# Optix for chemical sensing

## True gas sensing in vacuum and atmosphere, where RGAs fail to go

Optix from Gencoa is a truly universal tool for gas detection in vacuum. Quadrupole Residual Gas Analysers (RGAs) have been used for the last 30 years as the principle means to detect gases present in a vacuum environment. There are, however, two main aspects of an RGA that can limit its suitability for industrial processes:

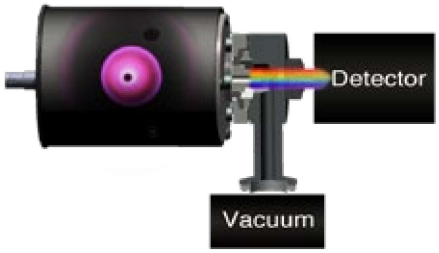
- Operation is suited to lower pressures meaning that most industrial vacuum processes also require a differential turbo pumping arrangement
- If volatile gases are present, they will deposit within the quadrupole. This restricts further operation until decontamination has occurred

This whitepaper will illustrate the ability of Optix to withstand volatile species and enable gas partial pressure measurement in all vacuum applications such as OLED, CVD, ALD, graphene and CNT (carbon nano-tube) production, and etch environments.

*Example of OLED display*

### Detector separation from the vacuum environment

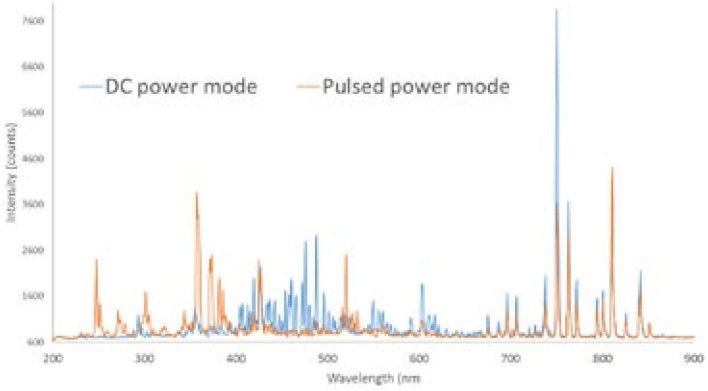
Optix uses an optical signal from a plasma to detect the gas species present. The light passes through a window, separating the detector from the vacuum environment. This is unlike an RGA where the detector has to be within the vacuum environment that is being sensed.
The separation of the Optix detector from a polluting atmosphere ensures that no damage can come as a result of accidental or process related contamination. As long as the plasma light is maintained, the gas composition can be measured.




*Optix schematic*

### Maintaining a plasma in the presence of volatile species

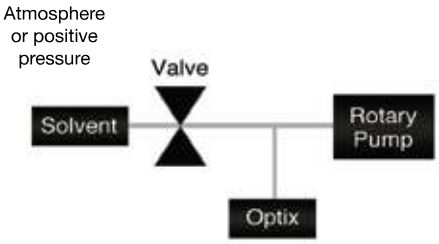
A plasma will crack the volatile species and create a reaction product within the plasma zone. For example, it is well-known that the presence of hydrocarbons will 'kill' an operating penning gauge quickly, due to the formation of an insulating layer on the cathode and anode surfaces. The Optix plasma generator functions similarly to a Penning type vacuum gauge in that it uses a magnetically enhanced type of DC discharge. Optix uses high speed feedback control of the plasma current to maintain a stable plasma from near-atmospheric pressure down to $10^{-6}$ mbar. This high speed current control means that generator contamination does not occur at high pressures and contamination can be controlled with volatile species. However, if sufficiently high levels of volatile chemicals are used in the process, the Optix plasma will be extinguished. A complete solution to the contamination problem is found by applying positive voltage pulses to the electrode. The positive pulsed mode of operation is subject to a patent application and has proved fully effective in maintaining the plasma in the presence of any form of chemical contamination (WO2017/046787, priority date 14th Sept 2015).




*Comparison of spectrums with DC and pulsed DC power modes*

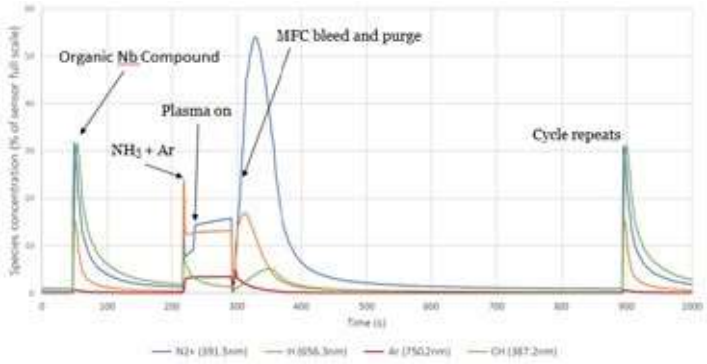
## Total Robustness

Optix will tolerate any form of vacuum environment or pressure without sustaining damage. Hence operators can be assured that whatever event transpires within the vacuum chamber, Optix will continue to function well. This compares favourably to RGA's, which cannot function in a wide range of environments, and also suffer from common filament problems that require remedial actions of some form. As Optix




*Schematic of Optix use for non-vacuum sensing*

does not require a differential pumping unit to operate at the common processing pressures, it alleviates both the running costs and maintenance associated with the use of a pump.

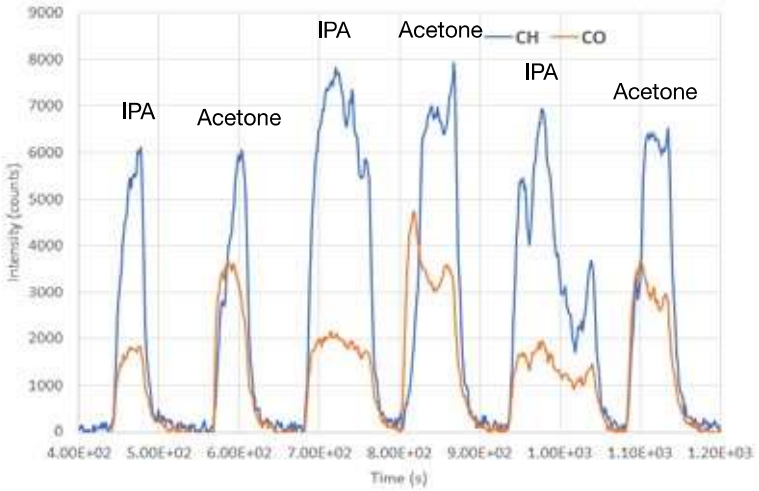



*Optix atomic layer deposition (ALD) precursor and reactant monitoring*

## Chemical sensing of common processes

There are a number of processes that involve working with varying amounts of chemicals within the vacuum as part of the production for which the inclusion of an RGA is not a practical solution. These include: OLED production; diamond growth; MOCVD; CVD; ALD; graphene and CNT production; photoresist and etch processes. Optix can be used for all such processes to sense the chemical environment, and is also proven to work well in positive pressure applications by the use of a simple mechanical pump to reduce the pressure at the plasma head.

All of these processes are excellent examples of how Optix can be used for chemical sensing in order to improve the regulation of the process as well as for troubleshooting. Reduced chemical use, faster cycles, better process feedback control, higher quality and reduced scrappage are all among the specific benefits that can result from using Optix to monitor the vacuum environment.


*Differentiation between two types of solvent sensed from atmospheric pressure*

## Further information

For further information on Gencoa's Optix sensor, visit **www.gencoa.com/optix** or email **sales@gencoa.com**

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