Innovative Technologies in Resistive Glass Products for Efficient Ion Transport

Count on the Leader in Mass Spectrometry Components for Detection and Instrumentation Solutions

PHOTONIS | INDUSTRY | SCIENCE | MEDICAL

PHOTONIS leads the mass spectrometry industry in providing innovative detectors, sensors and inlet tube technologies to manufacturers and researchers worldwide.

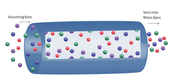
Overview:

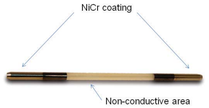
FieldMaster™ specialty glass tubes and plates are designed to control the velocity of ions by generating a uniform electric field. PHOTONIS resistive glass products are composed of a proprietary lead silicate glass that has been specially processed to create a resistive layer at the surface. The resistivity can be varied over several orders of magnitude to suit the specific application.

Single Capillary Inlet Tubes:

- Significantly improve ion transfer efficiency compared to conventional quartz inlet tubes.
- Voltage applied across the inlet tube creates an electric field that preferentially attracts ions into the inlet tube.
- Forces more ions into the mass spectrometer.
- Also prevents collisions with other ions and tube walls which can produce ion loss, resulting in more efficient sample transfer.
- Resistive glass inlet tubes provide unique ability to preferentially attract + or – ions.
- Rate of polarity switching can be accomplished more quickly with resistive glass tubes.
- An increase in ion transfer efficiency by factor of 100 has been achieved by a leading mass spectrometer manufacturer using PHOTONIS inlet tubes.

Conventional Inlet Tube vs Resistive Glass Inlet Tube





- Nickel-Chromium metallization areas for applying voltage.
- Non-conductive area designed to create conductive path on inside of tube only.

Typical Single Capillary Tube shown with an OD of 6.5 mm and an ID of 0.6 mm

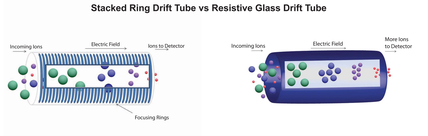
Multicapillary Inlet Tubes:

- Designed to further improve ion transmission into mass spectrometer compared to single capillary inlet tubes.
- Tubes manufactured by multi-bore extrusion process developed at PHOTONIS to create a circular array of six channels.
- An increase in ion transmission of up to 10X compared to single capillary inlet tubes has been achieved by a leading mass spectrometer manufacturer dramatically enhancing instrument sensitivity.
- Resistive glass multicapillary tubes therefore provide an increase in ion transfer efficiency of up to 1000X compared to conventional quartz tubes.

Drift Tubes for Ion Mobility Spectrometry:

- Demonstrated improved ion transmission compared to conventional tubes.
- Single piece, solid tube provides containment for counter-flow gas, eliminating the need for an additional enclosure.
- Resistive glass tubes are easily removed and cleaned without degrading the performance.
- Drift tube assembly with integral power supply being developed. Unit to include heater blanket, gas fittings for counter-flow gases and Faraday cup detector with integral anode.

Stacked Ring Drift Tube vs Resistive Glass Drift Tube



Reflectron Lenses for Mass Spectrometry:

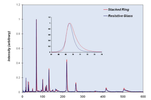
In a direct comparison, the resistive glass reflectron provided equal or better performance in an orthogonal TOF system than a traditional stacked ring reflectron.

127 pieces vs one piece design

SIMION Model

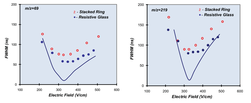
Spectral Comparison

- Spectra for the resistive glass and stacked ring reflectrons are nearly identical.
- Resistive glass reflectron (inset) produces narrower peaks.



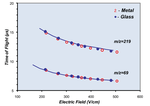
Peak Width

- Peak width as a function of reflectron electric field for the resistive glass and stacked ring configurations for two masses.
- Lower FWHM values of resistive glass reflectron indicate better energy focusing.
- SIMION simulations (solid line) include initial ion position as the only source of peak broadening.



Time-of-Flight

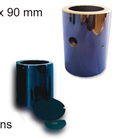
- Time-of-flight as a function of reflectron electric field measured at two masses shows good agreement between the two reflectron lenses. The solid lines are from a SIMION simulation.



Manufacturing Capability:

Tubes:
0.5 mm ID or greater
75 mm maximum OD
300 mm maximum tube length
1-6 mm wall thickness

Plates:
Sizes up to 90 mm x 90 mm
Flat within 3 fringes



Options:
Holes and/or slots drilled through glass
Custom metallization and/or sandblasting patterns
Custom end designs to accommodate specific cap configurations

Other Products from PHOTONIS:

Time-of-Flight Detectors:

PHOTONIS offers the widest and most technologically advanced array of Time-of-Flight Detectors. These patented Time-of-Flight Detectors offer previously unobtainable levels of temporal resolution, dynamic range, and high mass detection sensitivity for Time-of-Flight Mass Spectrometry.

UltraFast™ BiPolar TOF Detectors:

- Provides sub-nanosecond single ion pulse width and unsurpassed dynamic range.
- Optical isolation over 15 kV allows for post acceleration and fast polarity switching.
- No stray magnetic or electric fields generated.
- Available in 25 mm and 40 mm active diameter with a front flange mount.

Gen2 UltraFast™ TOF Detectors:

- PHOTONIS' newest TOF Detector provides pulse width of less than 200 picoseconds (FWHM) and near-symmetrical pulses with 120 picosecond rise and fall times.
- High voltage isolation is achieved through capacitive coupling.
- No stray magnetic or electric fields generated.
- Available in 18 and 40 mm active diameter with a front-flange mount.

TruFlite™ Microchannel Plates (MCPs):

- Prevent warping and cracking with PHOTONIS' Patented MountingPad™ technology.
- Increase the maximum linear output current with exclusive Extended Dynamic Range (EDR) option.
- An optimized bias angle and exclusive 2 micron pores minimize time jitter caused by the difference in ion arrival time.

Channel Electron Multipliers (Channeltron®):

- PHOTONIS offers the largest selection of standard and custom electron multipliers.
- Exclusive Extended Dynamic Range (EDR) option increases the linearity of the detector by a factor of ten.
- Superior high pressure performance up to 10^{-2} torr can be achieved in a compact, robust detector with the PHOTONIS family of Spiraltron™ detectors including the MegaSpiraltron™.

For more information, contact us at:

PHOTONIS USA
660 Main Street, Sturbridge Business Park
Sturbridge, MA USA 01566

Paula Holmes, Ph.D. (508) 347 4095
William Netolicky (508) 347 4003
www.photonis.com sales@photonis.com