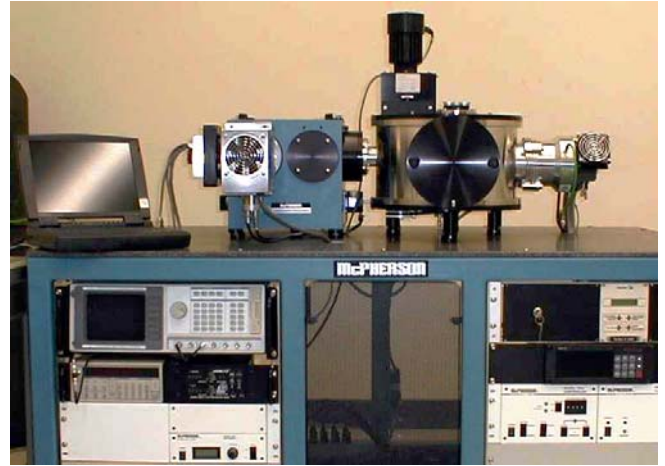
4.) Vacuum UV Universal Spectrophotometer (Reflectance / Transmission / Excitation or Emission Testing).

This system is a versatile system that is not only optimized for Phosphors, but also the Reflectance and Transmission or Fluorescence across a broad wavelength range. The system has a usable wavelength range of 115nm to 930nm - this can be expanded deeper into the Extreme UV or into the IR with addition of sources and detectors. The interchangeable sample holder(s) accept five 25mm diameter samples in the emission, transmission and reflectance positions. Samples can be indexed under vacuum. This is a versatile system for a research laboratory that allows the characterization of sample using different measurements. to IR, f/4.3

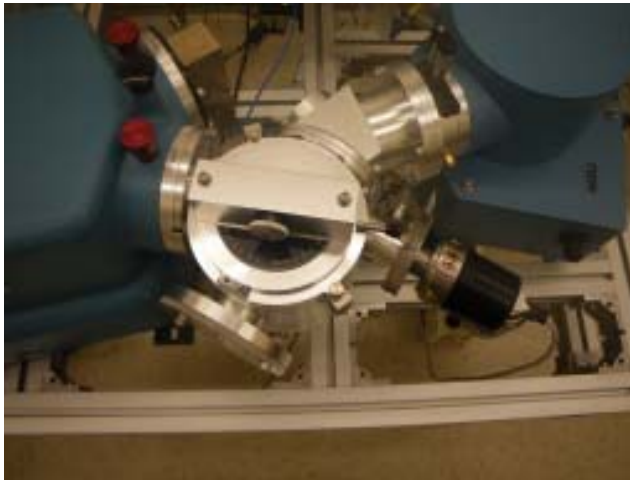
McPherson has the ability to add a calibrated detector in the sample position of any of these systems to measure actual excitation energy values.

1. Vacuum excited QC Phosphor Test Station (vEx PTS)

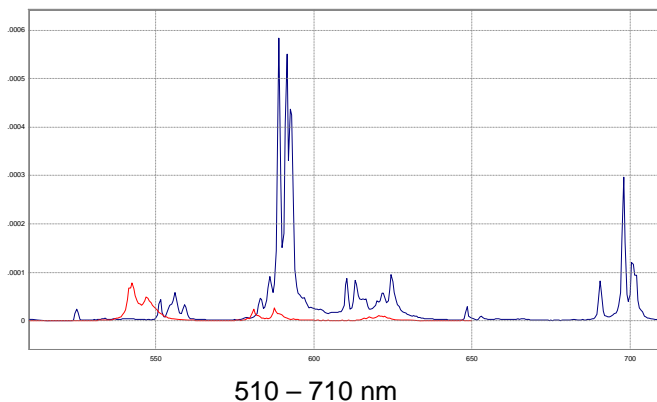
Excitation via integrated Deuterium lamp light (120 to 380nm +) or via filtered Deuterium at user specified wavelengths, eg. 147nm and 172nm (others available). Source energy is focused to 20-position (horizontal) sample wheel useful for powdered or 1" diameter samples. Sample holders are easily exchangeable making the system ideal for QC applications. Emission spectrum measured with McPherson 350mm focal length Model 2035 spectrometer equipped with CCD or PMT. Lifetime measurements via mechanical shuttering of CW light source and signal recovery with multichannel scaler / averager.



2. Vacuum Excited Optimized Phosphor System



**VUV (120nm-380 nm) Excited Phosphor System
With VUV Emission (105 nm – NIR)**



Example Emission Data: Emission of two samples; 10%Tb phosphor (red) and 25%Eu phosphor (blue)

The VUV Excited Optimized Phosphor System allow a variety of sources and spectrometer to be utilized to provide excitation from the soft x-ray (1 – 25 nm, lines) or two ranges in the VUV (30 – Vis, lines or 120 – 380 nm, continuum). The use of a variety of sources on a spectrometer allows excitation scans to be run.

The Sample chamber holds up to five 1 inch diameter samples in a vertical holder, with a special holder for powders and small samples. The sample chamber has accessory ports for measuring transmission or introducing a laser or x-ray source for sample excitation. A calibrated silicon photodiode can be provided for absolute energy measurement.

McPherson can provide a variety of fast emission spectrometer to cover the range from the VUV to the IR. Spectrometer Focal lengths vary from 0.2 m (f/2) to a 0.67m (f/4.7) Spectrometers. The emission spectrometers can be provided with either single channel detectors or CCD camera to provide a variety of configurations to measure the emission spectra from the VUV to the IR. A shutter can be supplied to measure lifetimes and an additional port is available for customer supplied lasers. Electronics are available for a DC or pulsed systems. Software is provided to collect and display the data collected. Spectra may be exported as a text file for use in post processing software. These Phosphor systems provides an optimized Research Tool for characterizing either the Excitation or Emission Spectra of phosphors.

3. VUVAS 1000 + PL Spectrophotometer System with a Phosphorescence/Florescence Option.

The McPherson VUVAS+PL instrument meets the requirements of deep and vacuum ultraviolet analysis in the 120 to 400nm range. It offers a clean, particulate free and tight, purge or vacuum capable enclosure. UV enhanced optics, sources, detectors, and a computer optimized optical system. All VUVAS+ elements are selected to improve analytical results and simplify measurement tasks for the user.

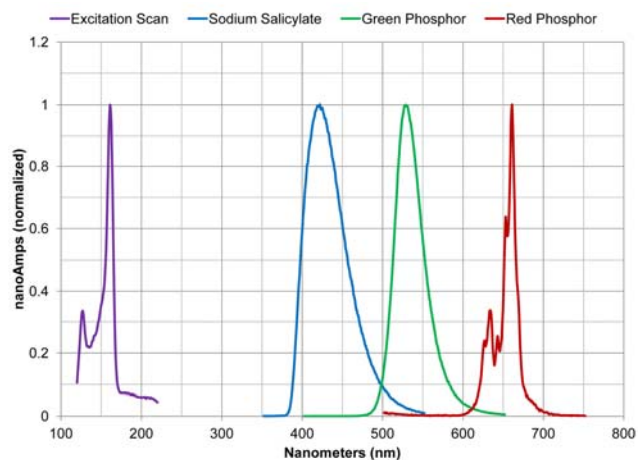
The VUVAS+PL spectrophotometer works with solid samples and can be equipped with gas or liquid sample cells. Most users employ optic-like substrates coated with sample for transmission measurements. A three-position sample holder is standard. Cryogenic single-sample mounts and raster-mapping attachments for large samples are available as specials. Reflectance is readily measured, and angle of incidence to the sample surface is easily altered. Detector angle is also adjustable. It can maintain theta/2-theta geometry for specular reflectance measurements, or deviate from this, to measure scatter or dispersive samples.



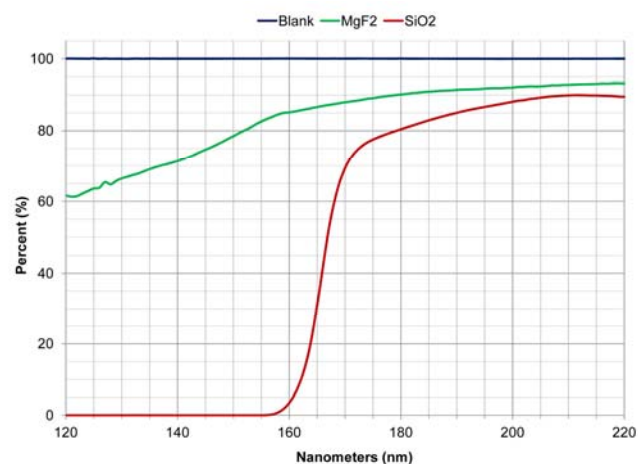
The VUVAS 1000+PL Spectrophotometer

The **VUVAS+PL** emission spectrometer operates from 140nm to 2600nm depending on the selected model; vacuum and atmospheric versions are available. It uses all reflective optics to collect emission at ninety degree angle and deliver signal – free from chromatic aberration – to the entrance slit of the emission spectrometer. The emission spectrometer may be optimized to detect signals into the near Infrared. Signal acquisition of the 400 to 800nm visible spectral region with resolution on order 0.2 nanometers full-width-half-maximum can occur in milliseconds using the charge-couple device (CCD) detector. Accessories for persistence measurements are available too.

The VUVAS+PL system is an integrated and total solution. The one-touch vacuum (purge) control system and software allow users to perform high quality deep and vacuum ultraviolet measurements more easily and with higher confidence. It complements high performance UV/Vis instruments found in many laboratories and provides solid performance for the deep and vacuum ultraviolet region.



Example Excitation and Emission Data: Excitation scan in 120 to 220nm region together with normalized emission of three samples; sodium salicylate,



Example Transmission Data: Measurements demonstrating precision; the VUVAS makes 0.05%T RSD measurements at a fixed wavelength, e.g. 157nm. Wavelength scanning over the 120 to 320nm region results in data better than 0.3%T RSD. Overall instrument stability is better than 0.5%T per hour

4. **Vacuum UV Universal Spectrophotometer (Reflectance / Transmission / Excitation or Emission Testing)**

McPherson presents unique systems to meet the requirements researchers across the world. McPherson's Universal VUV Spectrophotometer is a versatile system optimized for Phosphors, but also Reflectance, Transmission or Fluorescence.

Spectral Emission, Excitation and Luminescence Measurement ~ Optical Characterization

- 120 to 1800nm wavelength range
- 5 sample positions
- Lifetime / Persistence measurement capability
- PMT (optionally cooled) equipped with signal recovery
- Tunable monochromatic Excitation
- Tunable monochromatic Emission - optional CCD

Excitation and Emission

The excitation source is either a 30W or 150W CW Deuterium lamp with Magnesium Fluoride (MgF₂) window. The discrete excitation wavelength is selected by an optimized Vacuum UV McPherson Model 234/302 (f/4.5) 200mm scanning monochromator. Monochromatic excitation energy is collected and focused to the sample position. Alternate means of excitation are possible by use of accessory ports in the sample chamber, Excimer or customer's laser or x-ray sources.

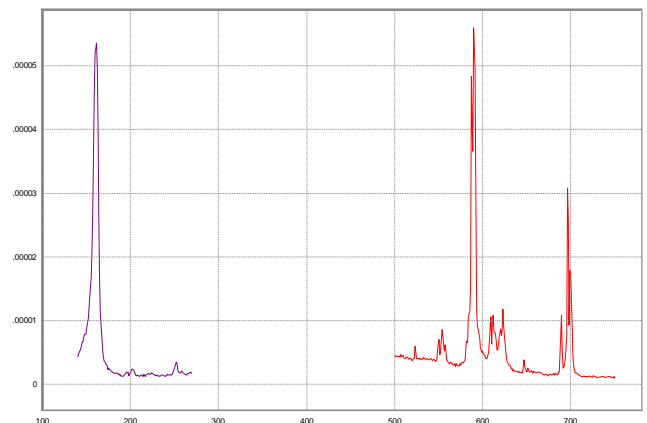


VUV (120 nm - Visible) Excited Phosphor System With VUV Emission (120 nm – Vis)

Emission spectra is detected with a McPherson Model 218 VUV high resolution 300mm scanning monochromator or a Model 2035 Visible to IR Spectrometer. It can scan from 105nm to far IR spectral region. If emission spectra are always >200nm, we can substitute the Model 2035 high resolution scanning spectrometer. The sample emission is collected and focused to the entrance slit. Many types of solar blind and/or cooled photomultiplier detectors can be fitted to the exit as can CCD or intensified CCD detectors.

When measuring reflection or transmission the excitation and emission monochromators can be scanned synchronously or one can be positioned at zero order. Scanning both instruments with an offset to reject fluorescence is also possible.

The McPherson Vacuum UV Spectrophotometer is designed for Transmission, Reflection and Emission measurements across a broad wavelength range. The system has a usable wavelength range of 115nm to 930nm - this can be expanded deeper into the Extreme UV or into the IR with addition of sources and detectors. The interchangeable sample holder(s) accept five 25mm diameter samples in the emission, transmission and reflectance positions. Samples can be indexed under vacuum. Electronics can be supplied as DC or pulsed for lifetime measurement. The optical, electrical and pumping systems are built into the supporting table for easy transport and set up. The computer sits on a separate table. All cables and lines are quick disconnect type and are labeled for easy set up. System are shipped as turn-key for installation in a customer's laboratory.



110 – 750 nm

Example Excitation/Emission Data: Eu phosphor