

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



HATR Accessory –
in-compartment
HATR for liquid
and solid
samples



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

FEATURES OF THE HATR

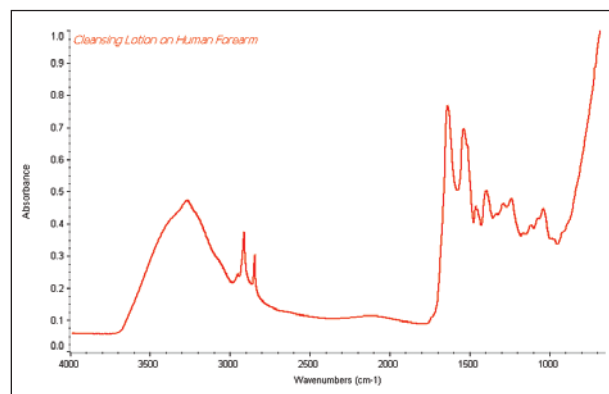
- *Excellent energy throughput offering high signal-to-noise ratio and spectral quality*
- *Up to 17 internal reflections for maximum sensitivity for low concentration components*
- *Removable crystal plates with pinned positioning for high precision and quick cleanup*
- *HATR plates with ZnSe, KRS-5, 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*

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.



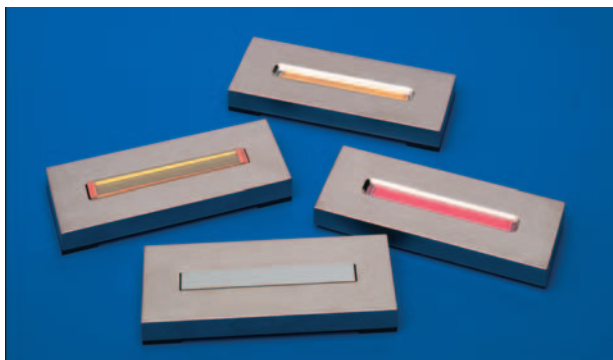
FTIR spectrum of cleansing lotion on human forearm – using the HATRPlus with flat plate Ge crystal.

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.

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



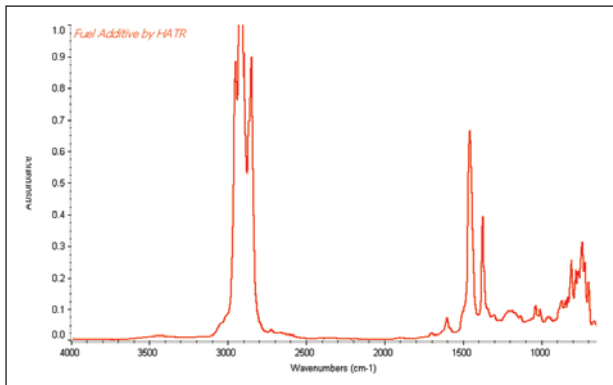
PIKE Technologies Crystal Plate Choices – for the HATR and HATRPlus.

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, pastes and gels.

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



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

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 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.

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.

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.

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.



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

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 for in-compartment and out-of-compartment configurations with complete selection of crystal material, sample format, and temperature and flow-through configurations.

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

ORDERING INFORMATION

HATR System Configurations (must select, insert spectrometer model for XX)

PART NO.	DESCRIPTION
022-10XX	HATR Trough Plate System, with 45° ZnSe Crystal <i>Includes: Trough Plate, Volatiles Cover and Powder Press</i>
022-11XX	HATR Flat Plate System, with 45° ZnSe Crystal <i>Includes: Flat Plate and HATR Pressure Clamp</i>
022-12XX	HATR Combined Trough and Flat Plate System with 45° ZnSe Crystals <i>Includes: Trough Plate, Flat Plate, Volatiles Cover, Powder Press and Sample Clamp</i>
026-11XX	HATRPlus Flat Plate System, with 45° ZnSe Crystal <i>Includes: Flat Plate and HATR Pressure Clamp</i>

Notes: HATR and HATRPlus Systems may be purchased with crystal plates other than ZnSe. Just add – Ge for germanium, – KR for KRS-5, –AM for AMTIR, or –Si for Silicon. Additional plates can be added to an order for any system above. Other configurations may be selected from the options below. Please see the FTIR instrument code sheet.

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

PART NO.	DESCRIPTION
022-19XX	HATR Platform Optics Assembly
026-19XX	HATRPlus Platform Optics Assembly

Notes: HATR and HATRPlus Platform Optics Assemblies include volatiles cover, powder press, purge tubes, purge kit and spectrometer base mount. Please see the FTIR instrument code sheet.

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

PART NO.	DESCRIPTION	REFURBISHED PART NO.
022-2010-45	Trough Plate, ZnSe, 45°	022-2110-45
022-2020-45	Flat Plate, ZnSe, 45°	022-2120-45
022-2030-45	Trough Plate, KRS-5, 45°	022-2130-45
022-2040-45	Flat Plate, KRS-5, 45°	022-2140-45
022-2050-45	Trough Plate, Ge, 45°	022-2150-45
022-2060-45	Flat Plate, Ge, 45°	022-2160-45
022-2070-45	Trough Plate, AMTIR, 45°	022-2170-45
022-2080-45	Flat Plate, AMTIR, 45°	022-2180-45
022-2090-45	Trough Plate, Si, 45°	022-2190-45
022-2100-45	Flat Plate, Si, 45°	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. Due to critical angle ZnSe, KRS-5 and AMTIR are not available in 30 degree face angle. If you need a crystal not listed here, please contact us.

ORDERING INFORMATION

HATR and HATRPlus Pressure Clamp

(must select for solids, films or powder analysis)

PART NO.	DESCRIPTION
022-3050	HATR (pivoting) Pressure Clamp
022-3053	HATR High Force Clamp
022-3054	HATR Heavy Duty (horizontal) Clamp
024-3050	HATRPlus Pressure Clamp
024-3053	HATRPlus High Force Clamp

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

HATR and HATRPlus Flow Cells

P/N FOR 100 µL	DESCRIPTION	P/N FOR 500 µL
022-4010-100	HATR Flow Cell, ZnSe, 45°	022-4010-500
022-4020-100	HATR Flow Cell, AMTIR, 45°	022-4020-500
022-4030-100	HATR Flow Cell, KRS-5, 45°	022-4030-500
022-4040-100	HATR Flow Cell, Si, 45°	022-4040-500
022-4050-100	HATR Flow Cell, Ge, 45°	022-4050-500

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

HATR and HATRPlus Liquid Jacketed Crystal Plates

PART NO.	DESCRIPTION
022-5310	HATR Liquid Jacketed Trough Plate, ZnSe, 45°
022-5320	HATR Liquid Jacketed Trough Plate, AMTIR, 45°
022-5330	HATR Liquid Jacketed Trough Plate, KRS-5, 45°
022-5340	HATR Liquid Jacketed Trough Plate, Si, 45°
022-5350	HATR Liquid Jacketed Trough Plate, Ge, 45°

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 Heated Crystal Plates

P/N FOR SINGLE RTD	DESCRIPTION	P/N FOR DUAL RTD
022-5110	HATR Heated Trough Plate, ZnSe, 45°	022-5010
022-5120	HATR Heated Trough Plate, AMTIR, 45°	022-5020
022-5130	HATR Heated Trough Plate, KRS-5, 45°	022-5030
022-5140	HATR Heated Trough Plate, Si, 45°	022-5040
022-5150	HATR Heated Trough Plate, Ge, 45°	022-5050

P/N FOR 100 µL	DESCRIPTION	P/N FOR 500 µL
022-5210-100	HATR Heated Flow-Through Cell, ZnSe, 45°	022-5210-500
022-5220-100	HATR Heated Flow-Through Cell, AMTIR, 45°	022-5220-500
022-5230-100	HATR Heated Flow-Through Cell, KRS-5, 45°	022-5230-500
022-5240-100	HATR Heated Flow-Through Cell, Si, 45°	022-5240-500
022-5250-100	HATR Heated Flow-Through Cell, Ge, 45°	022-5250-500

PART NO.	DESCRIPTION
076-1100	Digital Temperature Control Module, Dual RTD, PC Control
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 adjustable 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, Flow-Through Crystal Plates

P/N FOR 100 µL	DESCRIPTION	P/N FOR 500 µL
022-5410-100	HATR Liquid Jacketed Flow-Through Plate, ZnSe, 45°	022-5410-500
022-5420-100	HATR Liquid Jacketed Flow-Through Plate, AMTIR, 45°	022-5420-500
022-5430-100	HATR Liquid Jacketed Flow-Through Plate, KRS-5, 45°	022-5430-500
022-5440-100	HATR Liquid Jacketed Flow-Through Plate, Si, 45°	022-5440-500
022-5450-100	HATR Liquid Jacketed Flow-Through Plate, Ge, 45°	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" Swagelok fittings are included with each flow cell for connection with 16" tubing.

HATR and HATRPlus Replacement Parts

PART NO.	DESCRIPTION
022-3051	HATR Volatiles Cover
022-3052	HATR Powder Press
310-8010410	Crystal, 45°, Trap, 80 x 10 x 4 mm ZnSe
310-8010420	Crystal, 45°, Trap, 80 x 10 x 4 mm KRS-5
310-8010430	Crystal, 45°, Trap, 80 x 10 x 4 mm Ge
310-8010440	Crystal, 45°, Trap, 80 x 10 x 4 mm AMTIR
310-8010450	Crystal, 45°, Trap, 80 x 10 x 4 mm Si
311-8010430	Crystal, 30°, Trap, 80 x 10 x 4 mm Ge
312-8010410	Crystal, 60°, Trap, 80 x 10 x 4 mm ZnSe
312-8010430	Crystal, 60°, Trap, 80 x 10 x 4 mm Ge

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