

## Fiber Optic SMA Z-Flow Cell Manual

Version 2.0



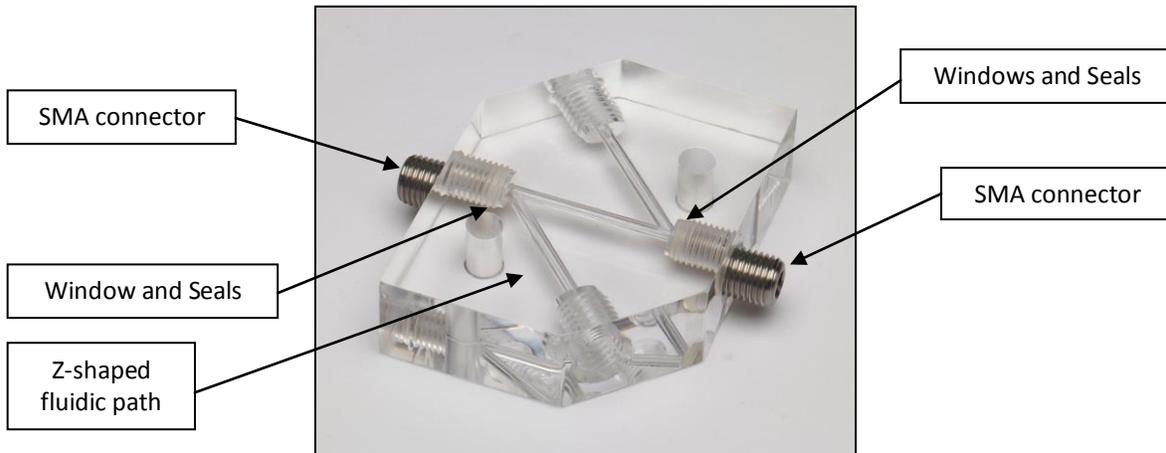
The line of fiber optic *SMA Z-Cells* is the top choice for many absorbance measurements. SMA-Z-Cell path lengths are available between 2.5mm - 100mm and can be made in PEEK, Plexiglas, Stainless Steel, Teflon, and Ultem. The cells contain fused silica windows and are compatible with standard SMA-905 terminated fiber optic cables.

The SMA Z-cell is designed to accommodate common optical measurements. It is designed to minimize bubble entrapment in flow injection and sequential injection and is readily disassembled for cleaning.

Please note that flow cells should not be exposed to aggressive materials for long periods of time and doing so may cause significant damage. If prolonged exposure is necessary, please consult the specification sheet at the end of this manual to select a flow cell material most suitable to your application.

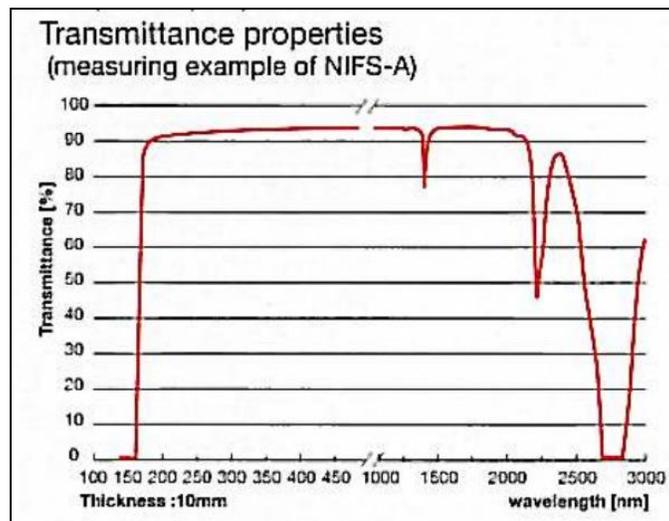
## Design:

SMA-Z-Cells are designed to accommodate common optical measurements. The Z-shaped fluidic path allows continuous flow up through the flow cell, minimizing bubble entrapment.



**Figure 1: SMA-Z Cell Design**

The flow cell optical path contains polished UV fused silica windows found at each of the cell's two fiber optic junctions. Non-corrosive and chemically resistant, these windows efficiently transmit light in the 170nm-2000nm range. Each window is sandwiched between two ring shaped Teflon seals, eliminating the possibility of fluid leakage through these ports.



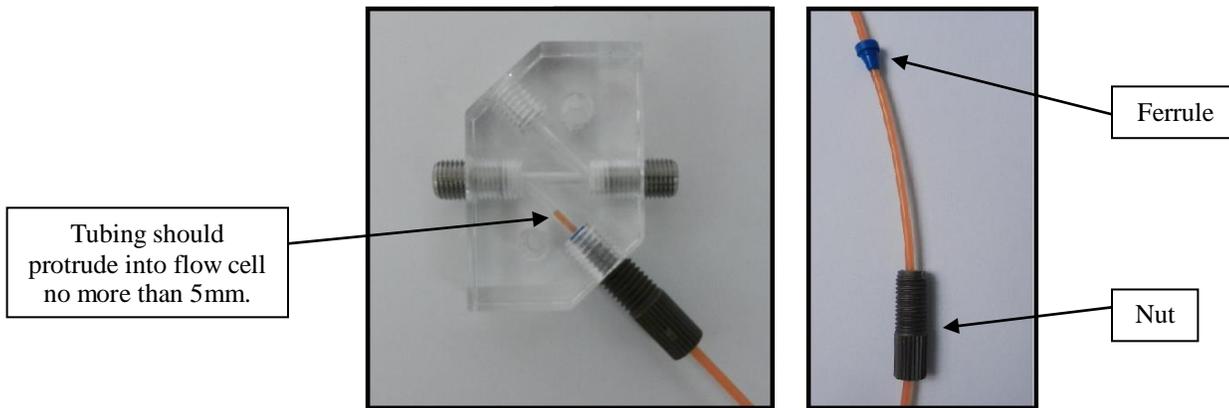
**Figure 2: Transmission of UV/Silica Windows**

1/4-36 thread Stainless Steel SMA-905 connectors attach to the two optical ports on the flow cell and serve both to connect to external fiber optic cables and to hold the seals and windows in place.

## Set up:

### Standard SMA-Z Cell

To use the SMA-Z cell, connect tubing to the cell's fluidic ports. Cleanly cut the supplied tubing to the desired length and place a colored nut onto the tubing following with a blue ferrule (with the cone side of the ferrule pointing towards the nut). Screw the tubing into the flow cell so that approximately 5mm of tubing protrudes from the end of ferrule. It is **CRITICAL** that the tubing is not blocking any portion of the light path. Repeat this procedure for tubing connecting to the other fluidic port.



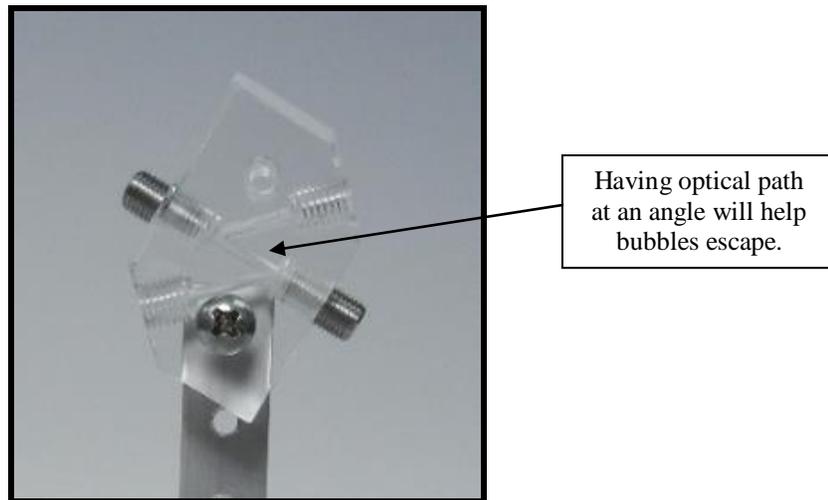
**Figure 3: Inserting tubing into Z Cell fluidic path**

### Microvol SMA-Z Cell

The fluidic path of the microvol SMA-Z line is designed in such a way so that tubing cannot protrude into its light path. To connect tubing to the cell's fluidic ports, cleanly cut the supplied tubing to the desired length and place a colored nut onto the tubing, following with a blue ferrule (with the cone side of the ferrule pointing towards the nut). Insert the tubing into the flow cell until you feel resistance and then screw nut to tighten. Repeat this procedure for the other fluidic port. Tubing should be pushed into the flow cell as far as it will comfortably go in order to minimize dead volume.

Whether using a microvol model or not, fiber optic cables connect to each of the flow cell's SMA connectors<sup>1</sup>. One should connect to a light source and the other to an absorbance detector.

Mount the flow cell in such a way that the light path is tilted upward and fluid enters from the bottom, exiting at the top. This is done to minimize the likelihood that air bubbles will get caught in the light path as measurements are being taken.



**Figure 4: Mounting SMA-Z Flow Cell**

## Use and Troubleshooting:

To test for leakage, before putting any chemicals through the cell, pump water through for at least ten minutes at or as close to the pressure and temperature you intend to use for your measurements. If leaks are observed coming from the fluidic ports, tighten the nut and ferrule more securely. If leaks are coming out of the junction between the SMA connector and the flow cell, tighten the SMA connector according to the instructions for replacing windows on page 6.

Whenever measurements are made, take care to make sure that the fiber optic cables don't move. If your fiber optic cables move at any point during the course of measurements, light throughput may vary.

Lastly, the most common problem with any type of flow cell is that of bubbles getting stuck in the light path. Bubbles cause significant deviations from accurate measurement as they absorb a substantial amount of the light introduced to the cell. Furthermore, since bubbles do not always remain in the flow cell throughout the course of measurements, not all samples will be influenced by their presence leading to even greater inaccuracy across the run.

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<sup>1</sup> A FIALab DCON-LED may be used on one side of the flow cell instead of a fiber optic cable as a direct connect light source.

If bubbles are of a small size and are entering the flow cell in streams, the source is likely in the temperature of the reaction or the reaction chemistry. This may be helped by adding a back pressure coil to the fluidic outlet of the cell. A back pressure coil can be made from 10ft of 0.02"ID Teflon tubing, wound tightly into a coiled pattern. Note that using a back pressure coil will affect the pressure throughout the system and thus pump rate or tightness of pump tubing may need to be adjusted to give the same flow rate.



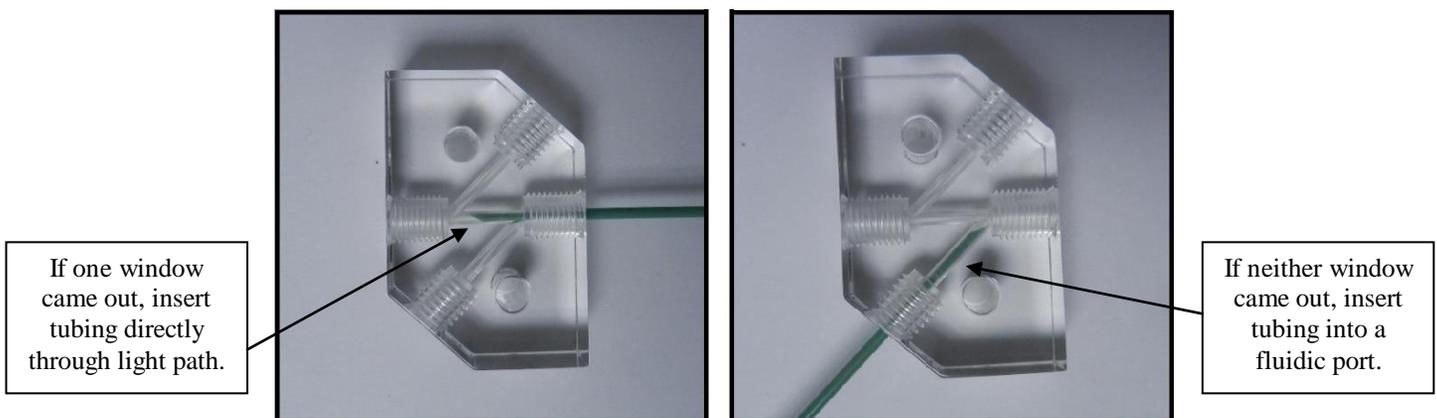
**Figure 5: Waste Coil**

To prevent large more sporadic bubbles from adhering to the flow cell wall, wash the flow cell first by pumping a soapy solution into the cell, letting it sit for a few hours and then rinsing well. It will also help to add a small amount of detergent to the reagents being used. Make sure that the detergent selected is compatible with the chemistry you are performing. 1 gram detergent per liter of reagent is a common ratio.

## Window Replacement:

When windows get stained, many users wish to replace them. Windows will also need to be replaced if for any reason they become cracked. To replace flow cell windows:

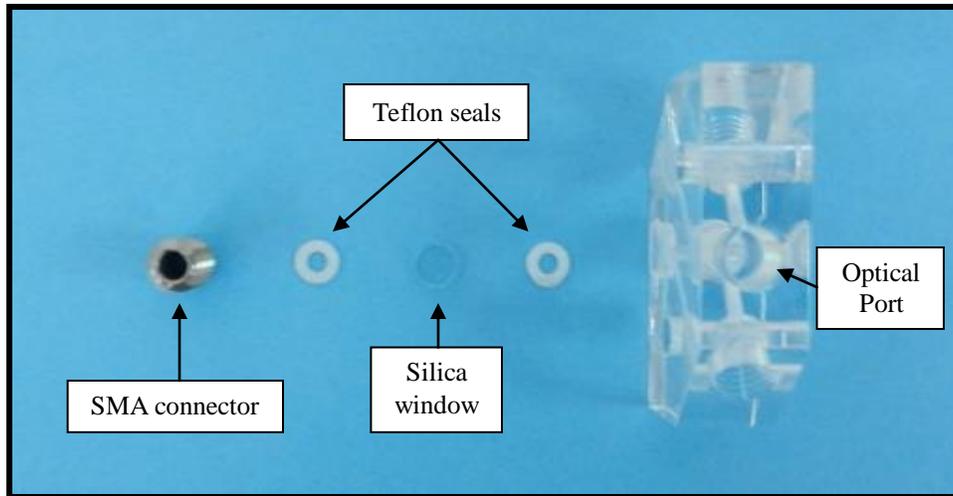
Unscrew one of the SMA fittings from the flow cell and tap the cell against the surface of a table until the seals and window fall out. Repeat this process on the other side. If windows do not come out on one or both sides, use a piece of 1/16<sup>th</sup> inch OD PEEK tubing cut at a sharp angle and insert into the flow cell to push them out. As an alternative, the flow cell can be soaked overnight in DI water.



**Figure 6: Use of PEEK tubing to remove flow cell windows**

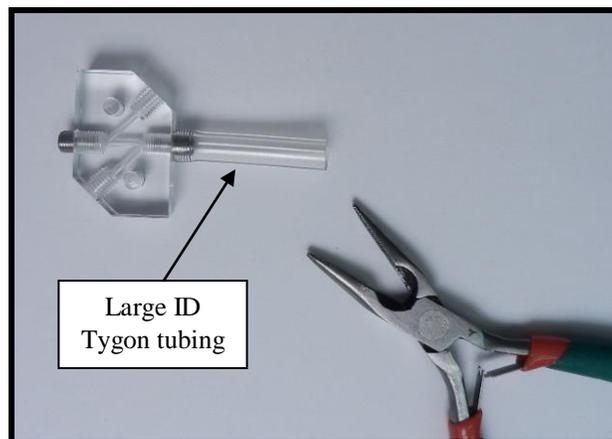
Make sure to clean the flow cell well with DI water or a 0.1% solution of detergent followed by a thorough rinse before replacing windows. Dry the flow cell completely, it may be helpful to use a Kimwipe and then also leave the flow cell to air dry overnight.

When dry, insert a new Teflon seal into one of the open ports. Follow this with a silica window and then again, another Teflon seal. To hold these parts in place gently screw in a SMA connector (the ones previously on the cell, if they have been maintained, can be reused) until it touches the seal but make sure to not tighten. Repeat this on the other side of the flow cell.



**Figure 7: Components into flow cell optical port**

Place a piece of large ID Tygon tubing snugly around one SMA connector and use pliers to tighten. Repeat on the other side. Insert a piece of plug tubing on one fluidic port of the flow cell and an empty syringe to the other fluidic port. Pull back the syringe's piston and check if it bounces back to ensure that the cell is airtight. Hold the flow cell up to your eye in room light and make sure you can see a clear path to check that the windows have not cracked in the replacement process.



**Figure 8: Tightening SMA connectors**

## SMA-Z-Cell Specifications

### Internal Volume (µL)

SMA-Z-2.5 Cell	2
SMA-Z-2.5 Cell uvol	2
SMA-Z-5 Cell	13
SMA-Z-5 Cell uvol	3
SMA-Z-10 Cell	26
SMA-Z-10 Cell uvol	6
SMA-Z-20 Cell	52
SMA-Z-20 Cell uvol	12
SMA-Z-50 Cell	130
SMA-Z-50 Cell uvol	30
SMA-Z-100 Cell	260
SMA-Z-100 Cell uvol	60

### Physical Parameters

	<b>PEEK</b>	<b>Stainless Steel (303)</b>	<b>Teflon (PTFE)</b>	<b>Ultem (1000)</b>	<b>Plexiglas</b>
Temperature (C)	100	100	100	70	70
Pressure (psi)	100	100	100	100	100

### Chemical Compatibility (common solvents – room temperature)

R = recommended; NR = not recommended

	<b>PEEK</b>	<b>Stainless Steel (303)</b>	<b>Teflon (PTFE)</b>	<b>Ultem (1000)</b>	<b>Plexiglas</b>
Acetic Acid	R	NR	R	R	NR
Acetone	R	R	R	R	NR
Acetonitrile	R	R	R	-	NR
Ammonia	R	NR	R	-	R
Benzene	R	R	R	-	NR
Chlorinated Hydrocarbons	-	-	R	NR	NR
Detergent Solutions	R	R	R	R	-
Hydrochloric Acid	R	NR	R	R	R (<35%)
Hydrofluoric Acid	NR	NR	R*	NR	NR
Hydrogen Peroxide (<40%)	R	NR	R	-	R (<30%)
Isopropyl Alcohol (<50%)	R	-	-	R	NR
Methanol (pure)	R	-	R	R	NR
Nitric Acid (20-70%)	R	R	R	R	R (<50%)
Phosphoric Acid (<10%)	R	NR	R	R	R
Potassium Hydroxide (50%)	R	R	R	R	R
Sodium Hydroxide	R	NR	R	R	R
Sodium Hypochlorite	R	NR	R	R	R
Sulfuric Acid (<30%)	R	NR	R	R	R (<15%)
Phosphate Buffered Saline	R	<b>NR</b>	R	R	R

\*Requires Sapphire Windows