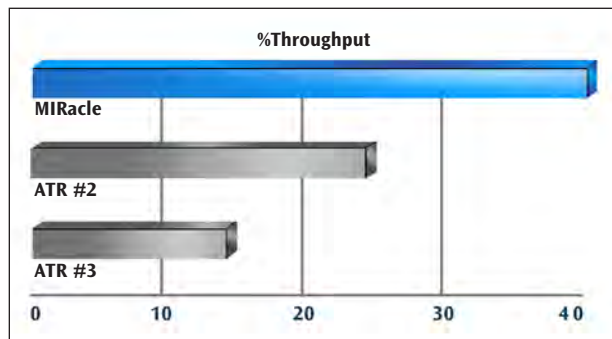


MIRacle ATR – Fast and Easy IR Sampling



FEATURES OF THE MIRACLE

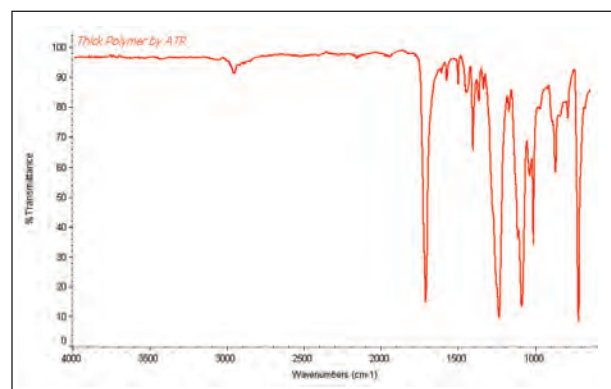
- Highest IR throughput – saving you time and improving your analysis quality
- Complete flexibility – add options to your MIRacle as your sampling needs change
- Highest value – for today's competitive analytical and research needs
- Fully configurable – diamond, ZnSe, Ge and Si MIRacle crystal plates
- Pinned-in-place, changeable crystal plates – for fast and easy sampling optimization
- Highest purity, type IIa diamond crystal – will not scratch and is chemically inert to acidic or caustic materials
- Optional specular reflectance plate – for measurement of coatings on reflective surfaces
- Choice of pressure clamps – high-pressure, digital high-pressure and micrometric sample clamps
- Sampling options – heating, temperature control, and flow through plate



MIRacle – Highest IR Throughput ATR

The PIKE MIRacle™ is a universal ATR sampling accessory for analysis of solids, liquids, pastes, gels, and intractable materials. In its most popular configuration it is a single reflection ATR accessory with high IR throughput which makes it ideal for sample identification and QA/QC applications. Easily changeable crystal plate design provides analysis of a broad spectrum of sample types while ensuring constant sampling pathlength.

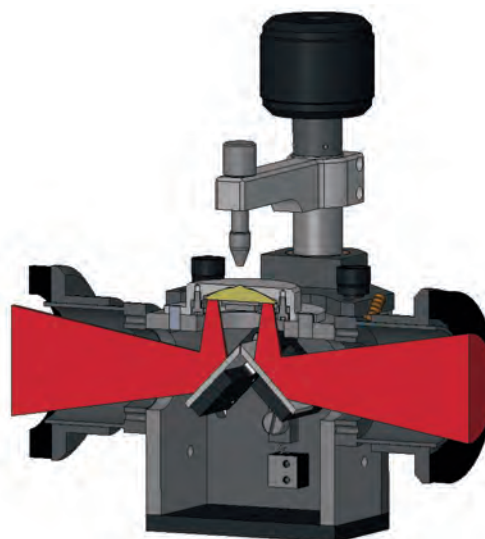
Single, three, and nine reflection ATR crystals are available to optimize general qualitative or quantitative analysis.



Thick Polymer Sample, using MIRacle with ZnSe Crystal and High-Pressure Clamp – No Sample Preparation.

MIRacle Optical Design

In the patented MIRacle optical design the ATR crystal focuses the IR beam and also provides the ATR sampling interface. This technology delivers much higher throughput than competitive products, saves considerable time and produces higher quality spectra.



MIRacle – High Throughput and Efficient Optical Design

MIRacle Crystal Options

The MIRacle ATR accessory is available with 5 different crystal types (diamond/ZnSe, diamond/KRS-5, ZnSe, Ge, and Si) and with unique versions of these crystal materials.

Crystal plates are pinned in place and easily changeable within seconds with no alignment required. With this flexibility, you can change the crystal type to exactly match your sampling requirements. For example, diamond is ideal for brittle samples because it will not scratch, whereas, Ge is ideal for carbon-filled samples because of its high refractive index and lower depth of penetration. Two single reflection diamond crystal plates are available, diamond/ZnSe and diamond/KRS-5. The latter offers a full spectral range to 250 cm^{-1} . Three and nine reflection crystal plates provide increased sensitivity for minor components in liquid or non-rigid materials. Three reflection diamond/ZnSe crystal plates are available flat and trough style, and nine reflection diamond/ZnSe is offered in trough style only.

An optional liquids retainer and volatiles cover set is compatible with all crystal plates, eliminating the need to purchase flat and trough crystal plates. A high-pressure clamp is required for use with the liquids retainer and the volatiles cover.



Liquids Retainer and Volatiles Cover set



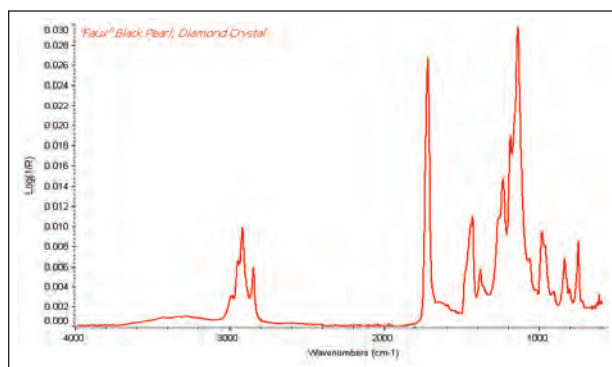
MIRacle ATR Crystal Plates

Table 1 shows MIRacle ATR crystal characteristics including refractive index, spectral range cutoff, pH range and hardness for single reflection ATR crystal plates. Still have questions? Please call as we are pleased to discuss your sampling requirements.

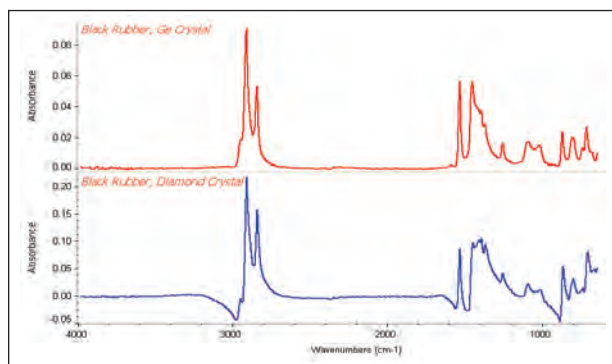
Table 1: MIRacle Crystal Plate Specifications

MIRacle Crystal Plate	Application	Hardness kg/mm2	Cutoff cm^{-1} , Spectral Range	Refractive Index @ 1000 cm^{-1}	Depth of Penetration @ 45°, μ	pH Range of Sample
Diamond/ZnSe	Ideal for hard samples, acids or alkaline	5700	525	2.4	2.00	1–14
Diamond/KRS-5	When you need full mid-IR spectral range	5700	250	2.4	2.00	1–14
Ge	General purpose and carbon filled or rubber	550	575	4.0	0.66	1–14
Si	Excellent for far-IR spectral measurement	1150	8900–1500, 475–40	3.4	0.85	1–12
ZnSe	General purpose ATR crystal	120	520	2.4	2.00	5–9

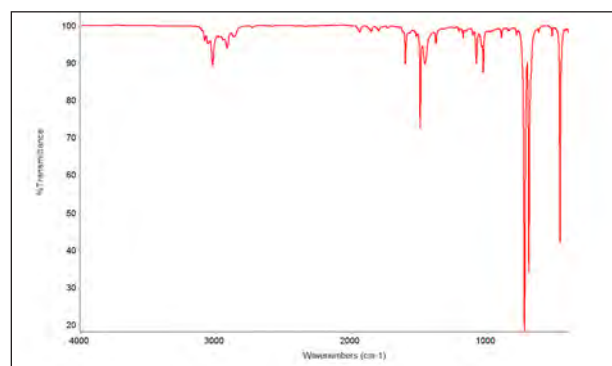
MIRacle Crystal plates are covered by PIKE Technologies patent numbers 5,965,889 and 6,128,075 or are manufactured under license of 5,200,609, 5,552,604 and 5,703,366.



"Faux" black pearl with MIRacle using diamond ATR crystal



Black rubber samples are best run using Ge ATR crystal



Toluene sample collected using diamond/KRS-5 crystal

MIRacle Pressure Clamp Options

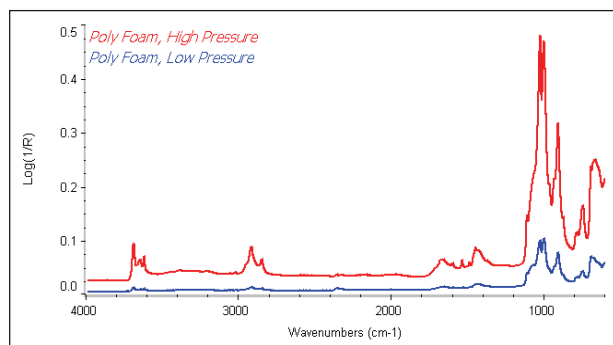
MIRacle pressure clamps are pinned in place and easily changeable within seconds. A high-pressure clamp is recommended for most applications and is available in basic and digital configurations. The digital version includes a high-pressure clamp and the Digital Force Adapter (DFA) that attaches directly to the clamping assembly. The DFA's embedded load cell exhibits high linearity, reproducibility, and exceptional accuracy. The magnitude of applied force is displayed on an external easy-to-read LCD readout. The digital clamp is ideal for applications that require controlled and reproducible pressure. All clamps include tips for hard, soft and pellet-shaped samples. High-pressure clamps are calibrated to deliver over 10,000 psi of pressure when used with the single reflection crystal plates.

Ability to deliver high pressure is very important for achieving spectral quality. In the example below, we demonstrate spectral differences for a porous polymer sample measured with the micrometer clamp and the high-pressure clamp. Clearly the spectrum obtained using the high-pressure clamp is required for a high quality result.

MIRacle high-pressure clamps utilize a slip-clutch mechanism to prevent excessive pressure from being applied to the crystal.

<i>MIRacle Clamp Pressures</i>	Max lbs Pressure	Crystal Diameter, mm	PSI
High-Pressure Clamps	40	1.8	10,141
		6.0	913
Micrometer Pressure Clamp	8	1.8	2,028
		6.0	183

Note: All clamps except Micrometer are high-pressure



Porous Polymer Sample Measured Using High and Low-Pressure Clamp

MIRacle Sampling Options

The MIRacle can be configured with optional resistively heated crystal plates using a PIKE temperature control module. Digital and digital with PC control versions are available. The PC control module includes TempPRO software which provides a graphical user interface for temperature control and kinetic measurements.



TempPRO software for graphical setup and control of kinetic measurements

MIRacle Pressure Clamps are Pinned in Place and Easily Upgraded



MIRacle Confined Space Clamp – For instruments with limited sampling area

MIRacle High-Pressure Clamp – Ideal for routine sampling

MIRacle Micrometer Clamp – For low pressure applications

MIRacle ATR Summary

The MIRacle ATR accessory is a high performance FTIR sampling tool for solid, liquid, or polymer samples. Easily changeable crystal plates provide optimized spectral data for unique sample types. With options for single, three, or nine reflection crystal plates, several pressure clamp styles and heating or cooling, the MIRacle is able to address a wide range of FTIR sampling applications.



ORDERING INFORMATION

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

PART NUMBER DESCRIPTION

025-18XX	MIRacle ATR Base Optics/Platform Assembly
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Notes: MIRacle Base Optics includes purge tubes, purge kit and spectrometer base mount. Please see the FTIR instrument code sheet.

MIRacle Crystal Plates (must select 1 or more)

PART NUMBER DESCRIPTION

025-2108	Diamond/ZnSe Performance Crystal Plate
025-2107	Diamond/ZnSe HS Performance Crystal Plate
025-2028	Diamond/KRS-5 Performance Crystal Plate
025-2027	Diamond/KRS-5 HS Performance Crystal Plate
025-2018	ZnSe Performance Crystal Plate
025-2058	Ge Performance Crystal Plate
025-2098	Si Performance Crystal Plate
025-2118	3 Reflection Diamond/ZnSe Performance Crystal Plate
025-2120	3 Reflection Diamond/ZnSe Performance Crystal Plate, Trough
025-2038	3 Reflection ZnSe Performance Crystal Plate
025-2218	9 Reflection Diamond/ZnSe Performance Crystal Plate, Trough
025-2208	Specular Reflection Performance Plate

Notes: MIRacle Crystal Plates are pre-aligned and pinned-in-place. Changing crystal plates is easy and fast to optimize sampling results. Crystal plates are manufactured using polished stainless steel for chemical resistance. The diamond/ZnSe crystal plate is available with optional Hastelloy (HS) metal for exceptionally caustic or acidic samples.

MIRacle Sampling Options

PART NUMBER DESCRIPTION

025-4018	Heated ZnSe Performance Crystal Plate
025-4058	Heated Ge Performance Crystal Plate
025-4108	Heated Diamond/ZnSe Performance Crystal Plate (60 °C Max)
025-2104	Liquid Jacketed Diamond/ZnSe Perf Crystal Plate (60 °C Max)
025-2014	Liquid Jacketed ZnSe Performance Crystal Plate
025-2054	Liquid Jacketed Ge Performance Crystal Plate
025-2094	Liquid Jacketed Si Performance Crystal Plate
026-5012	Flow-Through Attachment, sample volume 100 µL
026-5013	Liquids Retainer and Volatiles Cover Set
026-3051	Volatiles Cover for Performance Plates
026-5010	Liquids Retainer for Performance Plates
076-1220	Digital Temperature Control Module
076-1420	Digital Temperature Control Module, PC Control

Notes: Flow through attachment, liquids retainer and volatiles cover are compatible with non-trough crystal plate offerings but require High-Pressure Clamp, PN 025-3020 or PN 025-3035, sold separately. Temperature controller selection is required for heated crystal plates. Digital temperature controller with PC control includes TempPRO software. Liquid Jacketed Crystal Plates require customer-provided circulator. Do not exceed 60 °C when using temperature controlled diamond plates and 130 °C for all others.

MIRacle Pressure Clamps

(must select 1 or more for solids or polymer analysis)

PART NUMBER DESCRIPTION

025-3020	High-Pressure Clamp
076-6025	Digital Force Adapter for High-Pressure Clamp
025-3050	Micrometric, Low-Pressure Clamp
025-3035	Confined Space Clamp

Notes: The High-Pressure Clamp is recommended for general applications. Pressure clamps include a flat tip, a swivel tip and a concave tip. The Digital Force Adapter requires High-Pressure Clamp, PN 025-3020, sold separately.

MIRacle Replacement Parts

PART NUMBER DESCRIPTION

025-3095	Flat Tip for High-Pressure Clamp
025-3093	Swivel Tip for High-Pressure Clamp
025-3092	Concave Tip for High-Pressure Clamp
025-3052	Flat Tip for Micrometric Clamp
025-3061	Swivel Tip for Micrometric Clamp
025-3054	Concave Tip for Micrometric Clamp
025-3053	MIRacle Micrometer Clamp Tip Assortment
025-3094	7.8 mm ATR Pressure Tip – High-Pressure Clamp
025-3096	7.8 mm ATR Pressure Tip – Micrometer Clamp
025-3099	High-Pressure Tip Assortment

Notes: Please contact PIKE Technologies for items not described in this list. Reconditioning service for used MIRacle crystal plates is available.

MIRACLE ACCESSORY SPECIFICATIONS

ATR Crystal Choices	Diamond/ZnSe, Diamond/KRS-5, Ge, ZnSe, Si
Crystal Plate Mounting	User changeable plates
Crystal Plate Mount	Stainless steel or Hastelloy
Angle of Incidence	45 degrees, nominal
Crystal Dimensions, Surface	1.8 mm Single Reflection 6.0 mm Three Reflection
Pressure Device	Rotating, continuously variable pressure; click stop at maximum
Digital Force Adapter (option)	Load cell sensor for precise and reproducible pressure control. Attaches directly to MIRacle clamp. Digital readout.
Maximum Pressure	10,000 psi
Sample Access	55 mm, ATR crystal to pressure mount
Heating Options	Ambient to 60 or 130 °C maximum
Accuracy	+/- 0.5%
Sensor Type	3 wire Pt RTD (low drift, high stability)
Temperature Control	Digital or digital with PC control (up to 20 ramps, automated data collection, USB interface)
Input Voltage	90–264 VAC, auto setting, external power supply
Operating Voltage	2.5 A/24 VDC/50 W
Specular Reflection Option	Optional, 45 degree nominal angle of incidence
Purge Sealing	Purge tubes and purge line connector included
Accessory Dimensions (W x D x H)	104 x 103 x 210 mm (excludes FTIR baseplate and mount)
FTIR Compatibility	Most, specify model and type

Dedicated MIRacle Sampling Tools and Options

Sealed Clamp

The Sealed Sample Chamber for the MIRacle, Single Reflection ATR accessory attaches to diamond, ZnSe or Ge crystal ATR plates allowing the complete assembly to be moved from the spectrometer to a protective environment for sample loading and handling. Typical applications include studies of toxic or chemically aggressive solids and powders.

The chamber is made of stainless steel and is sealed against the crystal plate with a chemically resistant O-ring. The chamber contains an internal, spring-loaded anvil that compresses the sample against the ATR crystal at a pre-set, clutch-controlled setting.



Sealed Sample Chamber attached to a MIRacle

Specular Reflection Plate

The MIRacle may be converted from an ATR accessory to a specular reflection accessory by using the Specular Reflection Plate. The angle of incidence is 45 degrees, and the plate is easily interchangeable with ATR plates.



MIRacle Specular

Temperature Control Options

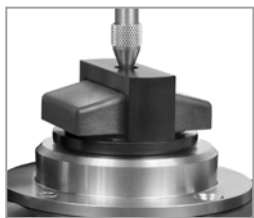
The MIRacle can be configured with liquid jacketed plates and resistively heated crystal plates with temperature control module. The PC module (resistively heated only) includes TempPRO software which provides a graphical user interface for temperature control and kinetics measurements.



Heated crystal plate and temperature controller

Liquids Retainer and Volatiles Cover

The Liquids Retainer offers a trough configuration for the MIRacle. The volatiles cover reduces the amount of evaporation of a highly volatile liquid sample on the surface of the crystal. The High-Pressure Clamp is required.



Liquids Retainer and Volatiles Cover Set

Digital Force Adapter for High-Pressure Clamp

The Digital Force Adapter attaches directly to the clamping assembly to precisely measure the applied force by using an embedded load cell that exhibits high linearity and exceptional accuracy. The magnitude of applied force is displayed on an external easy-to-read LCD readout. The digital clamp is ideal for applications that require controlled and reproducible pressure.



Digital Force Adapter

Flow-Through Attachment

The Flow-Through Attachment is used for continuous monitoring or handling samples that pose a hazard from ambient exposure. Samples are introduced using the Luer-Lok fitting by connecting a syringe or a flow line. The High-Pressure Clamp is required.



MIRacle ATR fitted with a Flow-Through Attachment

ORDERING INFORMATION

MIRacle Sealed High-Pressure Clamp (select the sealed clamp and at least one crystal ATR plate)

PART NUMBER	DESCRIPTION
025-6020	Sealed High Pressure Clamp
025-6108	Diamond/ZnSe Sealed Clamp Performance Plate
025-6018	ZnSe Sealed Clamp Performance Plate
025-6058	Ge Sealed Clamp Performance Plate

Temperature Controlled MIRacle Options (must select one or more heated plates and one controller)

PART NUMBER	DESCRIPTION
025-4018	Heated ZnSe Performance Crystal Plate
025-4058	Heated Ge Performance Crystal Plate
025-4108	Heated Diamond/ZnSe Performance Crystal Plate, 60 °C Max
076-1220	Digital Temperature Control Module
076-1420	Digital Temperature Control Module, PC Control

Other MIRacle Sampling Options

PART NUMBER	DESCRIPTION
025-2208	Specular Reflection Performance Plate
026-3051	Volatiles Cover for Performance plates
026-5013	Liquids Retainer and Volatiles Cover Set
076-6025	Digital Force Adapter for High-Pressure Clamp
026-5012	Flow-Through Attachment

Notes: The Flow-Through Attachment, Liquids Retainer and Volatiles Cover, and Digital Force Adapter requires High-Pressure Clamp, PN 025-3020, sold separately.