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PRODUCT SPECIFICATIONS

Thermo Scientific ISA-220 Integrating Sphere Accessory

For reflectance and transmission measurements of scattering materials

The Thermo Scientific™ ISA-220 Integrating Sphere Accessory can be setup in both reflectance and transmission configurations to extend the measurement capabilities of your Thermo Scientific™ Evolution™ Spectrophotometer. Ideal for measuring scattering solids and solutions, the ISA-220 can obtain transmission measurements of glasses, plastics, films, or turbid solutions and reflectance measurements of powders, solar cells, construction materials, and other refractory solids.

Introduction to scattering measurements

Measuring the transmission of light through scattering samples using a traditional sample holder will result in only a fraction of light reaching the detector. This can lead to reduced spectral quality and loss of information. Placing a scattering sample at the entrance port of an integrating sphere enables all the light that passes through the sample to be collected in order to obtain total transmission measurements (Figure 1). An integrating sphere also expands the capability of a spectrophotometer to collect total or diffuse reflectance measurements by positioning the samples at the exit port (Figure 2).

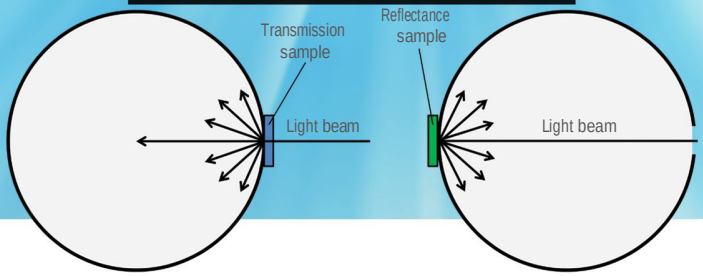

Figure 1: Transmittance measurements with an Integrating Sphere

Figure 2: Reflectance measurements with an Integrating Sphere

Evolution integrating sphere solution

The ISA-220 Integrating Sphere Accessory fits into the sample compartment of a Thermo Scientific Evolution 220 or Thermo Scientific Evolution 260 Spectrophotometer and is ideal for reflectance and transmission measurements of a variety of materials. The 60 / 50 mm diameter sphere delivers measurement performance to 3A and beyond, matching or exceeding the measurement range of larger more expensive spheres. The sphere is fully compatible with Thermo Scientific™ INSIGHT™ Software which features selectable application focused beam geometry (AFBG) settings to ensure the ideal sensitivity and resolution of your measurements. The ISA-220 is compatible with additional accessories that expand the measurement capabilities of the sphere including clips for solid samples, a cuvette holder for liquid samples that can accommodate cuvettes from 1 mm to 50 mm, and a powder cell holder to measure the reflectance of powders.

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Transmission measurements

The ISA-220 in the transmission configuration will enable the ability to accurately measure how much light passes through a solid or scattering material. (Figure 3). Measuring these sample types without an integrating sphere can result in an artificially low reading of the total transmittance since only the photons that pass through the material and stay on-axis will reach the detector.

Figure 3: ISA-220 in Transmission Configuration

Solids

The ISA-220 is ideal for measuring the transmission of UV or visible light through lenses, glasses, windows, plastics and films, or to evaluate the effectiveness of UV-absorbing coatings and additives in various materials. Plastics with a curved shape can be difficult to measure with a standard transmission accessory due to light scattering. Because of this, an integrating sphere is the optimal accessory for measuring the spectral transmission through pharmaceutical bottles as described in USP <671> Containers – Performance Testing and USP <661.2> Plastic Packaging Systems for Pharmaceutical Use (Figure 4).

Figure 4: An example of plastic pharmaceutical bottes used for spectral transmission measurements

Liquids

Solutions with suspended particles will scatter light at all wavelengths in addition to the electronic absorbance associated with the species in solution that you wish to analyze. The ISA-220 integrating sphere with an attached cuvette holder captures all forward scattered light which makes your measurements of scattering solutions more accurate, more reproducible, and far less dependent on the distribution of particle sizes in solution than they would be in a simple cuvette experiment. Additionally, the cuvette holder can be extended to measure cuvettes with pathlengths of up to 50 mm (Figure 5).

Figure 5: The ISA-220 integrating Sphere can measure cuvettes with a pathlength up to 50 mm

Reflectance measurements of solids

The ISA-220 is ideally configured to measure total reflectance and diffuse reflectance of solids (Figure 6). Light reflected off the sample surface at all angles is captured and measured by the sphere and single beam substitution error is virtually eliminated when you select the unique automated correction feature in INSIGHT Software. The accessory is perfect for measuring the reflectance of semiconductor powders, construction materials, refractory solids, solar cells, and inorganic chemicals that cannot be measured in solution. Reflectance measurements can also be used to gain information on the electronic properties of crystalline materials and coatings.

Figure 6: ISA-220 in Reflectance Configuration

If measuring the reflectance of paints or other colored materials, select the appropriate range for the color scale of your choice and use Thermo Scientific™ VISION*lite*™ ColorCalc Software to determine relative color consistency and quantitatively evaluate color differences between samples. The ISA-220 was used in the reflectance configuration to evaluate the color difference between four paint samples. The % reflectance spectra of the samples are shown in Figure 7. Table 1 lists the differences in the CIE L*a*b* Color values (a widely used international scale which represents color in three dimensions) that were automatically calculated from the spectral data in Figure 7. Sample 1 was used as the basis for comparison. Using these values, the software calculated the ΔE which is a common measurement of color difference. The color difference data can then be used as a metric to ensure sample quality in production.

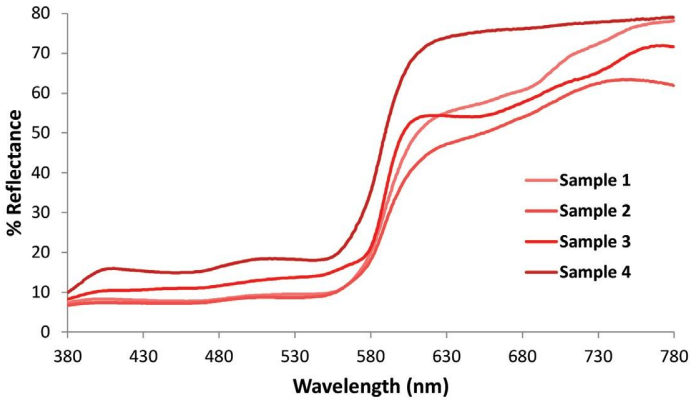

Figure 7: Red paint sample comparison data

Paint Samples	ΔL*	Δa*	Δb*	ΔE
Sample 1	0	0	0	0
Sample 2	-2.38	-3.64	-2	4.79
Sample 3	4.07	-6.24	-2.86	7.98
Sample 4	11.87	-2.75	-0.8	12.21

Color evaluated from 380 nm – 780 nm with an illuminant of D65 and an observer of 10 degrees

Table 1: Red paint sample CIE L*a*b* color difference data

Figure 8: Powder Cell Holder Kit for ISA-220

Measurements of powders

The ISA-220 can be expanded to measure powders by reflectance using the Powder Cell Holder Kit (Figure 8). Ideal for measuring flavorings, catalysts, coatings, polymers, or simply materials that cannot be measured when dissolved in solvent, the powder cell holder is ideal for a variety of applications. The powder cell holder comes with a reference cell filled with a Spectralon® plug and a sample cell where a spring and piston design carefully compresses the finely ground sample for accurate measurement. For total reflectance measurements that rely on an 8° mounting angle for the sample, a convenient alignment block positions the powder sample holder perfectly over the reflectance port of the sphere.

ISA-220 specifications

Parameter	Specification
Operation	
Wavelength range	220 nm – 1100 nm
Measurement range	Up to 3.6A Down to less than 0.1%T or 0.1%R
Maximum transmittance sample size	60 mm high x 60 mm wide x 50 mm thick
Maximum reflectance sample size	60 mm high x 60 mm wide x 40 mm thick
Compatible Instruments	Evolution 220, 260 Bio
Spectral bandwidth(s)	Variable: 2.0 nm, AFBG Materials
Cuvette size	1 mm – 50 mm
Integrating Sphere	
Diameter	60 mm / 50 mm (optional selectable)
Optical design	Single Beam
Reflective surface	Spectralon
Sphere reflectivity	>99%
Detector	10 mm x 10 mm Silicon photodiode
Port fraction	Transmission 1.95%, SPIN 2.27%, SPEX 3.02%

Find out more at **thermofisher.com/isa**

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