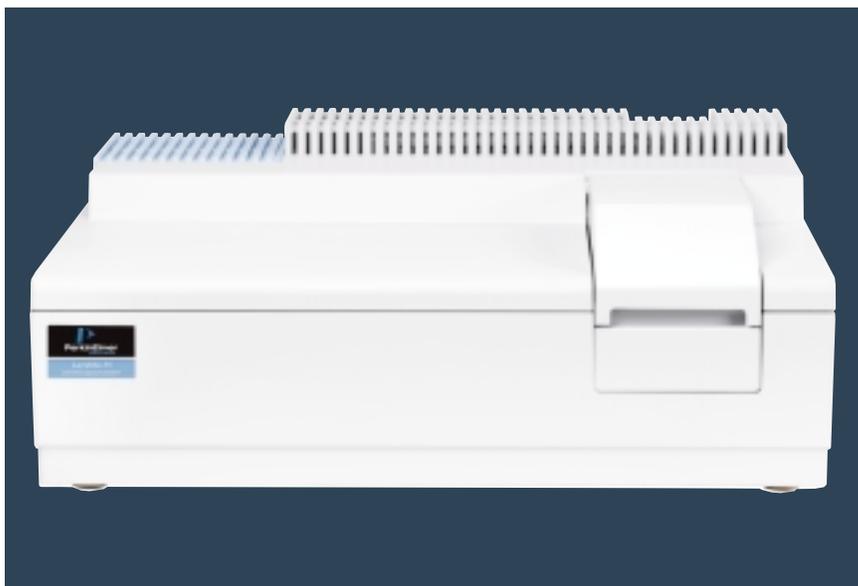


Diffuse Reflectance and Transmittance

The Lambda Series



When electromagnetic radiation in the UV/Visible wavelength range interacts with a sample, four results are possible: the radiation is absorbed, transmitted, reflected or scattered. Typically UV/Vis spectrometers are equipped to measure the transmittance or absorbance of a transparent solid or homogenous solution. However, when equipped with the proper accessories, UV/Vis instruments can measure the reflected and scattered energy from a sample.

Reflected radiation can be either specular or diffuse. An integrating sphere, when used in combination with the Lambda 35 spectrometer, is a valuable tool for collecting and measuring specular and/or diffuse reflectance. In addition, an integrating sphere can be used to capture the scattered light from a sample. The high-energy optical system of the Lambda 35 ensures

low noise measurements and dependable results. The Lambda 35 is controlled from a Windows® based computer using UV WinLab™ software. UV WinLab methods make routine data collection, analysis and reporting as easy as clicking a mouse. Application areas range from surface characterization and color measurements, to photometric analysis of translucent, transparent and turbid samples.

Collecting light from all angles

Our 50-mm machined Spectralon® integrating sphere makes use of the substitution principle in the spectrometer sample beam. The integrating sphere is a valuable tool for the quality control laboratory and can be used for a wide range of comparative measurements (relative to a standard sample).

Key Features

- ▶ Quality system for dependable results
- ▶ Comparative color measurements
- ▶ Diffuse reflectance and diffuse transmission measurements
- ▶ Spectralon® sphere for maximum reflectivity and long life
- ▶ Easy changeover from sphere to transmission samples
- ▶ Color measurement software available

The integrating sphere is placed in the sample beam of the spectrometer and is used in place of the sample beam detector. The instrument detector, external to the sphere, detects the reference beam as shown in Figure 1. The sphere can be used over the wavelength range of 250 nm to 1100 nm for either diffuse reflectance or diffuse transmittance. Figure 2 shows diagrammatically how the light enters the sphere, bounces around and ultimately ends up at the detector.

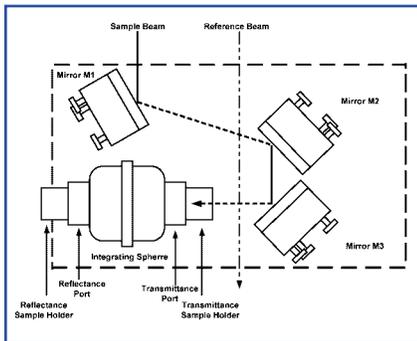


Figure 1. Optical schematics of the 50 mm integrating sphere for the Lambda 35.

By placing the sample at the entrance to the sphere, transmitted light enters the sphere and is collected and measured at the detector in diffuse transmittance mode. Figure 3 shows the spectra of two cardboard packaging material samples collected by a Lambda 35 with a 50-mm sphere. Alternatively, by placing a sample at the exit of the sphere, reflected light is collected and measured at the detector in diffuse reflectance mode (see Figure 4).

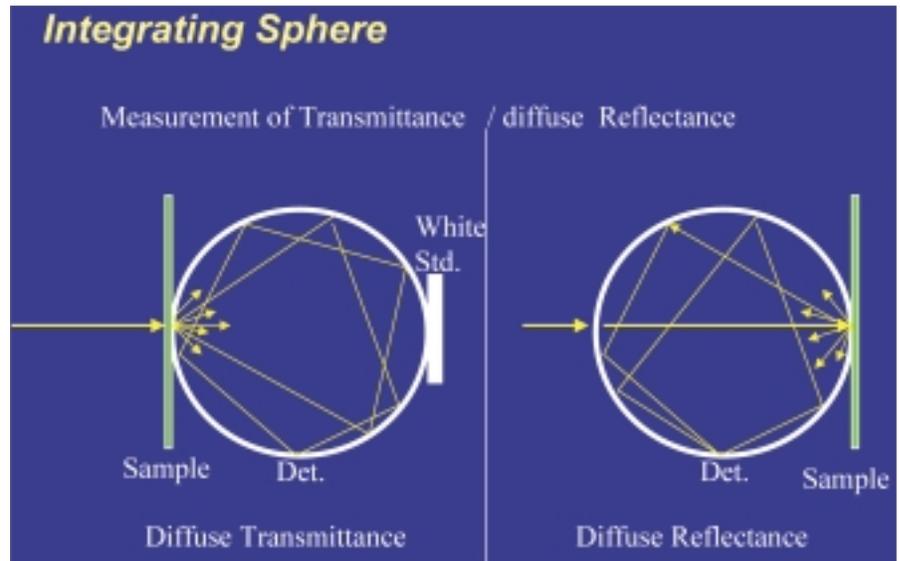


Figure 2. Measurement principles of the integrating sphere for the Lambda 35

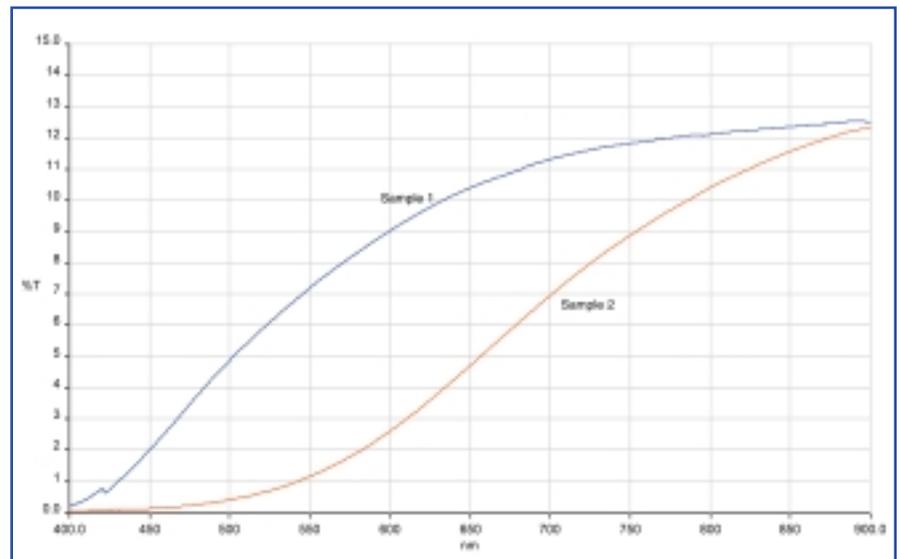


Figure 3. Average spectra of cardboard samples used as packaging material for milk. Measurement conditions; Lambda 35 with 50-mm integrating sphere. Sample in front of sphere (diffuse transmittance).

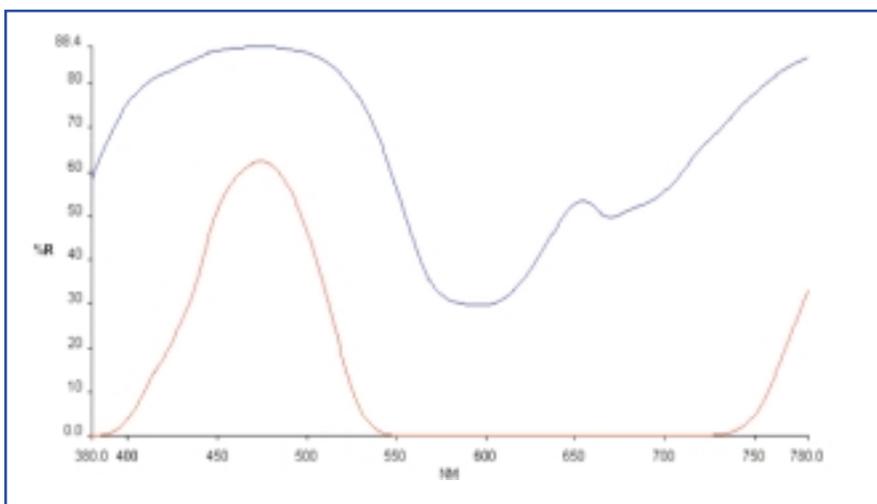


Figure 4. Comparison of two blue powder cosmetic formulations in diffuse reflectance.

Sample the possibilities

The Lambda 35 integrating sphere makes use of both the 0° specular excluded and 8° specular included geometries. A 0° transmittance port is standard and can accommodate samples up to 75 mm x 80 mm x 5 mm (width x height x depth). Reflectance samples up to 75 mm x 80 mm x 20 mm (width x height x depth) can also be measured.

The sphere is easily installed in the standard sample compartment of the Lambda 35 making it easy to switch between normal transmittance and diffuse reflectance/transmittance modes (see Figure 5). A cuvette holder for measuring the diffuse transmittance of liquids is provided as standard. In addition, a powder sample kit is available.



Figure 5. View into the Lambda 35 UV/Vis sample compartment with integrating sphere installed.

Color Measurement made easy

Color reproducibility is crucial to a consumer's impression of a product. Liquid, powder and solid color samples can be determined easily on a Lambda system configured with an integrating sphere. Our powerful ASSP software package includes a module for color evaluation according to CIE L*a*b, XYZ Tristimulus, Yxy Chromaticity, Hunter L*a*b and other standards organizations. Various illuminants and observers

are available for calculation according to various ASTM, CIE, AATCC or DIN norms. For additional information on the color measurement software, ask for Product Note: D-6290 Advanced Spectroscopy Software Package. Figure 6 shows the spectra of three differently colored plastics, and Figure 7 graphically presents the color values.

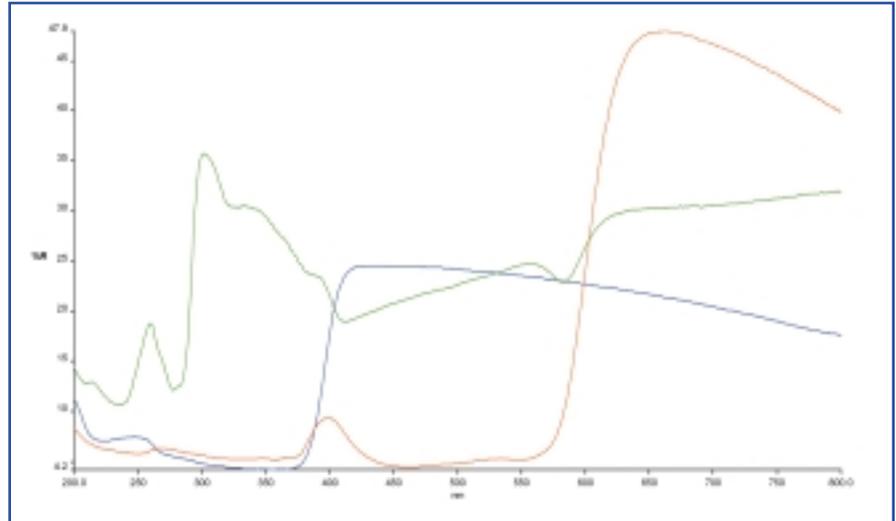


Figure 6. Reflectance spectra from 3 differently colored plastic samples measured with the Lambda 35 with integrating sphere.

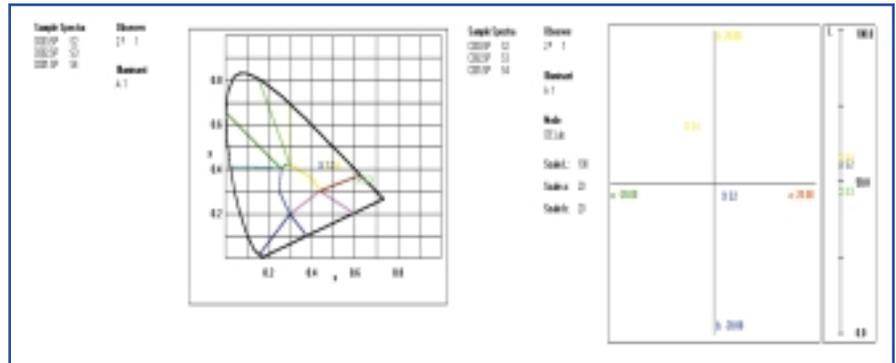


Figure 7. Graphical display of the color values obtained from above plastic samples spectra using ASSP software module.

Recommended Systems

The Lambda 35 UV/Vis spectrometer is a PC-controlled system operating with UV WinLab software. Therefore, a PC and printer are required.

Recommended Systems	
Spectrometer	Diffuse Reflectance/Transmittance Lambda 35 UV/Vis Spectrometer (P/N L600000C). Variable slits (0.5, 1, 2 and 4 nm), wavelength range 190 - 1100 nm. Includes software.
Software	UV WinLab software for instrument and accessory control
Integrating Sphere	Integrating sphere for Lambda 35 (P/N C6951014) for scattered transmittance and diffuse reflectance measurements. Spectralon sphere. Wavelength range 250 to 1100 nm.
Cell Holder	Cell holder for liquid samples (P/N B0505833) included.
Sample Holder*	Powder sample holder set (P/N B0505835).
Color Measurement Software*	ASSP software (P/N L6100000) for flexible data evaluation and color measurement.

*Optional

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