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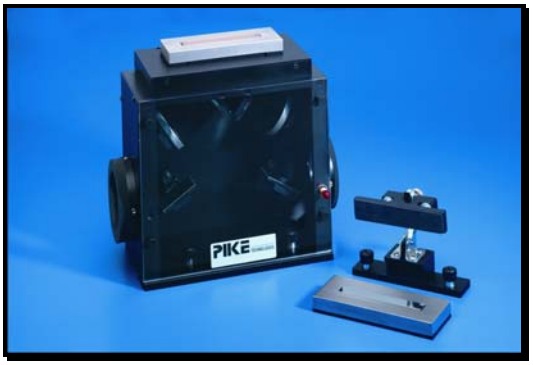
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Multiple Reflection HATR – *Maximum Sensitivity and Highly Versatile FTIR Sampling*



PIKE Technologies HATR Accessory – in-compartment HATR for liquid and solid samples.



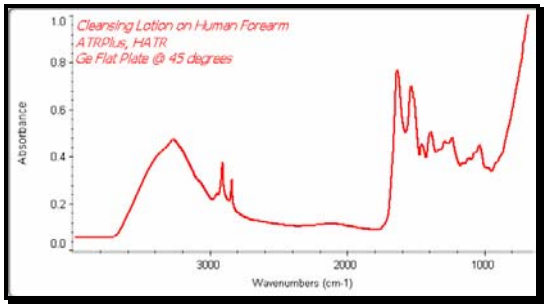
PIKE Technologies HATRPlus™ Accessory – out-of-compartment HATR for liquid and extra large solid samples.

Horizontal Attenuated Total Reflectance (HATR) accessories successfully replace constant path transmission cells, salt plates and KBr pellets used in the analysis of liquid, semi-liquid materials and a number of solids. HATRs feature a constant and reproducible effective pathlength and are well suited for both qualitative and quantitative applications. In general, sampling is achieved by placing the sample onto the HATR crystal – generally eliminating sample preparation.

PIKE Technologies HATR products are available in 2 base optic configurations. The HATR is an **in-compartment** design for samples which fit into the FTIR sample compartment.

The PIKE Technologies HATRPlus™ is an **out-of-compartment** design for samples which are larger and do not fit into the FTIR sample compartment. The sampling surface of the HATRPlus extends above the FTIR cover, thereby permitting analysis of very large samples. Applications examples include; coatings on large manufactured components, layered composition analysis on large objects, and skin analysis in the health care industry.

The PIKE Technologies HATRs are high performance accessories, carefully designed to provide excellent results with minimum effort. The accessories are easily located in the sample compartment, locking into position on the sample compartment baseplate.



FTIR spectrum of cleansing lotion on human forearm - using the HATRPlus with flat plate Ge crystal.

Stable alignment provides excellent analytical precision. Crystal plate changeover is rapid, allowing a wide range of samples to be analyzed with maximum convenience. PIKE Technologies HATRs have been optimized for maximum optical throughput and excellent quality spectra can be obtained from demanding samples. Several high quality crystal materials, covering a full spectrum of applications are available. Trough crystal plates are sealed using metallic gaskets, eliminating premature failure and the risk of cross-contamination associated with inferior, epoxy-bonded systems. Flat crystal plates are designed with positive surface relief to aid in improved sample contact.

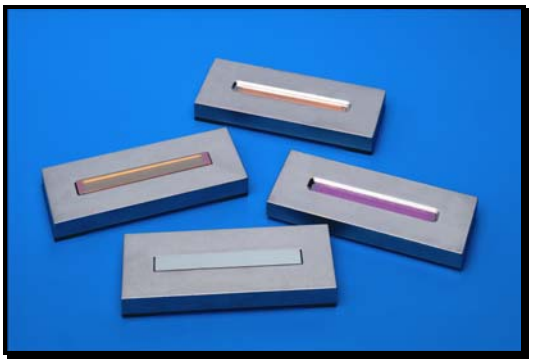
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PIKE Technologies HATR Features;

- **Excellent energy throughput offering high signal-to-noise ratio and spectral quality**
- **Up to 17 internal reflections for maximum sensitivity for low concentration components**
- **Removable crystal plates with pinned positioning for high precision and quick cleanup**
- **HATR plates with ZnSe, KRS-5, Ge, AMTIR or Si crystals with selectable face angles to optimize sampling depth**
- **Unique trough crystal sealing - eliminating epoxy degradation or contamination and prevents breaking from thermal shock**
- **Flat plate crystal mounting with positive surface relief - improving sample contact**
- **Sample clamp, powder press and volatiles cover options**
- **In-compartment (HATR) and out-of-compartment (HATRPlus) versions for small and extra large sample sizes**
- **Several temperature controlled and flow- through crystal plate options**

All PIKE HATRs include a purge tube interface for the FTIR spectrometer. This provides full integration of the accessory with the FTIR spectrometer's purging system (sealed and desiccated or purged) and removal of water and carbon dioxide artifacts from the FTIR spectra. Thanks to this, purging is very efficient and the spectrometer can be operated with the sample compartment door open.

HATR Crystal Plate Choices



PIKE Technologies Crystal Plate Choices – for the HATR and HATRPlus.

PIKE Technologies HATR crystal plates are available in trough and flat plate configurations.

The **trough plate** is designed for easy sampling, with a large, recessed crystal to accommodate the sample – generally a liquid, powder, or paste. The trough plate is ideal when samples must be cleaned from the crystal with some type of aqueous or organic solvent.



Trough plate HATR crystal plate – ideal for liquids, powders, and pastes and gels

Proprietary PIKE Technologies Crystal Seal

PIKE Technologies HATR trough plates feature a unique crystal seal. The crystal is attached to the plate mechanically and sealed with a special metallic gasket. Thanks to this design, the plate is completely leak proof and works well at high and low temperatures. No o-rings, glue or epoxy resins are used in the crystal plate assembly.

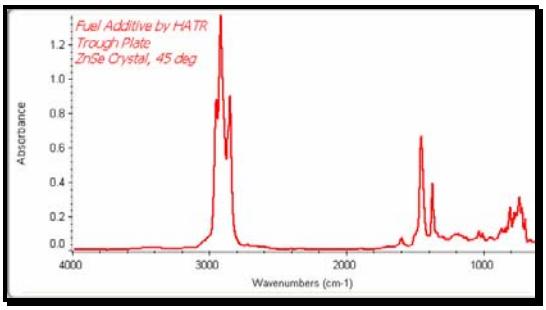
Our metallic seal is a soft metal with brilliant luster and has been found to be an excellent gasket material. The metallic seal is placed between the crystal and the supporting plate and then clamped. The low tensile strength of the metal allows it to flow into the gaps between the clamped materials, assuring intimate mechanical and thermal contact everywhere on the interface. Our metallic sealing characteristics are not affected by temperature changes and the gasket can withstand any temperature below its melting point of 155 ^{o}C, down to very low cryogenic temperatures.

And why is it important that no o-rings or epoxies are used in the crystal plate assembly? The reasons are multiple - rubber and adhesives can be affected by many organic solvents which may diminish their strength and lead to leaching and unwanted spectral features. Epoxies may not offer an adequate mechanical support for the entire crystal, since only the edges of the crystal are attached to the base and the crystal may break at extreme temperatures.

Typically, only a thin layer of the sample needs to be applied onto the crystal surface. For fast

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evaporating samples, a volatiles cover should be used to cover the sampling area.



FTIR spectrum of fuel additive using HATR trough plate with ZnSe crystal.

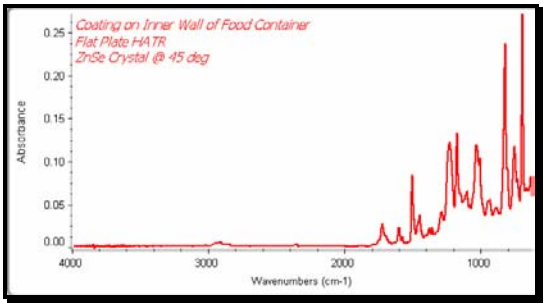
Soft powders will often produce good spectra when analyzed by HATR, assuming that they can be put in intimate contact with the crystal. A powder press option is used to achieve this. This device is placed directly on top of the sample filled trough and pressed by hand until the desired result is obtained.

The **flat plate** is used for the analysis of solid materials - including polymer and film samples. It is ideal for solid samples which are too large to fit within the trough plate configuration.



Flat plate HATR crystal plate – ideal for solids, polymer films and coatings.

The crystal is mounted slightly above the surface of the metal plate, which helps to achieve good crystal / sample contact when the flat plate press is used (the press attaches easily to the back of the HATR with two thumb screws).



FTIR spectrum of coating on inner wall of food container by HATR with ZnSe flat plate and pressure plate.

A large number of temperature-controlled and flow-through sampling plates are available for PIKE Technologies HATRs - all are pin-mounted to the HATR with no alignment required.



HATR with Heated Trough Plate and Sample Temperature Thermocouple - foreground shows Heated Flow-Through Cell.

All temperature controlled and flow-through crystal plate options are compatible and interchangeable with HATR and HATRPlus products. PIKE Technologies temperature controllers provide static or ramped temperature control and can also monitor sample temperature.

Summary

The PIKE Technologies HATR accessory provides high sensitivity for analysis of low concentration components in liquid, solid, and polymer samples. The highly flexible accessory is available in-compartment and out-of-compartment configurations with complete selection of crystal material, sample format, and temperature and flow-through configurations.

Do you need a HATR product or feature not shown here in our catalog? Please contact us to discuss your application.

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Ordering Information

HATR Base Optics (must select, insert spectrometer model for xx)

Part No.	Description
022-19xx	HATR Base Optics
026-11xx	HATRPlus Base Optics

Notes: HATR and HATRPlus Base Optics include volatiles cover, powder press, purge tubes, purge kit and spectrometer base mount.

HATR and HATRPlus Crystal Plates (must select 1 or more)

Part No.	Description	Refurbished Part Number
022-2010-45	Trough Plate, ZnSe, 45 degree	022-2110-45
022-2020-45	Flat Plate, ZnSe, 45 degree	022-2120-45
022-2030-45	Trough Plate, KRS-5, 45 degree	022-2130-45
022-2040-45	Flat Plate, KRS-5, 45 degree	022-2140-45
022-2050-45	Trough Plate, Ge, 45 degree	022-2150-45
022-2060-45	Flat Plate, Ge, 45 degree	022-2160-45
022-2070-45	Trough Plate, AMTIR, 45 degree	022-2170-45
022-2080-45	Flat Plate, AMTIR, 45 degree	022-2180-45
022-2090-45	Trough Plate, Si, 45 degree	022-2190-45
022-2100-45	Flat Plate, Si, 45 degree	022-2200-45

Notes: HATR Crystal Plates are pre-aligned and pinned-in-place. Changing crystal plates is easy and fast to optimize sampling results. For all HATR crystal plates, 30 and 60 degree face angles are also available – the last 2 digits of the part number designate this specification. If you need a crystal not listed here, please contact us.

HATR and HATRPlus Pressure Clamp (must select for solids, films or powder analysis)

Part No.	Description
022-3050	HATR Pressure Clamp

Notes: The pressure clamp is required for solids, films, coatings and powdered samples.

HATR and HATRPlus Flow Cells

P/N for 100 ul	Description	P/N for 500 ul
022-4010-100	HATR Flow Cell, ZnSe, 45 degree	022-4010-500
022-4020-100	HATR Flow Cell, AMTIR, 45 degree	022-4020-500
022-4030-100	HATR Flow Cell, KRS-5, 45 degree	022-4030-500
022-4040-100	HATR Flow Cell, Si, 45 degree	022-4040-500
022-4050-100	HATR Flow Cell, Ge, 45 degree	022-4050-500

Notes: HATR flow cells include Luer-Loc fittings for easy connection with a syringe. A set of 1/16" Swageloc fittings is included with each flow cell for connection with 16" tubing.

HATR and HATRPlus Heated Crystal Plates

P/N for Single RTD	Description	P/N for Dual RTD
022-5110	HATR Heated Trough Plate, ZnSe, 45 degree	022-5010
022-5120	HATR Heated Trough Plate, AMTIR, 45 degree	022-5020
022-5130	HATR Heated Trough Plate, KRS-5, 45 degree	022-5030
022-5140	HATR Heated Trough Plate, Si, 45 degree	022-5040
022-5150	HATR Heated Trough Plate, Ge, 45 degree	022-5050
P/N for 100 ul	**Description**	**P/N for 500 ul**
022-5210-100	HATR Heated Flow-Thru Cell, ZnSe, 45 degree	022-5210-500
022-5220-100	HATR Heated Flow-Thru Cell, AMTIR, 45 degree	022-5220-500
022-5230-100	HATR Heated Flow-Thru Cell, KRS-5, 45 degree	022-5230-500
022-5240-100	HATR Heated Flow-Thru Cell, Si, 45 degree	022-5240-500
022-5250-100	HATR Heated Flow-Thru Cell, Ge, 45 degree	022-5250-500

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P/N	
076-1100	Digital Temperature Control Module, Dual RTD
076-1200	Digital Temperature Control Module, Single RTD
076-1300	Manual Temperature Control Module, Single RTD

Notes: Single RTD plates are resistance heated with temperature control of the plate. Dual RTD plates permit the monitor of sample temperature in addition to temperature control of the plate and data collection can be sequenced with the sample temperature. Temperature is settable to 130 C for heated trough and flow-thru plates. Resistance heated plates require selection of a PIKE Technologies Temperature Controller.

HATR and HATRPlus Liquid Jacketed Crystal Plates

Part No.	**Description**
022-5310	HATR Liquid Jacketed Trough Plate, ZnSe, 45 degree
022-5320	HATR Liquid Jacketed Trough Plate, AMTIR, 45 degree
022-5330	HATR Liquid Jacketed Trough Plate, KRS-5, 45 degree
022-5340	HATR Liquid Jacketed Trough Plate, Si, 45 degree
022-5350	HATR Liquid Jacketed Trough Plate, Ge, 45 degree

Notes: Liquid jacketed crystal plates require customer provided circulating water bath. Liquid jacketed crystal plates enable heating to 130 C and cooling.

HATR and HATRPlus Liquid Jacketed, Flow-Through Crystal Plates

P/N for 100 ul.	**Description**	**P/N for 500 ul.**
022-5410-100	HATR Liquid Jacketed Flow-Through Plate, ZnSe, 45 degree	022-5410-500
022-5420-100	HATR Liquid Jacketed Flow-Through Plate, AMTIR, 45 degree	022-5420-500
022-5430-100	HATR Liquid Jacketed Flow-Through Plate, KRS-5, 45 degree	022-5430-500
022-5440-100	HATR Liquid Jacketed Flow-Through Plate, Si, 45 degree	022-5440-500
022-5450-100	HATR Liquid Jacketed Flow-Through Plate, Ge, 45 degree	022-5450-500

Notes: Liquid jacketed flow-through crystal plates require customer provided circulating water bath. Liquid jacketed flow-through crystal plates enable heating to 130 C and cooling. HATR flow cells include Luer-Loc fittings for easy connection with a syringe. A set of 1/16” Swageloc fittings is included with each flow cell for connection with 16” tubing.

HATR and HATRPlus Replacement Parts

022-3051	HATR Volatiles Cover
022-3052	HATR Powder Press

Notes: Please contact PIKE Technologies for items not described in this list.

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