

BURLE PHOTONIS

Performance of Electron Multipliers in High-Pressure Applications

BURLE Electro-Optics, Inc., A PHOTONIS Group Company

The vacuum systems of traditional mass spectrometers have long been a defining characteristic. Pressures of 10^{-5} torr or less have long been required in order to assure satisfactory operation. In order to reduce the size, weight, power consumption, and cost of mass spectrometers, it has become necessary to rethink vacuum requirements. One of the limiting constraints is the high vacuum requirement of high gain detectors. The ability of high gain, low noise electron multipliers to operate at millitorr pressures would permit the use of simpler, lower-cost vacuum systems.

BURLE Electro-Optics, now a member of The PHOTONIS Group, has developed a line of high performance electron multipliers that are capable of performing at these higher pressures.

The failure mechanism for electron multipliers in high pressure environments is a substantial increase in noise. This is caused by the signal electrons colliding with residual gas molecules. These residual gas molecules are ionized and are accelerated into the multiplying surfaces which cause secondary electron emission and create unwanted signals (ion feedback) that are not associated with any incoming event.

In order to increase the performance characteristics at higher pressures, the geometries and electric fields of the detectors must be drastically changed. As geometries are improved, the likelihood of collisions with residual gas molecules is reduced.

And as electric fields are reduced, any residual gas ions that are generated will have less energy and will be less likely to produce a secondary electron.

Typically, discrete dynode multipliers and single channel electron multipliers do not perform well at higher pressures. Spiraltron™ and MCP based detectors perform much better because of the much smaller geometries of the detector. Small pore MCP based detectors have been demonstrated that perform well in pressure up to the 50 millitorr range.

Tests were conducted in order to compare a variety of different technologies at higher pressures. These technologies included: a discrete dynode multiplier; a single channel electron multiplier; a Spiraltron™, and several types of MCP based electron multipliers.

The results of these tests demonstrated the clearly superior performance of several of the BURLE detector types when operated at pressures above 10^{-3} torr. Figure 1 shows the relative performance of the various electron multiplier types at increasing pressures. Note that specially designed Spiraltron™ and small pore MCP based detectors are exceptionally well suited for these high gain applications.

BURLE has designed a complete line of Spiraltron™ and MCP based detectors for use in higher pressure applications.

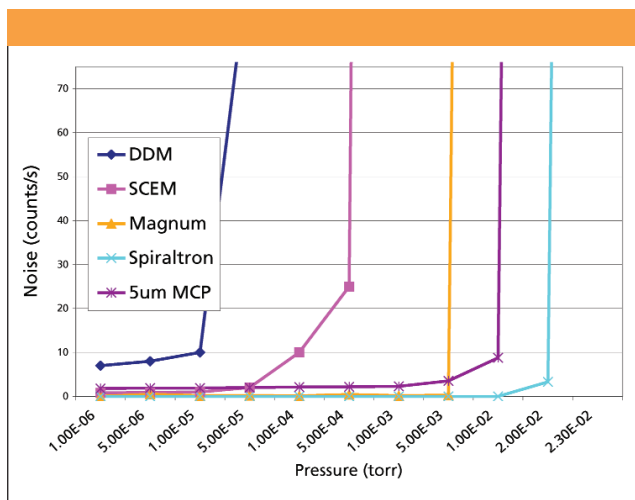


Figure 1: Relative performance of the various electron multiplier types at increasing pressures.

BURLE Electro-Optics, Inc.
A PHOTONIS Group Company

P.O.Box 1159
Sturbridge, MA 01566
Tel. (800) 648-1800 or +1 (508) 347-4000
Fax. +1 (508) 347-3849
sales@burle-eo.com, www.burle.com