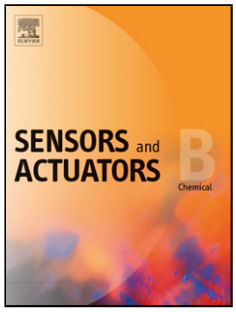

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Flexible passive tag based on light energy harvesting for gas threshold determination in sealed environments

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Abstract

In this work we describe a passive screen printed flexible tag for gas monitoring that can be used in sealed environments. The developed measurement system is based on chemical sensors that are sensitive to gases concentration presenting optical response, luminescent or colourimetric. The measuring electronics consist of a LED for optical excitation of the sensing membrane and a high resolution digital colour detector for the reading of the optical signal. A microcontroller receives and processes the data enabling the detection threshold for the corresponding gas. The whole system is powered by two miniaturized solar cells that provide 4 V and up to 250 μA each one. This system can run in sunlight or using a bright artificial light as the only energy source. The information of the inner environmental conditions regarding the gas concentration is transmitted to the user through a simple optical code using colour light-emitting diodes. These LEDs are activated to indicate whether the concentration of the monitored gas is within the expected limits, or not. Two prototypes based on this architecture and only changing the sensing module have been developed and applied for the determination of two common gases: oxygen and carbon dioxide. In the first case, a luminescent chemical sensor is used while in the second, the sensing membrane presents a colourimetric response. Both types of sensors can be used in this design. Resulting limits of detection are compatible with assessment of modified atmosphere packaging.

Keywords: Passive tag; Optical gas sensing; Colour detector; Light energy harvesting; Sealed environment sensing.