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Author: Tin C.D. Doan Jacob Baggerman Rajesh Ramaneti
Hien D. Tong Antonius T.M. Marcelis Cees J.M. van Rijn



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Carbon Dioxide Detection with Polyethylenimine Blended with Polyelectrolytes

Tin C. D. Doan^a, Jacob Baggerman^{b,*}, Rajesh Ramaneti^{a,b}, Hien D. Tong^b, Antonius T. M. Marcelis^a and Cees J. M. van Rijn^{a,b,*}

^a *Laboratory of Organic Chemistry, Wageningen University, Dreijenplein 8, 6703 HB*

Wageningen, The Netherlands

^b *Aquamarijn Research B.V., Berkelkade 11, 7201 JE Zutphen, The Netherlands*

* Corresponding Authors Tel.: +31 317 482370; Fax: +31-84-8823204; *E-mail addresses:*

jacob.baggerman@wur.nl (Jacob Baggerman), cees.vanrijn@wur.nl (Cees J. M. van Rijn)

Abstract

Branched polyethylenimine (PEI) is studied for use as a chemiresistor for detection of carbon dioxide (CO₂) 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 CO₂ (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 CO₂ and water. The response with increasing CO₂ 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 CO₂ sensors for greenhouses and offices.

Keywords

polyethylenimine, carbon dioxide, gas sensor, chemiresistor, Nafion

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