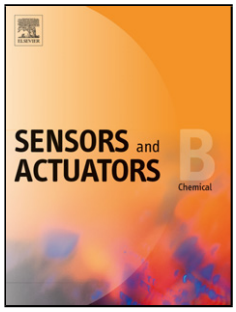

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The development of sensors for volatile nitro-containing compounds as models for explosives detection

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Abstract

Sensors capable of detecting explosives or their degradation products are important devices needed to safeguard citizens and infrastructure. We report on the sensor application of novel customized polymer films that we have produced to have high affinity for chemical vapors containing the nitro (NO_2) group, which is found in explosives such as TNT and DNT. We have used localized electrochemical growth of these polymers to realize miniature, high-selectivity capacitive sensors based on interdigitated electrodes (IDEs). These sensors have been tested for response to vapors of nitrobenzene and 2-nitrotoluene as model analytes for nitro vapors generated from explosive compounds. The sensors were demonstrated to be reversible and to have a very high selectivity to nitro-bearing compounds. In the ppm concentration region, our sensors exhibited a linear response up to three orders of magnitude higher to nitro groups than to other common volatile chemicals found in the atmosphere, which we believe is the highest selectivity to nitro compounds reported from a polymer-based chemicapacitor sensor.

Keywords: Chemicapacitor; Explosives sensor; Polymer; Microsensor; Electropolymerization

1. Introduction

The detection of explosive compounds is required to increase security for users of public transport and at venues of public gathering which have open or easy access [1]. Explosives detection is also required for monitoring the millions of tons of industrial explosives and their toxic chemical by-products produced annually from misuse, theft and to reduce health risks due to contamination [2]. Due to their excellent sense of smell and the ability to discern individual scents, the detection of explosives is performed by sniffer dogs, but training and maintaining these animals costs tens of thousands of dollars, and they can be deployed only