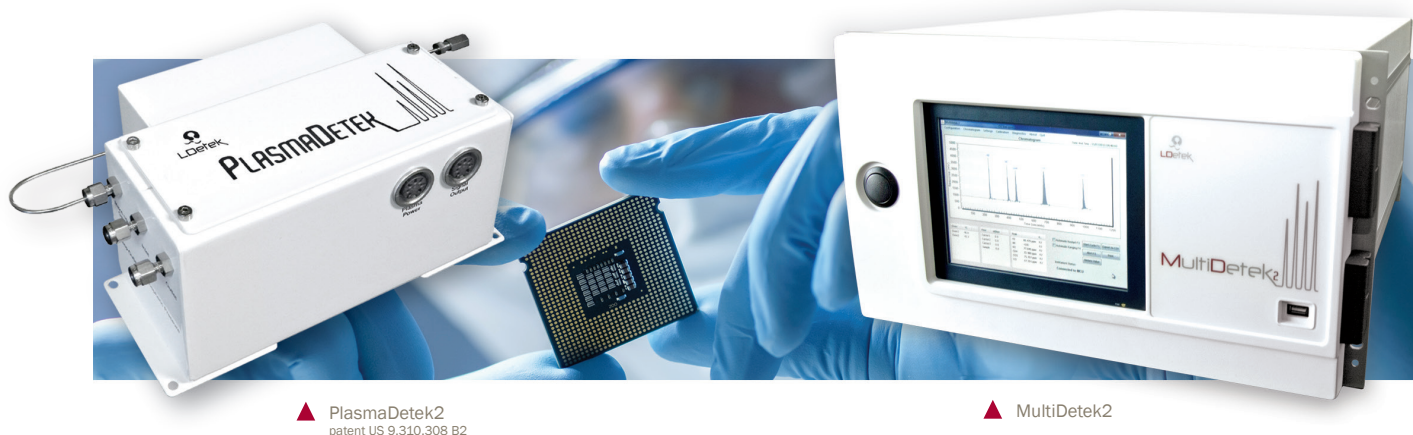


# APPLICATION NOTE

# LD21-03



## Analysis of trace impurities in UHP B2H6 used for semiconductor industry with the PlasmaDetek2 and MultiDetek2 GC



Measuring trace impurities down to sub ppb is required by the semiconductor industry for UHP Diborane (B2H6). This very reactive gas is used in the electronics and photovoltaic industries as a semi-conductor doping agent.

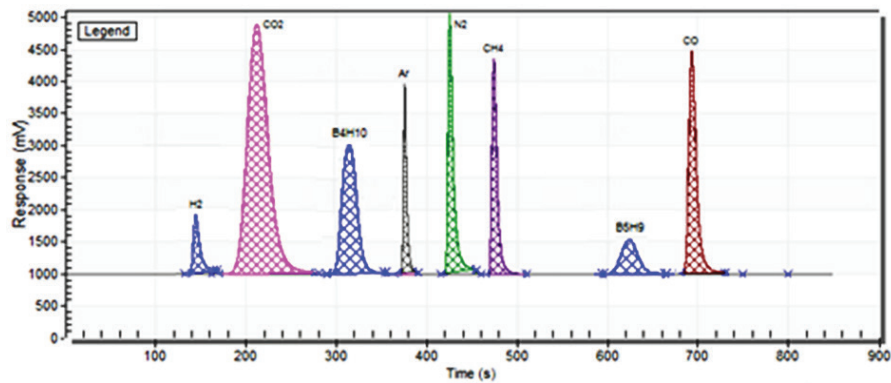
### LDETEK SOLUTION

The MultiDetek2 gas chromatograph is configured with one channel for the light impurities and another channel for the heavier impurities to measure. Both channels used a PED with Helium as carrier gas source.

Working here with the very reactive sample gas B2H6, which is also well known to generate weak acids, the separation columns and the detectors mounted in each channel are individually protected with a pre-column mounted in a backflush to vent configuration. The protection columns and the backflush/injection diaphragm valves are constructed with Hastelloy to be compatible with the aggressivity of the sample gas.

On top of that, the MultiDetek2 is equipped with an integrated stream selector system also constructed with Hastelloy material. The stream selector system allows to switch from stream B2H6 along to Span gas for calibration/validation purpose. An extra inlet has been added to the stream selector system to switch the sample gas between each analysis to an inert gas being helium in this case. This feature is used to protect the injection valves and sampling loops from the aggressivity of the sample gas. By this type of configuration, we keep the corrosion and degradation of the flow path away.

## RESULTS



**Chromatogram:**  
Trace H2-CO2-B4H10-Ar-N2-CH4-  
B5H9-CO-B5H11 impurities in  
Diborane (B2H6)

Limit of detection (based on 3 times the noise level from a blank)

COMPONENTS	CONCENTRATION (ppm)	PEAK HEIGHT	NOISE	LDL (3X NOISE)
H2	5.8	975mV	0.2mV	3.5ppb
CO2	6.6	3880mV	0.2mV	1.0ppb
B4H10	10.8	2007mV	0.2mV	3.2ppb
Ar	4.9	2989mV	0.1mV	0.5ppb
N2	12.9	4000mV	0.1mV	1.0ppb
CH4	5.8	3344mV	0.2mV	1.0ppb
B5H9	5.9	523mV	0.2mV	6.7ppb
CO	5.1	3503mV	0.2mV	0.9ppb
B5H11	n/a	n/a	0.2mV	5-10ppb

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

## CONCLUSION

Using the PlasmaDetek2 detector inside one-unit MultiDetek2 GC, the analysis of trace ppb/ppm impurities H2-CO2-B4H10-Ar-N2-CH4-B5H9-CO-B5H11 impurities in Diborane (B2H6) can be performed. The analysis time is less than 15 minutes. The unit was configured with a combination of Hastelloy and coated stainless steel valves/fittings/columns and tubing to be compatible with the aggressive and acid nature of the sample gas. Using the proper material, the system is robust and safe to operate for years. The unit uses 4-20mA outputs for each impurity and also the Modbus protocol for data transmission. Our LDGSS stream selector system has been used as well to allow switching across the different streams. The LDGSS also has been configured with Hastelloy material to be compatible with the aggressivity of the sample gas.

