

FNL Series UV-Visible ATR Cells

Accurate spectroscopic analysis of chromophores and other strongly absorbing liquids.

Many dyes, aromatics, and other chromophores have absorptions in the UV and visible regions of the spectrum that are orders of magnitude too strong to allow transmission analysis without substantial dilution.

However, these substances can often be analyzed by means of attenuated total reflectance (ATR). Previous UV-Visible ATR devices have generally been in the form of probes employing sapphire prisms as ATR elements.

While these probes work well for many applications, they are quite inflexible, being restricted to the use of sapphire with three reflections and a fixed angle of incidence. FNL Series ATR cells overcome this limitation by allowing the user to specify the element material (fused silica or sapphire) as well as the number of reflections (1 through 6) and the resultant angle of incidence.

FNL Series ATR Cells are closely related to Axiom Analytical's TNL Series mid-infrared Tunnel Cells. However, the FNL Series cells are modified for use with UV-Visible radiation and with ATR materials having relatively low indices of refraction.

In particular, the optical geometry has been modified to allow near-grazing incidence at the element/analyte interface. By varying the incidence angle and the resultant number of reflections, the sensitivity of a cell can be optimized for a given measurement task.

OPTICAL DESIGN

The figure on the next page shows a cross section of model FNL-120H. The mechanical structure is similar to the TNL-120H mid-IR Tunnel Cell with the addition of a pair of fiber-optic collimators.

However, in contrast to the mid-IR cell, the optical path within the ATR rod is determined by refraction at the ends of the rod rather than by reflection at the surface of a metallic cone. This enables the number of reflections and angle of incidence to be determined by specifying the appropriate cone angle on the rod ends.

STANDARD FNL CELLS

The standard FNL-120 ATR cell comes in two housing configurations. FNL-120A cells have a circular cross section.

FNL-120H cells have a rectangular cross section and are provided with a cartridge heater and thermocouple. The suffixes, Y and N specify the internal reflectance element material and number of reflection. (See the Table on the following page.)

SELECTING THE OPTIMUM ATR ELEMENT FOR YOUR APPLICATION

The performance of an FNL Cell in a given application will depend on the number of reflections employed and On the relationship between the refractive index of the material being analyzed and the critical index listed in the Table above.

For the cell to function properly, the refractive index of the analyze must



be below the critical index. Otherwise, the light will not be "totally" reflected at the interface and little or no signal will be obtained. Some non-polar solvents have refractive indices in the range of 1.5. Such substances will require the use of a sapphire element.

In cases where either element can be used, it often is preferable to choose fused silica due to its generally better optical quality and better transmission past 250 nm.

In either case, the absorbance sensitivity can be optimized for a given task by choosing the rod with the appropriate number of reflections.

As the number of reflections is increased, the absorbance sensitivity will increase due both to the greater number of reflections and to the fact that the penetration depth of the light into the sample increases rapidly as the critical index approaches the analyte index.

Please see Technical Note AN-915 for a further discussion and typical applications examples.

FEATURES:

- Fiber-optic coupling to most UV-Visible spectrometers
- Response down to 200 nm
- Sensitivity set by interchangeable ATR elements
- Compatible with lab and process applications
- Rapid sample cleanout

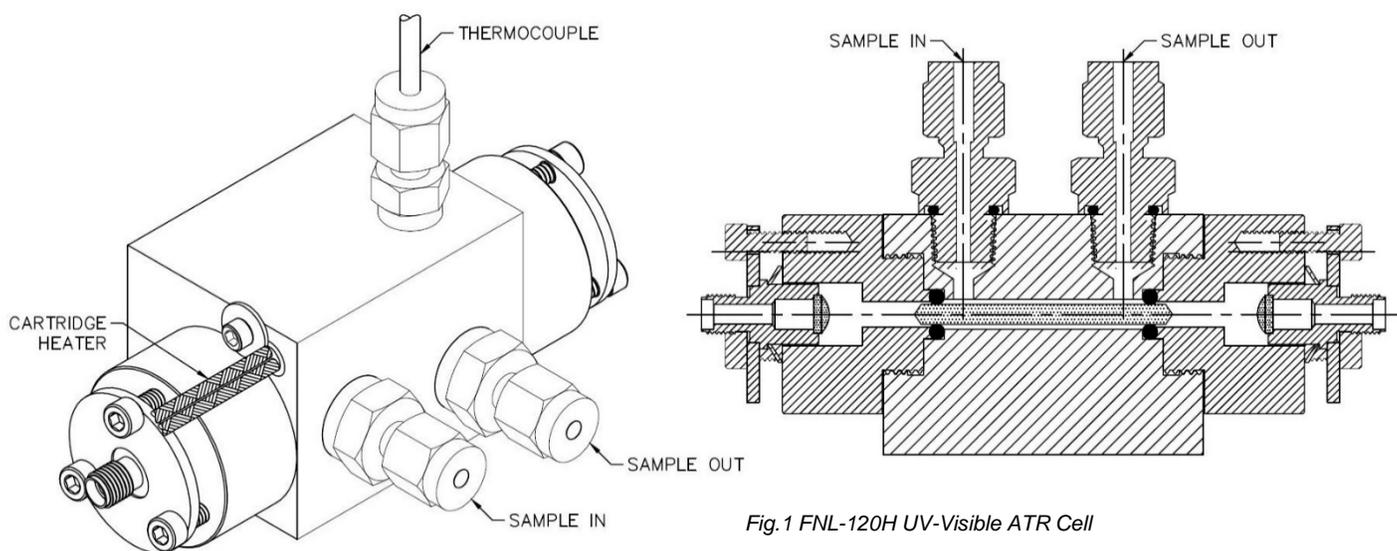


Fig.1 FNL-120H UV-Visible ATR Cell

GENERAL SPECIFICATIONS: All FNL-120 Tunnel Cells are provided with Kalrez™ O-rings and are rated for operation at temperatures to 280 °C and pressures to 20 bar. Standard cells are fabricated from 316 stainless steel. Other materials are available.

Table 1 - STANDARD FNL CELL MODELS:

	Element Dimension (diameter x length):	Flow Volume:	Liquid Fittings:	Housing Options "X":
FNL-120XY-N	3.2 mm x 40 mm	40 ul	1/8 NPT	A & H

Notes: 1. The model designations above include a suffix (XY-N), where "X" indicates the housing option, "Y" indicates the ATR element material, and "N" indicates the number of ATR reflections. 2. Housing Options: X = standard helical flow geometry, Y = High Temperature. Provided with cartridge heater and thermocouple. (For use with user supplied temperature controller.) 3. All cells are provided with male SMA-905 fiber-optic connectors. Recommended fiber-optic core diameter = 0.6 mm.



Table 2 - AVAILABLE FNL ATR ELEMENT CONFIGURATIONS:

UV-Grade Sapphire Elements ($n_o = 1.80 @ 240 \text{ nm}$)

Suffix "Y-N":	Cone Half Angle:	Number of Reflections:	Incidence Angle:	Critical Index (nc):
7-5	38.5	5	64.3	1.62
7-6	32.0	6	60.3	1.56

UV-Grade Fused Silica Elements ($n_o = 1.48 @ 310 \text{ nm}$)

Suffix "Y-N"	Cone Half Angle	Number of Reflections	Incidence Angle	Critical Index (nc)
23-1	67.50	1	82.5	1.467
23-2	54.75	2	77.7	1.446
23-3	43.70	3	72.9	1.415
23-4	24.70	4	68.5	1.377