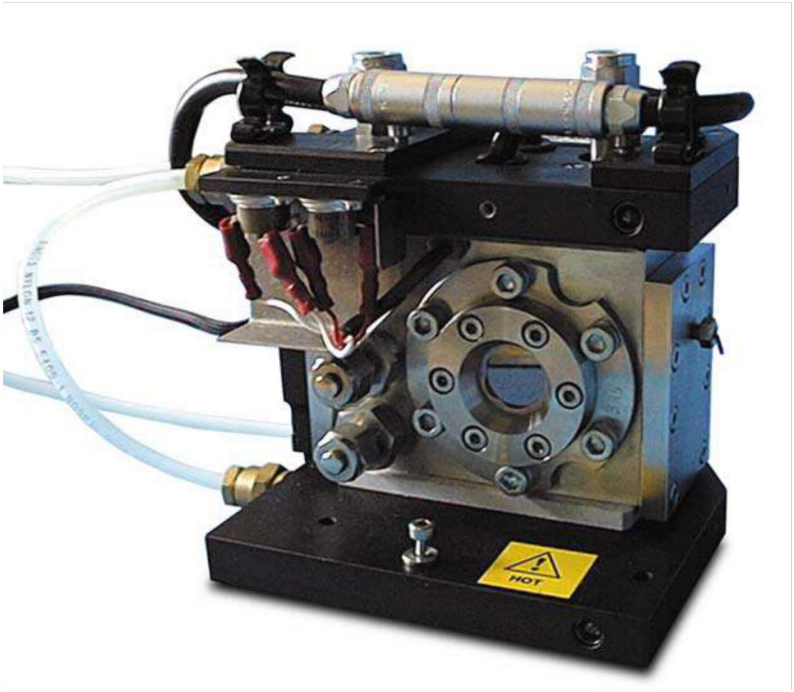
Keywords: HTHP Cell, Transmission, Decomposition, Specular Reflectance

P/N GS05850/GS05855 High Temperature High Pressure (HTHP) Cell Modes of Operation



The High Temperature High Pressure (HTHP) Cell P/N GS05850 has the capability of being operated at temperatures approaching 800°C and pressures up to 1000psi. In terms of its absolute limits of operation, the maximum temperature achievable by the HTHP Cell is at vacuum conditions, circa 10^{-4} bar (10^{-1} torr). Samples analyzed in a pressurized environment at 1000psi tend to be limited to approximately 550°C to 600°C in temperature in this accessory, the overall temperature being determined by the thermal conductivity of the specific gas at a particular pressure.

The HTHP Cell is supplied as standard with ZnSe windows, which allow for a wide frequency range of spectral analysis. Power is supplied by a dedicated temperature controlling system to the heating sample post and to heaters for the window assemblies. There are four gas connection ports on the cell, but one of them must be permanently connected to an over-pressurisation safety device called the burst disc assembly. The three other ports can be used for introducing different gases to be mixed and studied within the cell. Water cooling to external plates allows for safe operation, minimising the external heat from the cell when operating at temperatures up to 800°C. Thermal fuses are fitted to cut power to the heaters of the cell if the cooling water supply is interrupted.

The HTHP Cell as P/N GS05850 can be operated in transmission or decomposition mode. For the transmission mode of operation the sample is mounted as a solid 13mm disc into the sample heating post of the cell. The source of light radiation passes through the 13mm disc which is enclosed in a surrounding gas chamber, set to the operating conditions obtainable for the cell. The pathlength of the cell between the internal window face assemblies is 30mm in the transmission mode and the volume of the cell is $80cc^3$.

For the decomposition mode of operation, the 13mm sample disc, or a sample powder, fluid or gum is placed into a separate decomposition pan that rests in an alternative part of the sample heating post. Vapors that may evolve from the decomposition pan, generated from heating and/or depressurization of the surrounding gas in the enclosed chamber, are analyzed by the radiant light beam as it passes through the cell and over the decomposition pan.

An advanced version of the HTHP Cell, P/N GS05855, also includes an alternative baseplate and wedged, pressure certified ZnSe window assembly to allow the cell to operate in a specular reflectance mode. (See Specac document HTHP Parts). The sample MUST be a solid 13mm diameter disc when operating in this mode as the radiant light beam enters the cell through the wedged window from underneath the cell and is specularly reflected off the surface of the sample to exit through the same window. Because the IR beam enters the cell from below (deflected off a mirror on the baseplate), the sample cannot be loose or powdery as it would not be retained in the sampling position. Similarly, fluids or gum like substances cannot be analyzed in this mode of operation.

Depending on how the HTHP Cell is configured, either for transmission or reflectance measurements, it can be considered as a very flexible accessory with wide ranging applications for determining the type of information obtainable from a sample. Transmission spectroscopy is useful for total content measurement of a sample, whereas reflection spectroscopy is useful for surface information.

Typical examples of some applications are as follows: -

In catalysis and oxidation studies whereby a gas may interact on a solid surface at specific temperatures and pressures and the chemical process can be measured spectroscopically.

Samples that exhibit polymorphism as a function of physical state can be studied within the cell.

Solid fuels e.g. coals and oils can be heated and their evolved vapors can be measured quantitatively and qualitatively.

The effect on gases/vapors at high temperatures and pressures.

The effect of high temperatures and pressures on transmission and reflection properties of solid materials.

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