E2-19 Novel gas sensor based on polyaniline

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Polyaniline is a conjugated organic polymer which exists in 4 interconvertible structural forms depending upon the extent of oxidation and protonation. The 4 forms, namely, leuco-emaraldine, emaraldine base, emaraldine salt and pernigraniline have their own characteristic physical properties. For example, the colours of the 4 forms are yellow, blue, green and violet respectively. The emaraldine salt form is an electronic conductor while the other 3 forms are insulators.

The physico chemical properties of these interconvertible different forms of the same polymer have been utilised in several technological applications. In this paper we describe the utilisation of change of conductivity of the polymer upon the change of extent of protonation for the sensing of gases. Polyaniline coated ordinary glass plates were prepared by covalently attaching polyaniline onto glass surfaces. The modified glass plates were dried at 110°C for several days and stored in a dry desiccator. The electrical connections to the glass plates were obtained by connecting 2 copper wires using tight clips. The desiccator was connected to a manometer and evacuated. Known portions of the selected gas were administered into the desiccator through a drying tube and a manometer. The resistance of a 1 x 1 cm polymer sheet was measured as a function of the gas pressure.

In sensing of basic gases such as ammonia, the protonated and partially oxidised emaraldine salt form of the polymer was exposed to measured portions of ammonia gas and the increase of resistance was followed as a function of ammonia pressure. It was found that the resistance of the polymer is directly proportional to the ammonia gas pressure in the low pressure regime. The acidic gases such as hydrogen sulphide were meaasured by passing through water in order to remove other acidic fumes such as HCl. The decrease of resistance of the emaraldine base form of the polymer was monitored as a function of H_2S gas pressure. The resistance of the polymer is inversely proportional to the H_2S gas pressure over a range of pressures. It is therefore possible to determine hydrogen sulphide gas quantitatively using polyaniline.