Intrinsic Safety Consideration

Introduction

Sensoric´s toxic gas sensors are micro fuel cells to be maintenance free and stable over a long period of time.

Sensoric´s three electrode toxic gas sensors consist of a sensing electrode, a counter electrode and a reference electrode, which keeps the potential of the sensing electrode constant in co-operation with an electronic circuit.

The central feature of the sensor is the diffusion barrier, which limits the flow of the target gas to the sensing electrode in that way, that all gas can react either by oxidation or reduction at the electrode.

Under this condition there is a linear relationship between the current signal and the partial pressure of the toxic gas, which is combined with the volume concentration of the gas.

The electrocatalysts are especially developed by Sensoric and designed to be specific for the target gas.

The reaction can be a direct charge transfer process or an indirect process, where at first a chemical reaction takes place, before in a second step the electrochemical reaction occurs.

The counter electrode acts to balance out the reaction at the sensing electrode by reducing oxygen in air to water in the case of an oxidation reaction on the sensing electrode, and the inverse process of water oxidation to oxygen, if an oxidation process takes place.

Current and Open Circuit Voltages

Due to the mechanical dimensions and the principle working mechanism Sensoric sensors are electrochemical devices which produce very small voltages and currents.

Sensoric sensors are also not able to store large quantities of energy.
Considering the electrical characteristics of the sensors in normal operation and the possible fault conditions, Sensoric sensors may be considered as a simple apparatus.

Sensoric Sensors are electrochemical sensors which operate as micro fuel cells; which means a current will only be generated if the gas compound is present. Otherwise voltage and current will be nearly zero.

Sensoric Sensors are designed and manufactured in
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Application Note

Sensor	Electrode reaction	Open circuit voltage [mV] typical	Open circuit voltage [mV] limit	Short circuit current [µA] typical[1]	Short circuit current [µA] limit
AsH_3 2E/ PH_3	$6\ Ag^+ + AsH_3 + 2H_2O \Rightarrow H_3AsO_3 + 6H^+ + 6\ Ag\ 6\ Ag \Rightarrow 6\ Ag + + e-$	<50	<300	<0.8	10
AsH_3 3E 1 LT/ PH_3 3E 5 LT	not specified	<50	<300	<2	10
AsH_3 3E 1 F LT/ PH_3 3E 5 F LT	not specified	<50	<300	<2	10
Cl_2 3E 10	$Cl_2 + 2e^- \Rightarrow 2Cl$	<50	<200	<0.5	50
Cl_2 3E 50	$Cl_2 + 2e^- \Rightarrow 2Cl^-$	<50	<200	<0.5	50
ClO_2 3E 1 O	not specified	<50	<300	<1	10
CO 2E 300	$CO + H_2O \Rightarrow CO_2 + 2H^+ + 2\ e^-$	<100	<300	<0.09	500
CO 3E 300 / 500S	$CO + H_2O \Rightarrow CO_2 + 2H^+ + 2\ e^-$	<100	<300	<0.09	500
$COCl_2$ 3E 1	$COCl_2 + H_2O + 2\ Ag^+ \Rightarrow 2AgCl + 2H^+ + CO_2$	<100	<300	<0.8	10
$COCl_2$ 3E 1 S	$COCl_2 + H_2O + 2\ Ag^+ \Rightarrow 2AgCl + 2H^+ + CO_2$	<100	<300	<0.8	10
F_2 3E 1	not specified	<50	<300	<1	10
H_2 3E 1%	$H_2 \Rightarrow 2\ H^+ + 2e^-$	<100	<500	<0.005	500
H_2 3E 4%	$H_2 \Rightarrow 2\ H^+ + 2e^-$	<100	<500	<0.005	500
H_2S 2E 30	$2\ Ag^+ + H_2S \Rightarrow Ag_2S + 2\ H^+ + 2e^-$	<100	<300	<0.1	50
H_2S 3E 30	$2\ Ag^+ + H_2S \Rightarrow Ag_2S + 2\ H^+ + 2e^-$	<100	<300	<0.1	50
H2S 2E 50S	$H_2S + 4\ H_20 \Rightarrow H_2SO4 + 8\ H^+ + 8e-$	<100	<500	<0.5	500
H_2S 3E 100 / 100 S	$H_2S + 4\ H_20 \Rightarrow H_2SO_4 + 8\ H^+ + 8e^-$	<100	<500	<0.5	500
HCl 3E 30	$Au^+ + 4HCl \Rightarrow AuCl_4^- + 4\ H^+ + Au \Rightarrow Au^+ + e-$	<100	<500	<0.1	500
HCN 2E 30 F	not specified	<100	<300	<0.05	50
HCN 3E 30 F	$Ag \Rightarrow Ag^+ + e- / Ag + HCN \Rightarrow AgCN$	<50	<300	<0.04	50
HF 3E 10SE	not specified	<100	<500	<0.5	500
N_2H_4 2E 1	not specified	<50	<300	<2	10
NH_3 3E 100	not specified	<10	<500	<0.1	50
NH_3 3E 1000	not specified	<100	<500	<0.1	50
NH_3 3E 100 SE	not specified	<50	<200	<0.1	50
NH_3 3E 500 SE	not specified	<50	<200	<0.05	50
NH_3 3E 1000 SE	not specified	<50	<200	<0.02	50
NH_3 3E 5000 SE	not specified	<50	<200	<0.01	50
NO 3E 100	$NO + 2\ H_2O \Rightarrow NO_2 + 2\ H^+ + 2e^-$	<100	<500	<0.03	300
NO_2 3E 50	$NO_2 + 2\ H^+ + 2e^- \Rightarrow NO + 2\ H_2O$	<50	<200	<0.1	50
O3 3E 1	not specified	<50	<300	<2	10
O3 3E 1 F	not specified	<50	<300	<1	10
SeH2 3E 5LT	not specified	<50	<300	<2	10
SiH_4 / GeH_4 / B_2H_6	$SiH_4 + 3H_2O \Rightarrow H_2SiO_3 + 8H^+ + 8e^-$	<50	<300	<0.1	50
THT 3E 50	not specified	<100	<500	<0.2	50
TBM 2E 50	not specified	<100	<300	<0.02	10

[1] Regarding to 1 ppm

The Counter electrode acts to balance out the reaction at the sensing electrode either by reducing oxygen in air to water or by reducing water to oxygen. O2 + 4H+ + 4 e- => 2H2O

All Sensoric sensors do not contain any electric components, if not otherwise specified.

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