

SERIES 450 Extruder Diffuse Reflectance Probe

Diffuse reflectance spectroscopy is the technique of choice for highly scattering materials such as soft or hard organic powders, tablets, fermentation broths, slurries, food, textiles, non-wovens and polymer beads. Diffuse reflectance measurements greatly simplify sample preparation. Sampling is as easy as touching the tip of the probe against the sample's surface. The technique relies on the phenomenon that takes place when IR radiation reflects off a rough surface or highly dispersive liquid. Under such conditions, the radiation is reflected, absorbed, scattered and transmitted at the sample's surface. The diffusely reflected light is collected by a probe and directed onto the spectrometer's detector, producing an IR spectrum. Only the part of the beam that is scattered within the sample and returned to the surface has significance in diffuse reflection measurements.

PSD's Dynisco-type Extruder Diffuse Reflectance Probe Assembly is a precision optical instrument that is designed for high performance near-IR, UV or visible sampling. The optical design and performance of this probe is the same as the Series 400. This probe is used to collect and transmit reflected radiant energy from polymer materials in reactors, extruders, injection molding machines, etc. The probe tip is machined to conform to the standard Dynisco-type 1/2"-20 UNF configuration. The probe screws into a compatible machined well in the polymer mechanism, where the tip of the probe is flush with the inside wall of the machine and in direct contact with the material. The probe can also be screwed into a PSD Model CLS High Pressure Cross-Line Spool piece that can be attached to the barrel of an extruder or injection molding machine.

The probe body is normally fabricated from 316/316L stainless steel, or the metal specifically requested, with an embedded sapphire window. A major advantage and unique design feature of this probe is a proprietary sapphire-to-metal seal capability. This technique eliminates the use of O-rings or a brazed joint that can limit the long-term operational reliability of the sapphire window seal. This capability enables these probes to operate up to 300°C and 5,000 PSI. The sapphire window is chemically inert and has a very hard surface that resists etching from caustic solutions and scratching from the polymer material. The tip of the probe has no gaps or crevices to retain the sample and can be very easily and quickly cleaned. This probe can also be provided in a purged configuration using a vortex cooler (Ranque-Hilsch Tube) to provide long term reliable operation at polymer process temperatures up to 400°C.

A flexible bundled fiber optic assembly is an integral part of the probe. The standard assembly consists of 200 micron low OH silica fiber, other sizes are available based on customer requirements. The end of the fiber assembly are terminated with SMA connectors. However, the fiber termination can be changed to satisfy the specific connection requirements of any spectrometer. The length of the micro-bundle fiber optic assembly can be made to satisfy specific customer requirements.

The energy source of the spectrometer is focused onto the end of one of the fiber optic assembly's legs. Very low loss, high throughput silica fibers are used to transmit the near-IR, UV or visible energy to the probe body. The transmitted energy interacts with the sample material and the diffuse reflection is collected through the sapphire window and the second portion of the fiber optic assembly transmits the energy back to the spectrometer for analysis. The probe houses the transmit and collection fibers in a special tip configuration. This probe uses a special, optically designed sapphire window concentrator that virtually eliminates undesirable specular reflectance while it very efficiently collects the diffuse reflectance component from the sample. The fibers are contained in a very rugged, flexible sheathing material.

PRODUCT HIGHLIGHTS & SPECIFICATIONS

- No O-rings or brazed joints to fail
- Optional UV and visible light sampling
- High sensitivity with minimal spectral reflection or background noise (<1%)
- Robust and inert construction for industrial process applications

- Alternate material per customer request to construct probe
- Internal purge capability available for higher temperature applications
- Proprietary sapphire-to-metal seal providing robust and inert design
- Capable of operating up to 300°C and 5,000 PSI