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Dna-templated conductive polymer nanowires as sensors for volatile organic compounds and ammonia

M. I. Yahaya[1]* and **B. R. Horrocks**[1]
[1]Chemical Nanoscience Laboratories,
School of Natural and Environmental Studies,
Bedson Building Newcastle University,
Newcastle upon Tyne, NE1 7RU, UK

Scientific and technological communities globally have great interest on materials that can form well-defined materials on the nanometre scale. Chemical sensors have become a crucial part of our technology driven society and can be found in chemical process, pharmaceutical, environmental and indoor monitoring applications to mention a few. However, gas sensor technologies are still developing and have yet to reach their full potential in capabilities and usage.This research work involved the synthesis, chemical and structural characterisation and design of gas sensors for a range of analytes of industrial interest, primarily volatile organic compounds. The sensing elements are based on conductive polymer (Imidazole, Im; Indole, In; and pyrrole, Py) nanowires created using a simple and low cost fabrication method by employing DNA as a template on which to carry out the polymerisation. The chemical and structural properties of the nanowires were probed using various spectroscopic techniques such as Fourier Transform Infrared (FTIR) spectroscopy, Ultra-Violet Visible (UV-Vis) spectroscopy and X-ray Photoelectron Spectroscopy (XPS); these techniques together demonstrated the formation of a supramolecular hybrid polymer containing DNA and conductive polymers. Atomic force (AFM) and electron microscopy (SEM or TEM) were used to characterise the nanowire dimensions.The sensing performance of the different CP/DNA nanowires were characterised by recording their electrical responses when exposed to different gaseous analyte / air mixtures: analytes included alcohols, chlorinated hydrocarbons and ammonia. Generally, all the DNA-templated CP nanowires show a reversible response of their resistance upon exposure to the analyte.These findings demonstrate that CP/DNA nanowires have promise for future applications in gas sensing for a range of analytes of industrial interest.

ymansur64@gmail.com

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