Application Note AN-105

May 2016

SPEC Sensor™ Selectivity and Cross-Sensitivity

Scope

This application note discusses the selectivity of the different SPEC sensors to a list of common gases and air pollutants, and considerations for different applications.

SPEC Sensors are design to be selective to compounds or specific classes of compounds. However, in cases where the presence of electrochemically similar compounds is possible, there may be potential errors in the measurement of the target compound. The following table includes a list of common gases and air pollutants and the typical effect they would have on the measurement of our various sensors.

	Sensor>>	CO	H2S	O3; -200mV	O3; 0mV	NO2	SO2	EtOH	NO	TOX	Tred
Gas	ppm tested	ppm Measured									
Carbon Monoxide	400	400.0	1.1	<0.05	<0.05	<0.1	7.3	251.4	4.0	400.0	-2.8
Hydrogen Sulfide	25	<1	25.0	-5.8	-12.5	-5.8	142.3	63.2	78.6	92.1	-67.6
Ozone	5	<1	-0.9	5.0	5.0	5.0	-3.3	<5	-1.8	-3.6	3.8
Nitrogen Dioxide	10	<1	-2.0	10.0	5.0	10.0	1.4	<5	0.8	-5.5	10.0
Sulfur Dioxide	20	<1	1.7	0.1	tbd	<0.1	20.0	11.6	11.0	14.7	-13.9
Ethanol	200	5.4	-1.9	2.3	tbd	2.3	-1.8	200.0	-1.0	285.3	12.7
NO	50	26.1	1.2	0.2	tbd	0.2	90.5	54.5	50.0	40.8	0.1
Chlorine	10	<1	-2.2	9.4	10.0	9.4	-2.8	-14.3	-1.6	-5.5	6.5
n-Heptane	500	<1	<0.05	-0.2	-0.2	-0.2	-0.7	-12.6	-0.4	<0.1	-0.3
Ammonia	100	<1	0.1	<0.05	tbd	<0.1	<0.2	<5	<0.1	0.3	-0.3
Methane	500	<1	0.1	<0.05	<0.05	<0.1	0.7	<5	0.4	<0.1	0.4
Hydrogen	100	17.0	---	---	---	---	---	---	---	---	---
Carbon Dioxide	5000	<1	---	---	---	---	---	---	---	---	---

Improving Selectivity

To improve selectivity, several approaches are possible:

Chemically Selective Filters

In the 15x15 package, SPEC currently offers a filter for the CO sensor. This filter removes potentially interfering gases before they reach the working electrode. The capacity of this filter corresponds to more than 20,000 ppm-hours of H_2S, or several years of typical ambient levels of interfering concentrations. With this filter in place and operating properly, the sensor will respond to CO and have no response to ppm levels of H2S.

NOTE: *For highest accuracy in cases where continuous operation of the sensor in areas of elevated or fluctuating concentrations of interfering gases is needed, it is recommended that a larger, perhaps even external, replaceable filter be used. Replacement of the filter at routine intervals, or before any critical measurement, is recommended so that the minimum interference is observed.*

SPEC Sensors can assist in the design of special high capacity filters for special applications. Please consult SPEC engineers with any questions about interferences and potential solutions to these kinds of application problems.

Using Multiple Sensors

Improving selectivity using multiple sensors are provided by the following examples:

i. It is desired to measure a gas in an environment where it is expected an interfering species will be present. **Example:** measuring CO in a sample where NO is also present. NO exhibits an approximate 50% cross-sensitivity on the CO sensor; while CO exhibits virtually no response on the NO sensor. By including an NO sensor in the detector, the CO readings can be automatically compensated for the measured NO.

ii. Applications where it is desired to measure two or more gases for which both sensors exhibit cross-sensitivity to the other gas. **Example:** measuring O3 and NO2 in the air: These sensors both exhibit cross-sensitivity to the other gas. By carefully measuring the response of each sensor to precise concentrations of the individual gases, it is possible to include compensation terms (simultaneous equations) in the calibration algorithms.

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Revision History

Rev Date	Description of Rev	Approved by:
2015-03-24	Working Draft	M. Findlay
2015-04-20	Rev 0.01 with Title change and Brian K comments	M. Findlay
2015-05-06	Rev 0.02 revised x-sensitivity table	M. Findlay
2015-11-17	Rev 0.03 Added 0mV bias O3 snsr x-sensitivity data	M. Findlay