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NOVEL GAS SENSORS BASED ON POLYANILINE

H.D.S. PREMASIRI, R.M.G. RAJAPAKSE, H.M.N. BANDARA, D.T.B. TENNAKOON AND J.S.H.Q. PERERA

Department of Chemistry, Faculty of Science, University of Peradeniya.

Polyaniline is a conjugated organic polymer that can exist in six different structural forms depending upon the extent of oxidation and/or protonation of the polymer backbone. These forms are called leuco-emaraldine base, leuco-emaraldine salt, emaraldine base, emaraldine salt, pernigraniline base and pernigraniline salt. First two polymers are in completely reduced forms with neutral and positively charged backbones respectively. These two forms are transparent yellow in colour. The third form which is blue in colour is partially oxidised but deprotonated. Forth form is an electronic conductor with a conductivity around 100 S cm^{-1} and is green in colour. This form of the polymer exists with a partially oxidised and protonated structure. Fifth and sixth forms of polyaniline are in their fully oxidised states with the former being deprotonated and the latter being protonated. These two forms are violet in colour. These forms of polyaniline are interconvertible by redox and/or acid/base treatments. These changes of the same material can be utilised in several technological applications.

In this presentation , we describe novel sensors for gases such as NH_3, H_2S, CO, CO_2, Cl_2 and HCl which are based upon polyaniline attached glass templates. A novel method was developed to covalently attach polyaniline on to ordinary glass surfaces. Such templates were dried at 110 °C and stored in a dry desiccator. The templates were exposed to gases at different pressures and changes of conductivity and the optical absorption were measured. The conductivity of the emaraldine salt form decreases upon exposure to basic gases such as NH_3. The colour of the template is changed from green to blue concomitantly. The changes of absorbance and the conductivity were proportional to the gas pressure, while with acidic gases the opposite changes occur. Corresponding changes were observed for reducing and oxidising gases also. With the suitable choice of the polyaniline form it is therefore possible to fabricate electrical and optical sensors for gases that are important environmental pollutants. Since most of the above forms of polyaniline are stable under remote and hostile environmental conditions, these sensors are attractive for the monitoring of industrial atmospheres and those at which geological changes take place. The performance of common gas sensors based upon semiconducting oxides and membranes in remote and/or hostile environments is not very satisfactory.