



## REACTION CHAMBERS FOR THE PRAYING MANTIS

### APPLICATIONS

- ▶ Allows diffuse reflection measurements under controlled pressures and a wide range of temperatures.
- ▶ Used in conjunction with the Praying Mantis Diffuse Reflection Accessory.

### FEATURES

- ▶ Two models available:
  1. High Temperature, Low Pressure Reaction Chamber (HVC-DRP) for operation from high vacuum ( $10^{-6}$  torr) to two or three atmospheres and at high temperatures (up to 600°C under vacuum). Readily adapted for high-pressure operation with a high-pressure dome assembly. Use with the ZnS high-pressure dome (HVC-DWI-1) for operation to 500 psi.
  2. Low Temperature Reaction Chamber (CHC-CHA) for studies from high vacuum to two or three atmospheres and at temperatures from -150°C to 600°C (under vacuum).
- ▶ Three inlet/outlet ports provided for evacuating the cell and introducing gases.
- ▶ Made of chemically resistant 316 stainless steel.



Low Temperature  
Reaction Chamber

### INCLUDES

- ▶ Reaction Chamber.
- ▶ Heating cartridge.
- ▶ K-type thermocouple.
- ▶ Dome with two KBr windows and one glass observation window.



High Temperature Reaction Chamber

#### WINDOWS FOR VACUUM CHAMBERS

MATERIAL	CATALOG NO.
SiO <sub>2</sub>	WAD-U23
Si	WED-U23
CaF <sub>2</sub>	WFD-U23
ZnS	WID-U23
ZnSe	WMD-U23
KBr	WPD-U23

#### HIGH PRESSURE DOMES FOR THE HVC-DRP

MATERIAL	CATALOG NO.
ZnS	HVC-DWI-1
Ge	HVC-DWJ-1
ZnSe	HVC-DWM-1

### ORDERING INFORMATION

High Temperature Reaction Chamber (110V).....	HVC-DRP-1
High Temperature Reaction Chamber (220V).....	HVC-DRP-2
Low Temperature Reaction Chamber (110V).....	CHC-CHA-1
Low Temperature Reaction Chamber (220V).....	CHC-CHA-2

#### OPTIONS & REPLACEMENT PARTS

Automatic Temperature Controller (110V).....	ATC-001
Automatic Temperature Controller (220V).....	ATC-002
Screen Set, two each of three mesh sizes.....	116-439
Heater, 100W (110V).....	HSC-251.25
Heater, 100W (220V).....	HSC-251.25-2
K-Type Thermocouple.....	008-144
Vacuum Pump (110V).....	PDC-VP
Vacuum Pump (220V).....	PDC-VP-2

Diffuse reflection spectroscopy is a very sensitive method for detecting changes at the surface of rough materials. It is particularly effective for powders with a high surface area. This makes diffuse reflectance a valuable tool for catalysis, oxidation, and photochemical studies. However, measurements for these applications must be obtained in a carefully controlled environment.

For this purpose, Harrick Scientific offers two reaction chambers for use in conjunction with the Praying Mantis Diffuse Reflection Attachment. Both reaction chambers are constructed of chemically resistant 316 stainless steel and can be heated up to at least 600°C under vacuum. The reaction chambers feature a sample cup that is part of a temperature-controlled sample stage. This stage incorporates a cartridge heater and K-type thermocouple. The electrical leads to the heater and thermocouple are located on the outside of the chamber for convenience. The stage is thermally isolated from the outer chamber. A water-cooling jacket is provided to control the temperature of the outer chamber and windows during high and/or low temperature operation. The reaction chamber also features three gas ports for evacuating, pressurizing or flowing gas through the sample. These ports have 1/4" VCO fittings with Viton o-rings. One of these ports leads directly under the sample cup; the other two lead into the sides of the chamber.

Optically, the reaction chambers are designed to minimize reflection losses from the windows and maximize light interaction with the sample. The radiation enters and exits the chamber perpendicular to the two optical apertures. A third aperture is provided for viewing, illuminating, or irradiating the sample. This makes the reaction chambers useful for photochemical studies. Both reaction chambers include two KBr windows and a glass observation window. These windows are mounted in a removable stainless steel dome using o-ring seals. Both reaction chambers can be operated from high vacuum to two or three atmospheres with the KBr and glass windows provided. Other window materials are available for higher operating pressures and for different wavelength regions. Low refractive index window materials should be selected to minimize reflection losses.

The High Temperature Reaction Chamber, HVC-DRP, is designed for operation from room temperature up to at least 600°C under vacuum. It can be adapted for use at high pressure by simply replacing the dome assembly. The high-pressure dome assembly utilizes a hemispherical optical window mounted in a stainless steel dome. ZnS is the standard optical material for high-pressure operation due to its superior mechanical strength and good transmission properties in the mid-infrared. With the ZnS window, the reaction chamber can be operated at pressures to up 500 psi. Note that for high-pressure operation, the maximum temperature limit could be lower due to energy losses that depend on properties of the gas, characteristics the sample, and the operating pressure. For optimal temperature control, Harrick Scientific

recommends our Automatic Temperature Controller for gradual heating of the system. Heater and thermocouple connectors are compatible with this controller.

The Low Temperature Reaction Chamber, CHC-CHA, is designed for operation from -150°C to 600°C under vacuum. In addition to the heater incorporated in the sample stage, the CHC also features a cooling conduit connected to a dewar. The dewar can be filled with liquid nitrogen or other coolant to cool the sample stage below room temperature. For optimal temperature control, Harrick Scientific recommends our Dual Automatic Temperature Controller for gradual heating of the system, both above and below room temperature. Heater and thermocouple connectors are compatible with this controller.

To evacuate these chambers, use our highly reliable, compact, low-noise level PDC Vacuum Pump with a minimum pumping speed of 1.4m<sup>3</sup>/hr. Compliant with international standards, it is ideally suited both for use with Harrick equipment and for general use in chemistry and research laboratories. Hermetically sealed by oil pressure controlled valves, the vacuum chamber is protected against inadvertent venting and oil backstreaming. This vacuum pump is supplied with a three foot length of 1/2" ID vacuum tubing and with the hardware to connect this tubing to the pump. Connections between this tubing and the HVC or CHC fittings (Cajon SS-4-VCO-1) are provided by the user.

Figure 1 shows several spectra recorded with the High Temperature Reaction Chamber in the Praying Mantis Diffuse Reflection Attachment. Harrick's Automatic Temperature Controller was used to regulate the temperature.

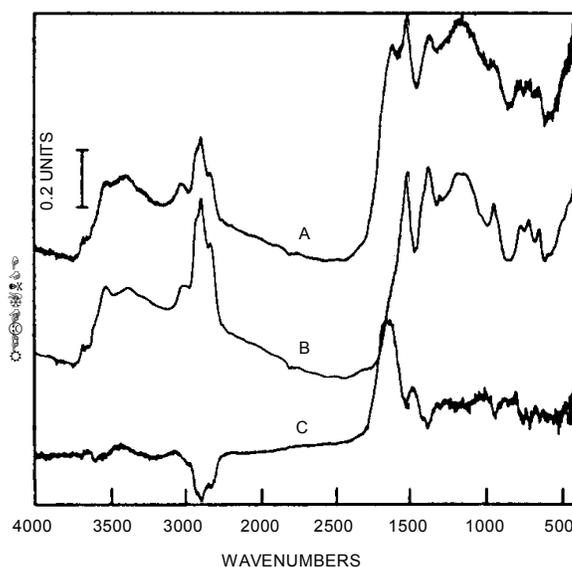


Figure 1. Diffuse Reflection of Wyodak Coal a) after 24 hrs. of oxidation at 2.4KPa at 393°C, b) dried unoxidized samples, and c) the difference spectrum (a-b).