

Integrating Sphere Reflectance

Remote reflectance measurements from solid surfaces for spectral and color analysis

Hardware

The fiber optic coupled integrating sphere provides diffuse uniform illumination to measure *reflectance* from samples of varying gloss and texture. The fiber optic coupling allows for measurements on large panels that are otherwise impossible to measure in traditional bench top spectrographs and color measuring instruments. The fiber coupling also allows for quick and easy conversion of the instrument back to a laboratory grade spectrophotometer. The sphere is configured for *specular* and *diffuse* reading of the sample. The wavelength range of the sphere is 250 nm 980 nm and custom coatings are available.

Software

The *colorimetry* software for the Series 400 Spectrophotometer provides a full range of colorimetry calculations in an intuitive Windows® based application. Values in *Tristimulus, CIE Chromaticity, CIELAB, CIELUV and Hunter Lab* as well as industry unique scales are available. The standard laboratory instrument software can also be used with the reflectance integrating sphere for transmission and absorption measurements from 350 to 980nm, which are out of the colorimetry range.

Configuration

The 4-inch diameter sphere has 4 ports; lamp, fiber, reference and sample. The smaller ½" port is for the lamp. The port opposite the lamp can be used as a reference port to improve sampling accuracy. The sample port is 90° from the lamp port and has a baffle to prevent the light from the lamp directly illuminating the sample. The collecting fiber port is 180° from the sample port. For accurate low noise measurements the collection fiber is mounted to an external shutter which provides for automatic dark current correction.

(Continued other side)

Lamp port

A lamp is mounted on one of the sphere ports at 90° to the sample port and there is a baffle to block direct illumination of the sample. The internal tungsten lamp is conveniently powered from a connector on the front of the Model 430 or 440 Spectrophotometer. The instrument's internal power supply and lamp circuitry provides very stable regulated power to the lamp. The lamp is a long life (2000 hr) low color temperature tungsten halogen.

Sample port

The fiber numerical aperture and the spectrometer optics limit the sample area to about a 3/4-inch diameter at a 4-inch distance. Smaller spot sizes can be achieved with the use of the port reducers. The sample should be placed as close to the sample port opening as possible. The sample should also be placed at the same distance each time. The sphere is supplied with a general-purpose stand.

Fiber port

The fiber port is where the light is collected and transferred to the spectrometer. For large objects, fiber optic cables as long as 20 feet can be used to increase the distance of the integrating sphere from the instrument.

Reference port

A small amount of the light reflecting off of the object placed in front of the sample port will reflect back into the sphere, bounce around and then eventually strike the sample again. Since this light has already been filtered by the sample it is no longer white light and can cause a minor effect on the measurement if the sample is very dark. To eliminate this effect the blank measurement is taken with the sample or similarly colored object in the reference port. The white reflectance standard in the sample area is then switched to the reference port during sample measurements. This minor effect may not have a relevant impact on their measurement accuracy but is available if needed.