PÔSTER - RESUMO - SENSORES E BIOSSENSORES

AMMONIA AND NITROGEN DIOXIDE DETECTION USING LOW-BANDGAP POLYMER-BASED SENSITIVE SURFACE

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Ammonia (NH_3) and nitrogen dioxide (NO_2) are hazardous compounds commonly found in industrial and household environments, making their detection essential due to their significant environmental impact and high toxicity. As an alternative to inorganic materials, such as metal-oxide semiconductors (MOS), conductive polymers (CPs) have emerged due to their low cost, high sensitivity, and room-temperature operation. Among CPs, low-bandgap polymers are evaluated in gas sensing due to their low-energy electronic structure, which may facilitate significant and detectable changes in conductivity upon interaction with gas molecules. Although sensors based on low-bandgap polymers toward NH_3 detection have already been reported [1], their performance as chemiresistive sensors remains underexplored. In this work, sensitive sensors to NH_3 and NO_2 based on the low bandgap polymer

poly[4,4' diethylhexyl 4H cyclopenta[2,1 b;3,4 b']dithiophene alt 2,5 didodecyl 3,6 bis(thiophen-2-yl)pyrrolo[3,4-c]-pyrrole-1,4-dione] (PCPDTDPP_C12) are proposed. The devices were fabricated by drop-casting onto interdigitated electrodes and evaluated through exposure protocols toward NH3 and NO2 at 6%, 42%, and 53% relative humidity (RH). The sensors exhibited opposite responses to each analyte: an increase in resistance for NH3 and a decrease in resistance for NO2, consistent with p-type semiconductor behavior for reacting and oxidizing analytes. For NH3, the highest sensitivity (0.128 ± 0.065 %/ppb) was obtained at 42% RH, with a limit of detection (LOD) of 7 ppb and high repeatability (2.3%). For NO2, the highest sensitivity (-0.135 ± 0.006 %/ppb) was at 6% RH, with a 9 ppb LOD achieved. In both cases, humidity affected the sensors' behavior. Overall, the PCPDTDPP_C12 polymer demonstrates the potential as chemiresistive gas sensors at room temperature sensing, working as a proof of concept as detectors of NH3 and NO2 at ppb levels.

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References:

[1] Z. Wang, Z. Liu et al, Advanced Electronic Materials Vol.4, Issue 5, 1800025 (2018)

Palavras-chave: low-bandgap polymer; chemiresistive sensor; ammonia; nitrogen dioxide.