# The Study of Polyaniline as a Cathode Material for Fuel Cell Sensors.

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The application of conducting polymers in sensor devices has aroused much interest recently. Polyaniline (PANI) is a material that has shown much promise in this field. In this study a PANI cathode is utilized in the development of an improved fuel cell sensor for the detection of low-ppm concentrations of formaldehyde vapour.

PANI films were formed by potential cycling methods in a sulfuric acid solution on platinum black electrodes. The PANI deposited electrodes were used as the cathode in fuel cells consisting of a platinum black anode. A schematic diagram of the fuel cell sensor is shown in Fig. 1. Fuel cell sensors were tested for their response to low-ppm levels of formaldehyde and methanol. The results are discussed in comparison to a standard fuel cell containing a platinum black anode and cathode.

We propose that a PANI film deposited on a platinum-black counter electrode will behave as a more stable electron sink for the counter electrode reaction instead of the inefficient oxygen reduction reaction which relies on diffusion. In addition, the response time of the fuel cell would be controlled by the rate of electron transfer rather than diffusion of oxygen, which is quite fast in PANI

We report that the performance of a fuel cell sensor with a PANI based cathode is far more superior to the same fuel cell without PANI. The PANI fuel cells showed improved sensitivity and selectivity towards formaldehyde. Fig. 2. shows the output of the PANI based fuel cell to different levels of formaldehyde. In addition we report a ten fold reduction in the response to humidity as can be seen in Fig. 3.

We conclude that PANI is an attractive and reliable cathode material for applications in fuel cell sensors for formaldehyde.

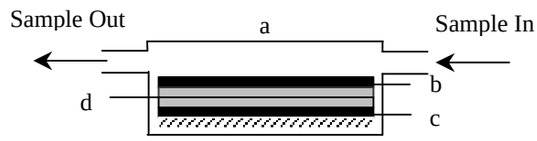


**Fig. 1**. Schematic diagram of the fuel cell sensor. a. fuel cell casing; b. platinum black anode; c. PANI deposited platinum black cathode; d. porous matrix

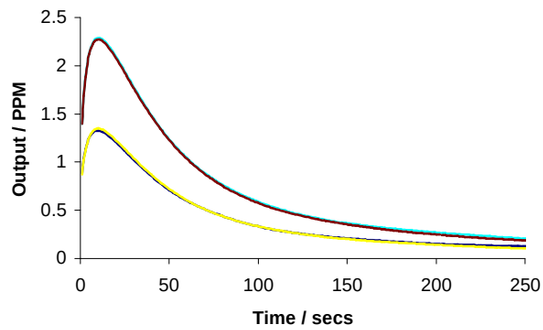


**Fig. 2**. Output of the fuel cell sensor to Formaldehyde at different vapour concentrations

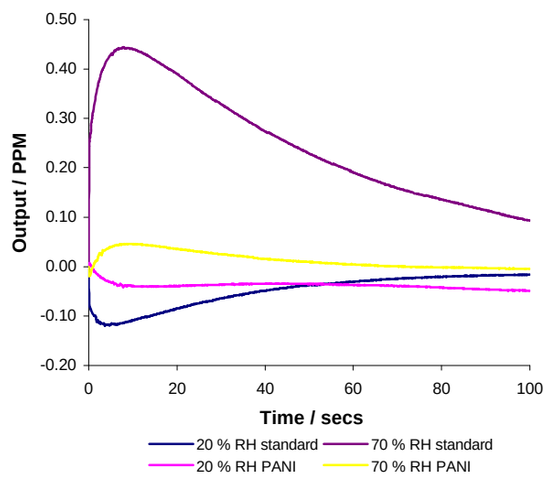


**Fig. 3**. Comparison of the humidity effects on the PANI fuel cell sensor and the standard non-PANI fuel cell