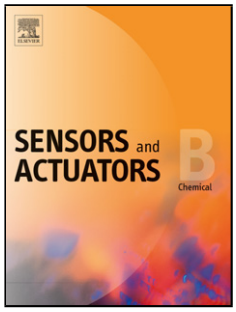

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Carbon Dioxide Detection with Polyethylenimine Blended with Polyelectrolytes

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Abstract

Branched polyethylenimine (PEI) is studied for use as a chemiresistor for detection of carbon dioxide (CO_2) at room temperature. The DC and AC measurements of drop-coated PEI films on interdigitated electrodes revealed a noticeable decrease in conductivity upon exposure to CO_2 (400-2,000 ppm) under high humidity (>60% RH) at room temperature. The increased resistance/impedance is attributed to the formation of carbamates and bicarbonates at amine sites of the PEI chain in the presence of CO_2 and water. The response with increasing CO_2 concentration followed a Langmuir isotherm, indicating that the response can be attributed to an adsorption process. The conductivity is also found to be larger at higher humidity. Blending of PEI with the polyelectrolytes yielded a higher sensitivity for the blend with Nafion sodium salt and shorter recovery times for both blends with Nafion sodium salt and poly(sodium 4-styrenesulfonate) in comparison with PEI. The improved sensitivity of the PEI blend opens possibilities of using these blends in CO_2 sensors for greenhouses and offices.

Keywords

polyethylenimine, carbon dioxide, gas sensor, chemiresistor, Nafion