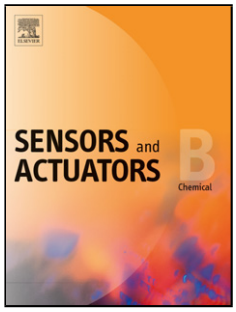

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Dual Transduction on a Single Sensor for Gas Identification

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Highlights

- Dual transduction is implemented on a single sensor to achieve gas identification and overcome the selectivity issue of adsorption-based sensing materials.
- A film bulk acoustic wave resonator with interdigitated electrodes is designed to simultaneously detect the resistance and mass variations in sensing material.
- The sensing range of the sensing material is expanded through dual transduction.
- The dual transduction method can help fully explore the potential of conductive gas sensing materials.

Abstract

Poor selectivity is one important limitation of gas sensors based on chemisorption or physisorption. This poor selectivity is usually tackled through the use of a gas sensor array, whose individual elements have diverse selectivity. Gas identification can be achieved by analyzing the unique response patterns of the sensor array. However, such an approach is costly due to its complexity. In this paper, we investigate an alternative solution enabling single sensor gas identification through the integration of two transduction mechanisms in one sensor. We demonstrate this approach through the design of a novel dual transduction gas sensor capable of simultaneously detecting gas-induced variations in the mass and resistance of the sensing material. The relative independence of acquired gravimetric and resistive responses is shown to enable subsequent gas identification. In addition, the proposed approach can also improve the overall limit of detection (LOD) to different gases by exploiting the individual responses with the best LODs. The proposed dual transduction gas sensor was implemented by integrating a film bulk acoustic wave resonator (FBAR) together with interdigitated electrodes. A configurable dual-mode oscillator circuit is also proposed to simultaneously read-out both responses from the sensor.

Keywords: gas sensor, dual transduction, FBAR, conductive polymer