4th World Congress on Biomimetics, Artificial Muscles and Nano-Bio

Reproducibility, Selectivity and Sensitivity of P-3-Met Polymer sensors for pollutant gases detection

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We have already developed a portable electronic nose using an array of metal oxide sensors, dedicated to environmental pollution [1, 2]. Unfortunately these sensors need to be heated continuously at a working temperature (~300°C) to avoid irreparable drift. To use low energy consumer gas sensors, we have decided to study conducting polymer sensors working at room temperature. The other advantage of these types of sensors is that they are small, easy to connect and present good sensitivity to very low gas concentration [3]. We have chosen to work with poly-3-metylthiophen polymer sensors, using four different dopants ($LiClO_4$, $TBAClO_4$, $TBABF_4$, $LiCF_3SO_3$) in order to find selective, sensitive and stable sensors in presence of studied gases such as H_2S, NO_2, SO_2. For this study, the sensors are mounted in a stainless-steel test chamber with a reduced volume (~15ml). A dry synthetic air flux is passed through the box until the stabilization of the sensor signals (typically 1 hour). Then pulses of pollutant gases at low concentration in air are introduced in the test chamber. After each pulse, synthetic air is passed during fifteen minutes to ensure the sensor regeneration and the signal base line recuperation.
Sensitivity studies show a very high sensibility of all the sensors to NO_2 at very low concentrations (from 0.1ppm). For H_2S and SO_2 the detection thresholds are higher (Figure 1). In the studied concentration range, resistance variation of all the sensors along with the gas concentrations is quasi linear. The study with H_2S presents promising results concerning the time sensor stability and the reproducibility of the sensor fabrication. We are currently studying the same behavior of these sensors under NO_2 and SO_2, in order to have a competitive array for our electronic nose.

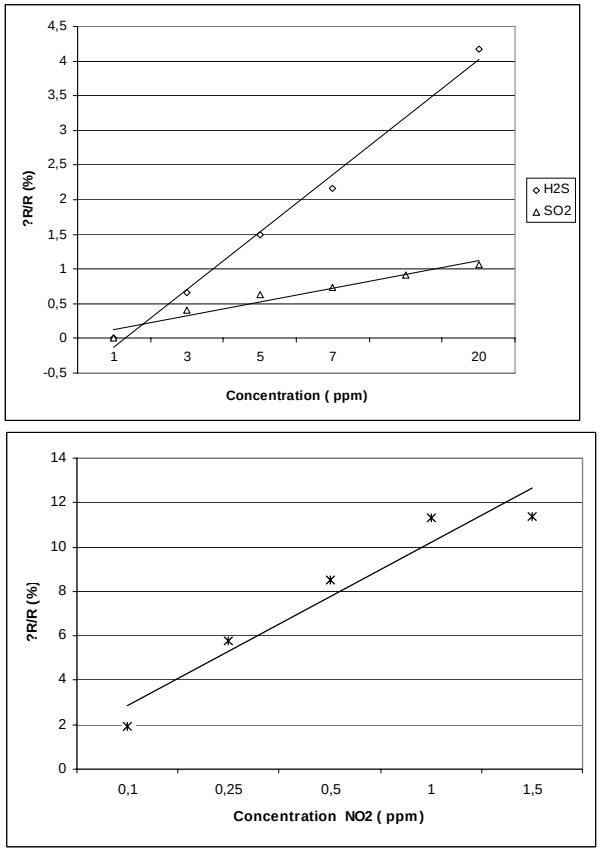

Fig1: Relative response of one sensor to different concentrations of the three target gases: NO_2, H_2S, SO_2

[1] O. Helli *and Al.*, Qualitative and quantitative identification of H_2S/NO_2 gaseous components in different reference atmospheres using a metal oxide sensor array, Sens. Actuators B, vol 103, p. 403-408, 2004.

[2] W. Schmid, N. Barsan, U. Weimar, Sensing hydrocarbons with tin oxide sensors: possible reaction path as revealed by consumption measurements, Sensors and Actuators B, vol 89, p. 232-236, 2003.

[3]A. Guadarrama *and Al.*, Electronic Nose based on conducting polymers for the quality control of the olive oil aroma: Discrimination of quality, variety of olive and geographic origin, Anal. Chim. Acta, vol 432, p. 283-292, 2001.