Gas Sensors based on Conducting Polymers

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Mots-clés : Gas Sensors, Conducting polymers, Electrochemistry

Résumé :

Conducting polymers are an important class of functional materials that has been widely applied to fabricate chemical sensors, because of their interesting and tunable chemical, electrical, and structural properties [1]. Conducting polymers can also be designed through chemical grafting of functional groups, nanostructured, or associated with other functional materials such as nanoparticles to provide tremendous improvements in sensitivity, selectivity, stability and reproducibility of the sensor's response to a variety of analytes.

Conducting polymers have demonstrated great potential for chemical gas detection at room temperature since their electrical conductivity can be varied when they are exposed to oxidative or reducing gas molecules at room temperature. Consequently, our team has for several years been developing chemiresistive gas sensors using electrodeposited polypyrrole or polyaniline films as the sensitive layers. To improve the sensitivity of these films and lower their detection limit, they have been successively combined with macrocycles [2], surfactants [2], ionic liquids [3] or other organic molecules [4]. The electrodeposition parameters (electrodeposition time and potential, concentrations of electrolyte constituents) were also varied to modify the physico-chemical properties of the films and optimize the response of the sensors. The resulting polymer-based sensors exhibited high sensitivity to ammonia, low detection limit of detection (2 ppb for the best sensor), good repeatability, and reversible response in a broad range of relative humidity [4].

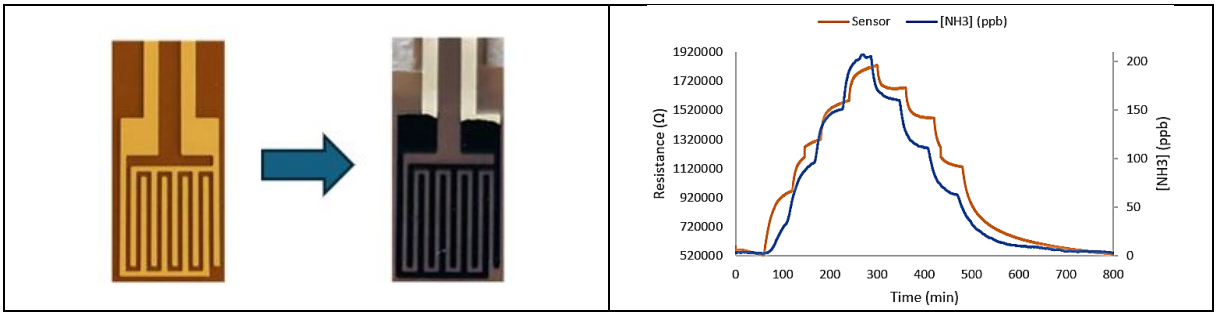

Figure 1. Left: image of the flexible sensor before and after electrochemical deposition of polyaniline. Right: resistance of the polyaniline-based sensor as a function of time during exposition to increasing and decreasing concentrations of NH_3 from 50 to 200 ppb. RH: 50%, T: 25°C.

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