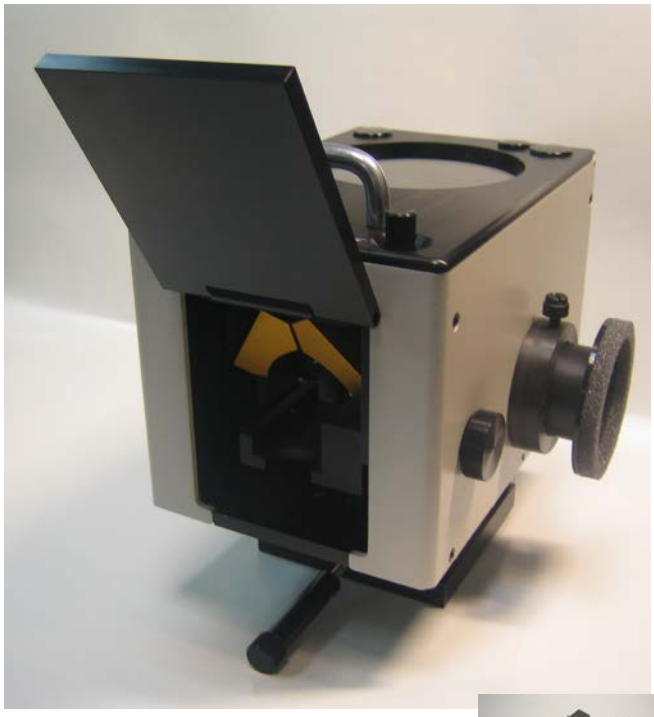
The Praying Mantis Diffuse Reflectance Accessory



Design for an easy and reliable analysis of solids, powders and catalyst, the Praying Mantis™ was the first generally available diffuse reflection attachment and remains the forerunner in the field. It incorporates two 6:1, 90°off-axis ellipsoids which form a highly efficient diffuse reflection illumination and collection system.

This unique configuration deflects the specular reflectance away from the collecting ellipsoid, minimizing the associated spectral distortions.

If needed, diffuse reflection measurements under controlled pressure, atmosphere and temperature also can be done using the dedicated reaction chamber.

Two models are available:

- a high-Temperature Low Pressure Reaction Chamber for operation from high vacuum (10^{-6} torr) to 3,44 MPa and at high temperatures (up to 910°C under vacuum).
- Low Temperature Chamber for studies from high vacuum (10^{-6} torr) to 133kPa and at temperatures from -150°C to 600°C (under vacuum).

Features:

- Highly efficient collection system.
- Minimizes the detection of the specular component.
- Ellipsoids pivot to provide easy access to the sampling area.
- Allows easy attachment of reaction chambers.
- Several models offered for compatibility with a wide range of IR-UV-VIS spectrometers.
- Exclusive PermaPurge™allows rapid exchange with minimal interruption of the system purge.
- Includes Cart with two mounted alignment mirrors.
- Two sampling cups: 10mm (0,25ml) adjustable height and 3mm (0,03ml) adjustable microsampling.
- Three inlet/outlet ports permit evacuation of the cell and introducing gases

High/Low Pressure
Reaction Chamber

Low Temperature
Reaction Chamber

The Praying Mantis™ was the first generally available diffuse reflection accessory (DRA) and remains the forerunner in the field today. It is ideal for reliable diffuse reflectance studies of powders and other rough surface solid samples.

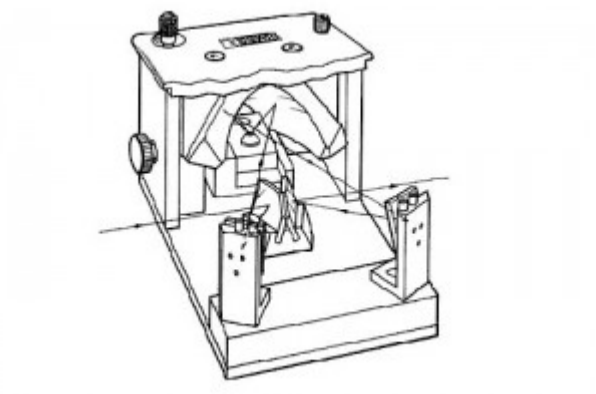


Figure 1. Interior View of the DRP.

The typical optical configuration of the Praying Mantis™ Diffuse Reflectance Attachments is shown in Fig. 1. The DRA incorporates two 6:1 90° off-axis ellipsoidal mirrors. One ellipsoid focuses the incident beam on the sample while the second collects the diffusely reflected radiation from the sample. Both ellipsoidal mirrors are tilted forward so the diffusely reflected radiation is collected at an azimuthal angle of 120°. This deflects the specularly reflected component behind the collection ellipsoid, minimizing the intensity of restrahlen bands caused by the specularly reflected light. Most other commercially available attachments collect the diffusely reflected light at 180°, where the restrahlen bands have maximum intensity. This optical geometry permits collection of up to 20% of all the diffusely reflected radiation, making the DRA quite practical for routine measurements.

The Praying Mantis™ can be used to examine powders and small solid samples. The sample is placed in one of the diffuse reflectance supplied sampling cups on the Praying Mantis™ sampling stage. The height of the stage can then be adjusted for optimal performance. The micrometer-style height adjustment allows for accurate and reproducible positioning of the sample. For easy access to the sampling area, the Praying Mantis™ features the ability to flip its illumination and collection ellipsoids away from optical plane of the attachment.The Praying Mantis™ also features PermaPurge™ and hence is enclosed in a purgeable box for rapid sample exchange with minimal interruption of the purge. This eliminates interference from water and carbon-dioxide bands in the infrared spectra.

The Praying Mantis™ is ideal for studying samples in a controlled environment and several optional environmental chambers are offered. Our Ambient Sample Chamber is designed for analysis of air-sensitive samples. The samples can be loaded in a glove box or similar enclosed environment. The chamber can then be sealed, removed from the glove box, and inserted in the Praying Mantis™ for diffuse reflectance analysis.

This Ambient Sample Chamber features a removable stainless steel dome with two KBr or UV quartz windows and a glass observation window.

Two additional reaction chamber models (see separate data sheet) are also available for use with the Praying Mantis™ diffuse reflectance accessory. These reaction chambers are designed for operation in static or flow conditions. Our Low Temperature Reaction Chamber is designed for operation up to 133 kPa (1 ktorr) and for temperatures ranging from -150deg;C to 600deg;C. Our High Temperature, Low Pressure Reaction Chamber operates at temperatures up to 910deg;C (under vacuum) and from pressures of 133 µPa (10^{-6} torr) to 133 kPa (1 ktorr). With its optional High Pressure Dome, this chamber can withstand pressures up to 3.44MPa (25.8 ktorr). This reaction chamber can be purchased as part of a kit including the Praying Mantis™, Temperature Controller and comprehensive sampling tools (mortar and pestle, KBr powder, finger cots and spatula).

Representative DRIFTS spectra recorded with the Praying Mantis™ are shown here in Figures 2 and 3. Note that Figure 3 was recorded using the DRA with its HVC reaction chamber.

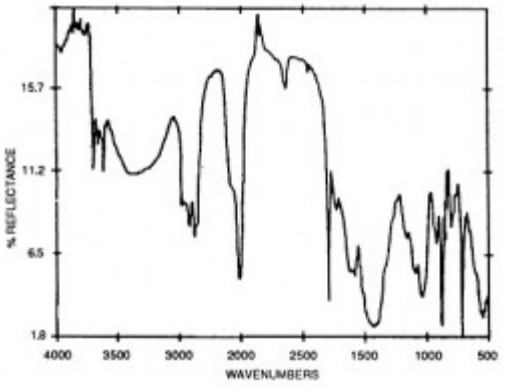


Figure 2 (left). Diffuse Reflection of Chalk.

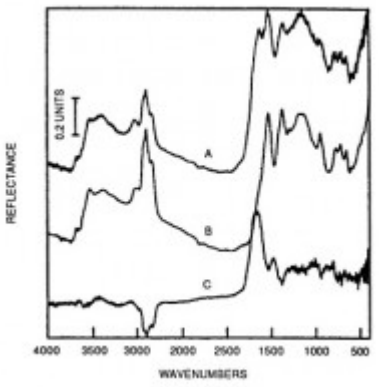


Figure 3 (right). Diffuse Reflection of Wyodak Coal (A) after 24hrs of oxidation at 2.4KPa at 393deg; C, (B) dried unoxidized samples and (C) the difference spectrum (A-B).