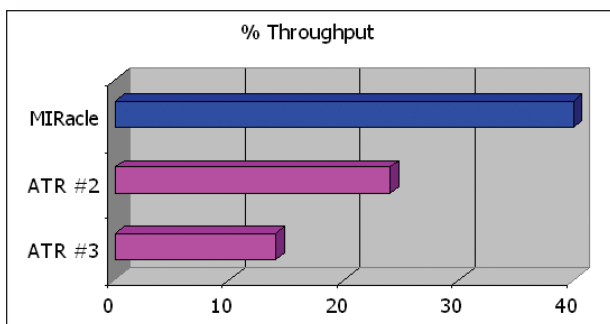


## MIRacle ATR – Fast and Easy IR Sampling



### 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** – ZnSe, Diamond, 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

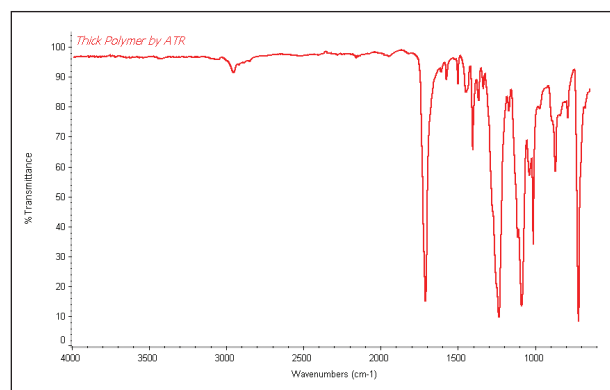


MIRacle – Highest IR Throughput ATR

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. Advanced options include three reflection ATR crystal plates to optimize for lower concentration components. Easily changeable crystal plate design provides analysis of a broad spectrum of sample types while ensuring constant sampling pathlength.

Single and three-reflection ATR crystals are available to optimize general qualitative analysis or quantitative analysis of minor components.

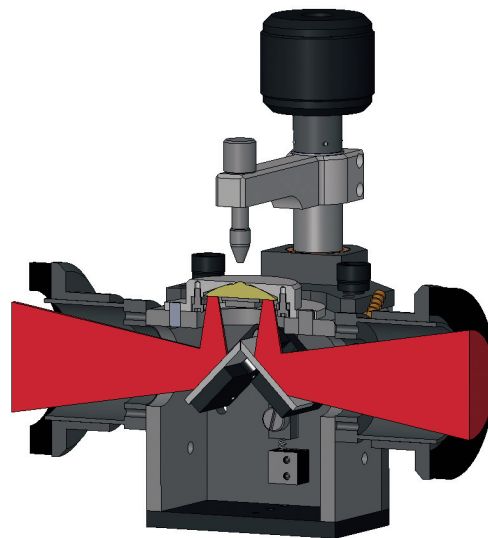
The PIKE MIRacle provides higher throughput – saving you time and generating higher quality spectra.



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

### MIRacle Optical Design

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



MIRacle – High Throughput and Efficient Optical Design

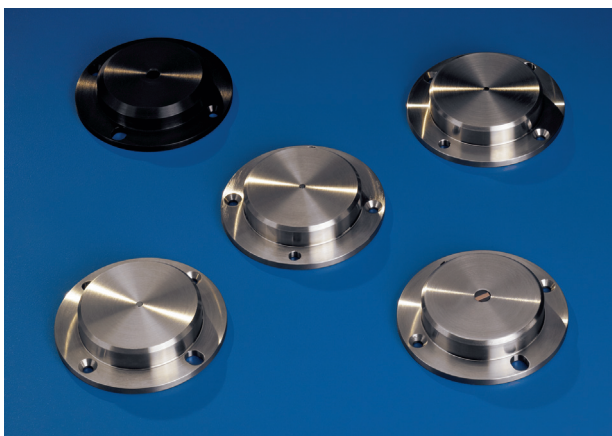
### MIRacle Crystal Options

The MIRacle ATR accessory is available with 4 different crystal types (ZnSe, Diamond, Ge, and Si) and with unique versions of these crystal materials.

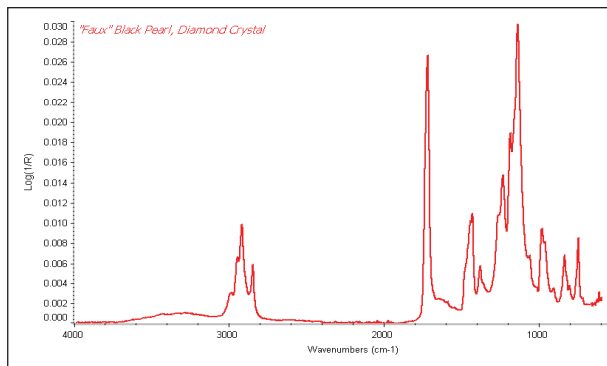
Crystal plates are pinned in place and easily changeable within seconds with no alignment required. With this flexibility, you can change the crystal type to exactly match your sampling requirements. For example, diamond is ideal for brittle samples because it will not scratch, whereas, Ge is ideal for carbon filled samples because of its high refractive index and lower depth of penetration. Three reflection crystal plates provide increased sensitivity for minor components in liquid or non-rigid materials.

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.

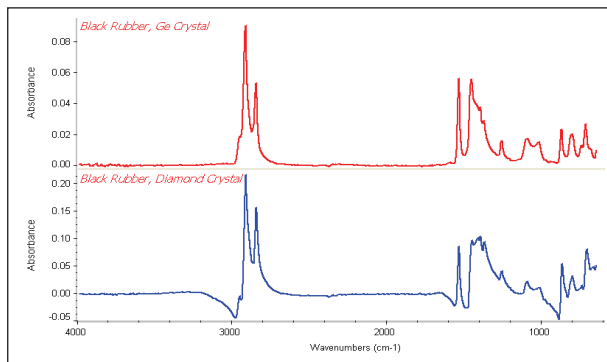
Table 1 shows MIRacle ATR crystal characteristics including refractive index, spectral range cutoff, pH range and hardness for single reflection ATR crystal plates. *Still have questions? Please call as we are pleased to discuss your sampling requirements.*



MIRacle ATR Crystal Plates



"Faux" Black Pearl with MIRacle using Diamond ATR Crystal



Black Rubber Samples are best run using Ge ATR Crystal

Table 1: MIRacle Crystal Plate Specifications

| MIRacle Crystal Plate | Application                                 | Hardness kg/mm <sup>2</sup> | Cutoff cm <sup>-1</sup> , Spectral Range | Refractive Index @ 1000 cm <sup>-1</sup> | 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               |
| Ge                    | General purpose and carbon filled or rubber | 550                         | 575                                      | 4.0                                      | 0.66                          | 1–4                |
| 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.

## MIRacle Pressure Clamp Options

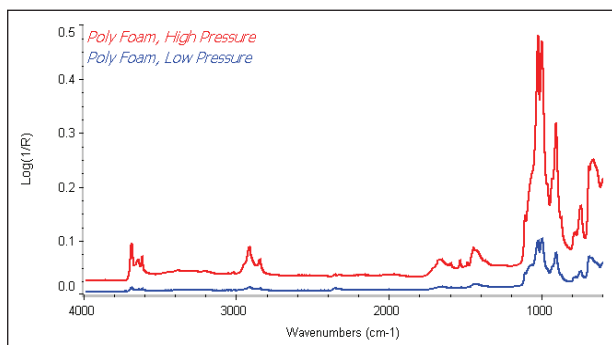
MIRacle pressure clamps are pinned in place and easily changeable within seconds. A high-pressure clamp is recommended for most applications and is available in basic and digital configurations. The digital version includes a high-pressure clamp and the Digital Force Adapter (DFA) that attaches directly 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.

| MIRacle Clamp Pressures   | 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

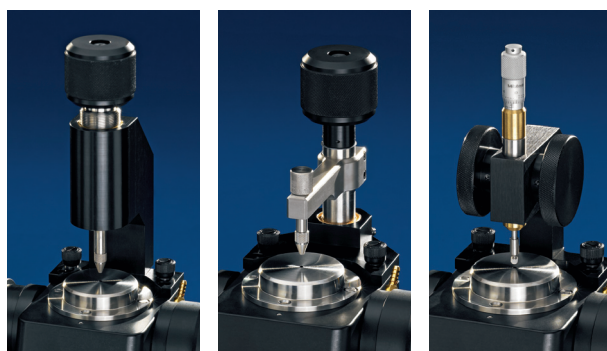
## MIRacle Sampling Options

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 – OK 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 or three reflection crystal plates, several pressure clamp styles and heating or cooling the MIRacle is able to address a wide range of FTIR sampling applications.



MIRacle with Optional Heated Crystal Plate and PIKE Temperature Control Module

## ORDERING INFORMATION

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

| PART NUMBER | DESCRIPTION                               |
|-------------|---|
| 025-18XX    | MIRacle ATR Base Optics/Platform Assembly |

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           |
| 025-2118    | 3 Reflection Diamond/ZnSe Performance Crystal Plate |
| 025-2018    | ZnSe Performance Crystal Plate                      |
| 025-2038    | 3 Reflection ZnSe Performance Crystal Plate         |
| 025-2058    | Ge Performance Crystal Plate                        |
| 025-2098    | Si Performance Crystal Plate                        |
| 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) |
| 026-5012    | Flow-through Attachment for Performance Plates            |
| 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 all crystal plate offerings but require High-Pressure Clamp, PN 025-3020, sold separately. Temperature controller selection is required for heated crystal plates. Digital temperature controller with PC control includes TempPRO software.

### 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 Clamps           |
| 025-3093    | Swivel tip for High-Pressure Clamps         |
| 025-3092    | Concave tip for High-Pressure Clamps        |
| 025-3096    | Sealed Pressure 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 Clamp Tip Assortment                |
| 025-3094    | 7.8 mm ATR Pressure Tip                     |

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

### MIRACLE ACCESSORY SPECIFICATIONS

|                                       |  |
|---------------------------------------|--|
| <b>ATR Crystal Choices</b>            | Diamond/ZnSe, Ge, ZnSe, Si   |
| <b>Crystal Plate Mounting</b>         | User changeable plates   |
| <b>Crystal Plate Mount</b>            | Stainless steel  |
| <b>Angle of Incidence</b>             | 45 degrees, nominal  |
| <b>Crystal Dimensions, Surface</b>    | 1.8 mm   |
| <b>Pressure Device</b>                | Rotating, continuously variable pressure; click stop at maximum  |
| <b>Digital Force Adapter (option)</b> | Load cell sensor for precise and reproducible pressure control. Attaches directly to MIRacle clamp. Digital readout. |
| <b>Maximum Pressure</b>               | 10,000 psi   |
| <b>Sample Access</b>                  | 55 mm, ATR crystal to pressure mount   |
| <b>Heating Options</b>                | 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 10 ramps, automated data collection, USB interface)                        |
| Input Voltage                         | 90–264 VAC, auto setting, external power supply  |
| Operating Voltage                     | 3 A/24 VDC/30 W  |
| <b>Specular Reflection Option</b>     | Optional, 45 degree nominal angle of incidence   |
| <b>Purge Sealing</b>                  | Purge tubes and purge line connector included  |
| <b>Accessory Dimensions</b>           | 104 mm wide, 103 mm deep, 210 mm high (excludes FTIR baseplate and mount)  |
| <b>FTIR Compatibility</b>             | Most, specify model and type   |