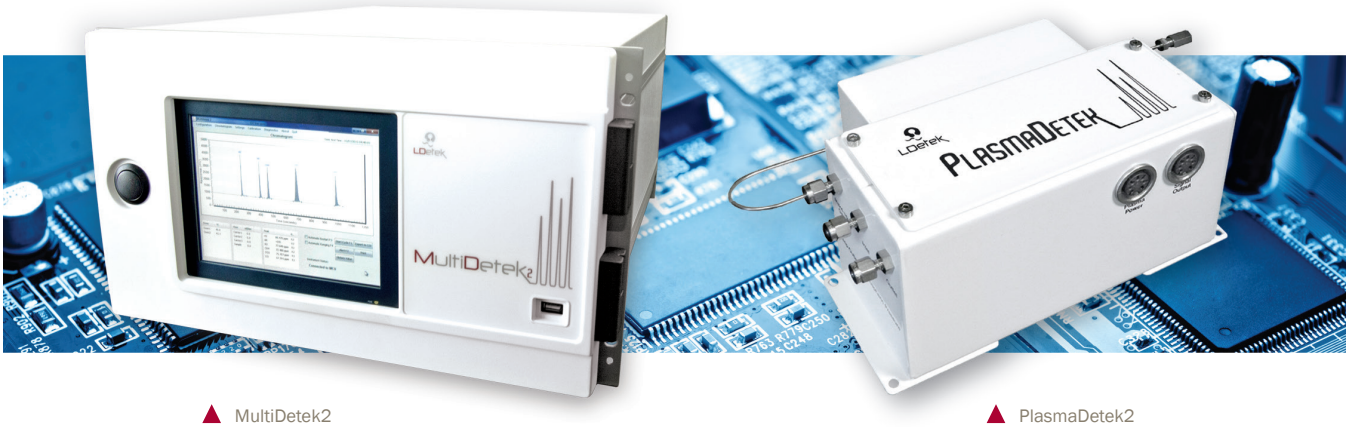
# APPLICATION NOTE
# LD19-02

## Measurement of trace impurities
## in high purity Nitrogen trifluoride (NF3) for electronic gas industry using PlasmaDetek2 and MultiDetek2 GC




▲ MultiDetek2

▲ PlasmaDetek2
patent US 9,310,308 B2

The analysis of high purity nitrogen trifluoride is commonly used for the electronic market in the plasma etching of silicon wafers for the production of liquid crystal displays.

### LDETEK SOLUTION:

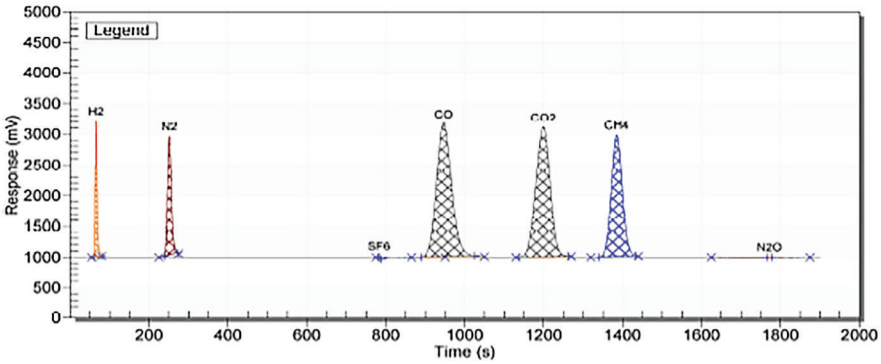
The GC configuration for this type of application is generally configured with coated stainless steel purged diaphragm valves and coated MXT columns to improve the performances of the system. At the end of the GC configuration, the PlasmaDetek-2 detector is configured to selectively measure the impurities requested. Multiple channels can be configured depending of the application. For this application note, the MultiDetek2 GC is configured with 4 channels merging in the PED detector.

- **Trace H2-Ar+O2-N2-CO impurities measured with channel #1**
- **Trace SF6 impurities measured with channel #2**
- **Trace CO2-N2O impurities measured with channel #3**
- **Trace CH4-CF4 impurities measured with channel #4**

## RESULTS:

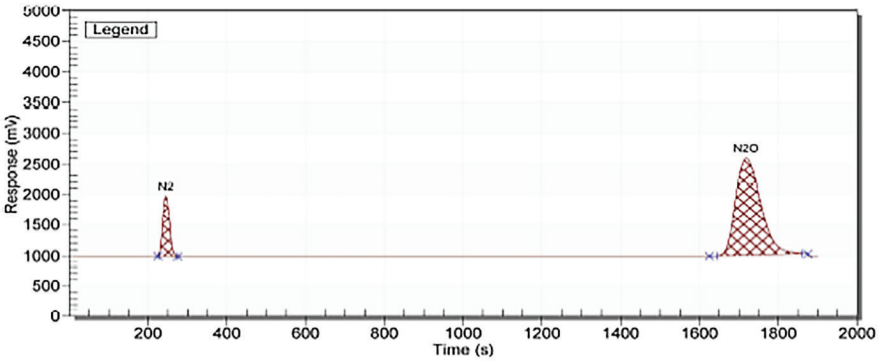
**Chromatogram :** Trace CO2-H2-N2-CO-CH4 impurities in NF3

| Peak | Unit | Calibration Value | Area Counts |
|---|---|---|---|
| CO2 | ppm | 5.00 | 89184 |
| H2 | ppm | 5.00 | 11170 |
| N2 | ppm | 5.00 | 22814 |
| CO | ppm | 5.00 | 96257 |
| CH4 | ppm | 5.00 | 64378 |



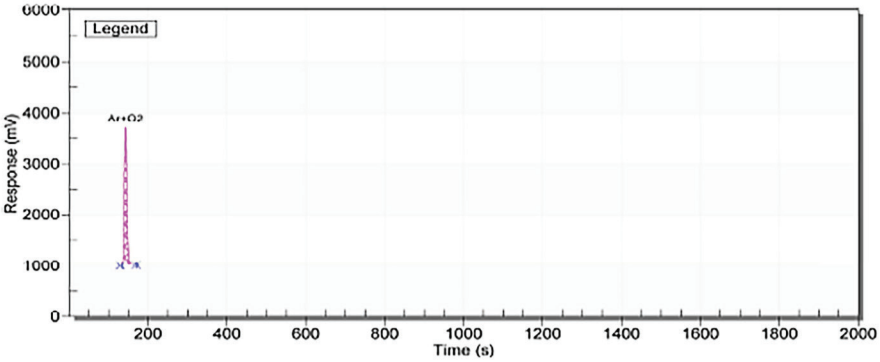

**Chromatogram :** Trace N2O impurities in NF3

| Peak | Unit | Calibration Value | Area Counts |
|---|---|---|---|
| N2O | ppm | 4.90 | 114967 |



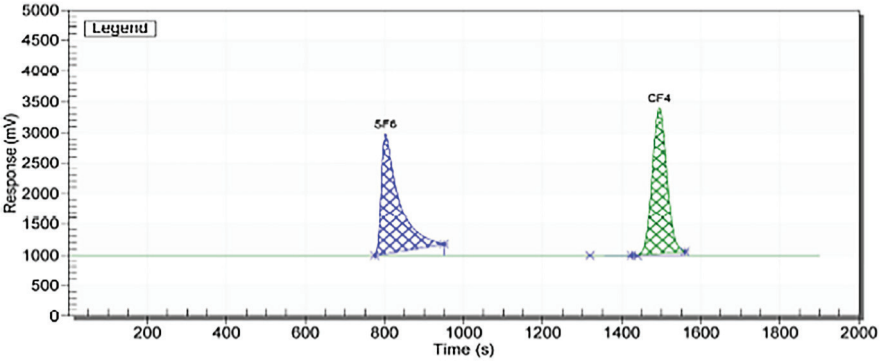

**Chromatogram :** Trace AR+O2 impurities in NF3

| Peak | Unit | Calibration Value | Area Counts |
|---|---|---|---|
| Ar+O2 | ppm | 5.00 | 19120 |




**Chromatogram :** Trace SF6-CF4 impurities in NF3

| Peak | Unit | Calibration Value | Area Counts |
|---|---|---|---|
| SF6 | ppm | 5.00 | 99694 |
| CF4 | ppm | 5.00 | 100767 |

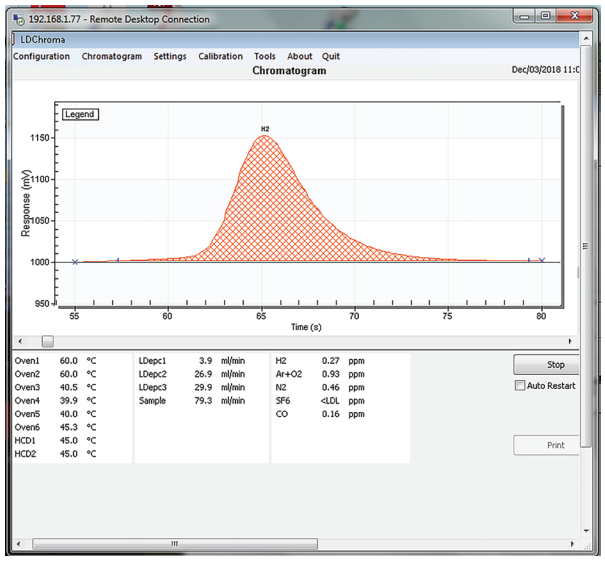


## LIMIT OF DETECTION

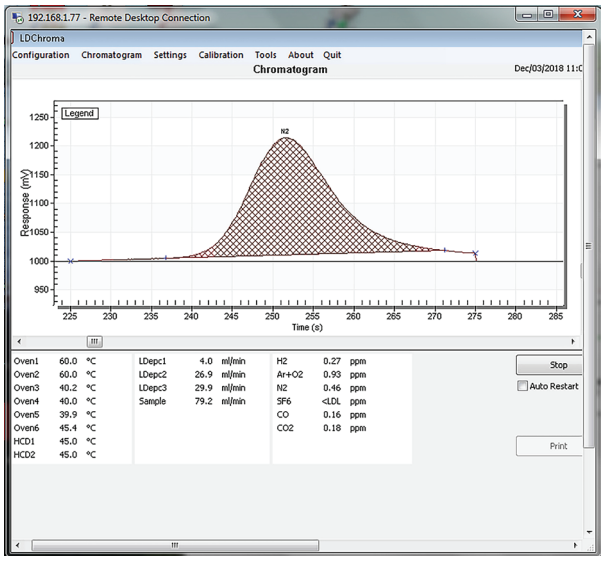
| COMPONENTS | CONCENTRATION | PEAK HEIGHT | NOISE | LDL (3X NOISE) |
|---|---|---|---|---|
| H2 | 0.27 ppm | 150 mV | 1.0 mV | 5.4 ppb |
| Ar+O2 | 0.61 ppm | 130 mV | 1.0 mV | 14.0 ppb |
| N2 | 0.46 ppm | 200 mV | 0.5 mV | 3.4 ppb |
| CO2 | 0.18 ppm | 93 mV | 1.9 mV | 11.0 ppb |
| CH4 | 0.18 ppm | 80 mV | 1.4 mV | 9.4 ppb |
| CO | 0.23 ppm | 105 mV | 2.3 mV | 15.0 ppb |
| N2O | 0.1 ppm | 34 mV | 2 mV | 17.6 ppb |
| SF6 | 1.5 ppm | 660 mV | 1 mV | 6.8 ppb |
| CF4 | 1.37 ppm | 700 mV | 3 mV | 17.6 ppb |

Note: other LDL could be obtained with different injection volume and chromatographic condition

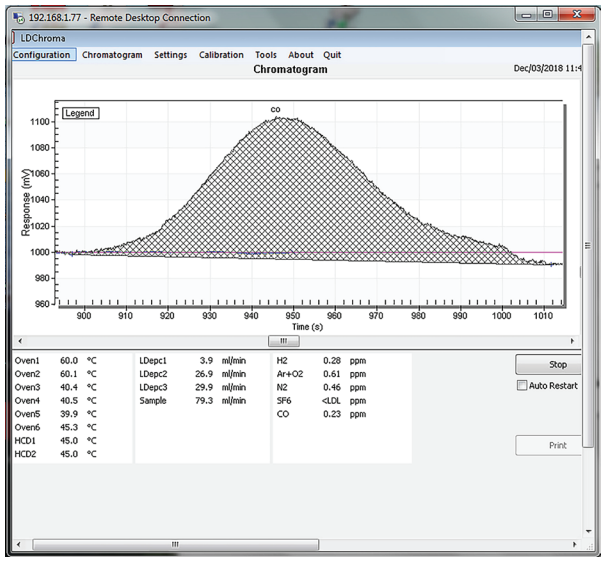
**Channel 1 : 0.27ppm H2**



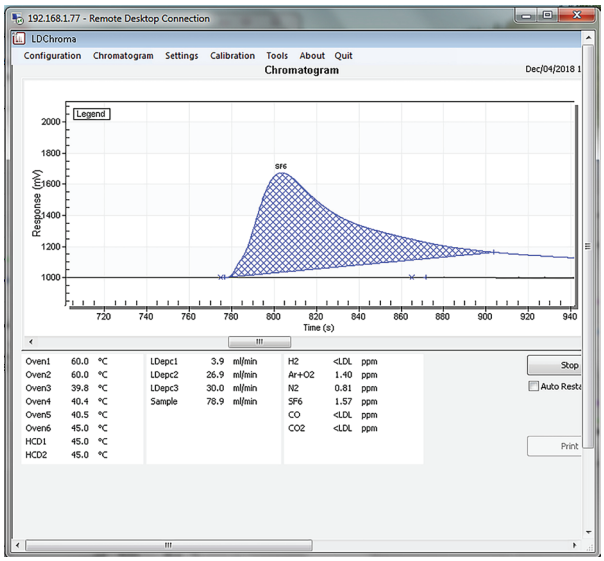

**Channel 1 : 0.46ppm N2**



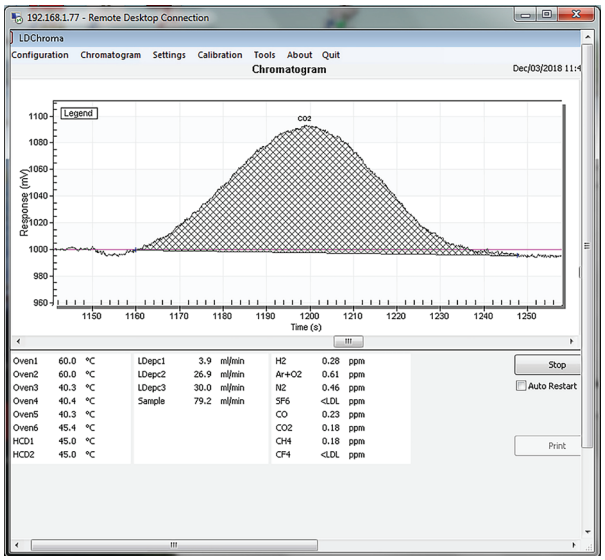

**Channel 1 : 0.23ppm CO**



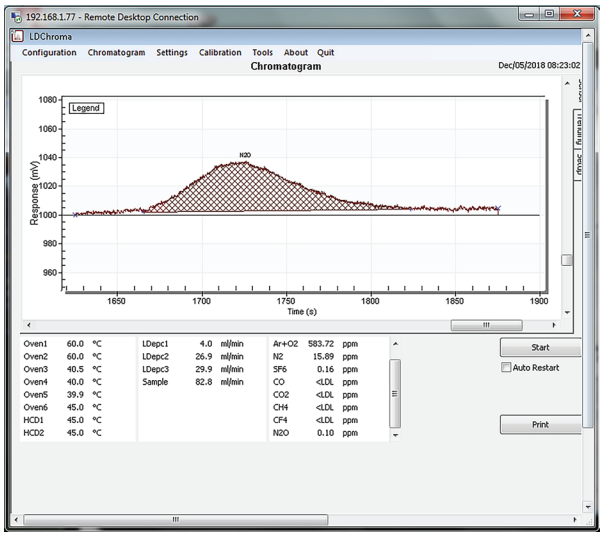

**Channel 2 : 1.5ppm SF6**



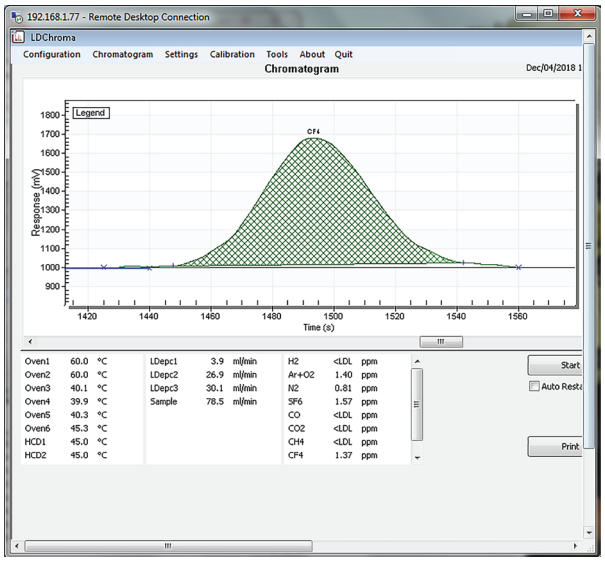
**Channel 3 : 0.18ppm CO2**



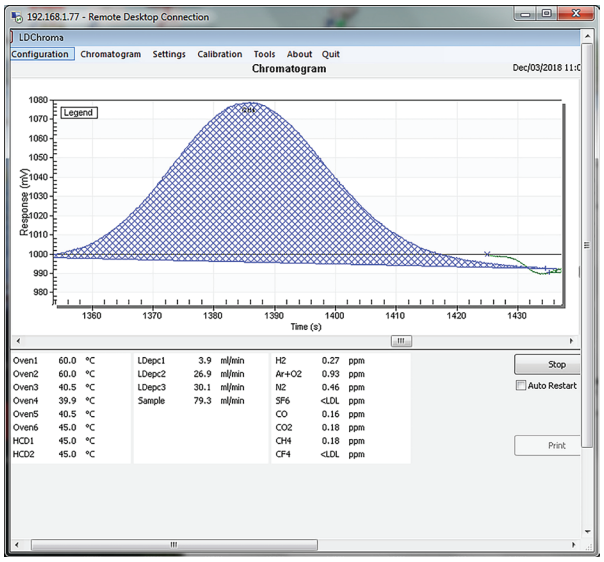

**Channel 3 : 0.1ppm N2O**




**Channel 4 : 1.37ppm CF4**




**Channel 4 : 0.18ppm CH4**




## CONCLUSION:

The system is configured with the proper columns and valve configuration to get a quick analysis time and a robust configuration. The use of the PlasmaDetek2 offers a good selectivity for the detection allowing to get a relatively good short analysis time with good limit of detection.


LDetek
990 Monfette Est, Thetford Mines, (Qc), Canada, G6G 7K6
Phone: 418 755-1319 • Fax: 418 755-1329 • **info@ldetek.com**
www.ldetek.com