

Acetone Bio-sniffer (YSZ-based Electrochemical Gas Phase Biosensor) toward Diagnosis of Diabetes

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Abstract:

Acetone bio-sniffer, because of its ability of continuous non-invasive monitoring, is recognized as a potential method for the diagnosis of diabetes. In this study, mixed potential electrochemical sensors based on YSZ and K_2NiF_4 -type oxides $Sm_{2-x}Sr_xNiO_4$ ($x = 0.4, 0.6$ and 0.8) sensing electrode were fabricated as bio-sniffer for diagnosis of diabetics by detecting acetone concentration in exhaled breath. The results showed that when $Sm_{1.4}Sr_{0.6}NiO_4$ was used as sensing material, the fabricated sensor exhibited the best performance in comparison with other sensors, the present device also exhibited prominent reliability, excellent humidity resistance and good stability over 30 days. What's more, the low detection limit of sensor to acetone was 300ppb, indicating that the sensor had ability for acetone detection in exhaled breath. The exhaled breathes of the diabetics with ketosis were used for detection and results showed that the sensor had a manifest and stable signal. Besides, the response and recovery time were also acceptable to real-time detection. In addition, the relationship of the blood ketone level and the acetone concentration in exhaled breath was given in the paper. Above all, the fabricated sensor has enormous potentiality for the diabetes monitoring through breath analysis.

Key words: Bio-sniffer, Acetone, Mixed potential electrochemical sensor, Exhaled breath

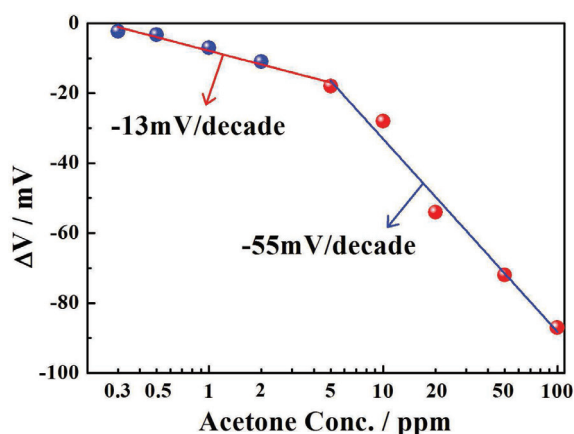


Fig. 1. Dependence of ΔV for the sensor attached with $Sm_{1.4}Sr_{0.6}NiO_4$ -SE on logarithm of acetone concentration in the range of 0.3-100ppm at 675°C.

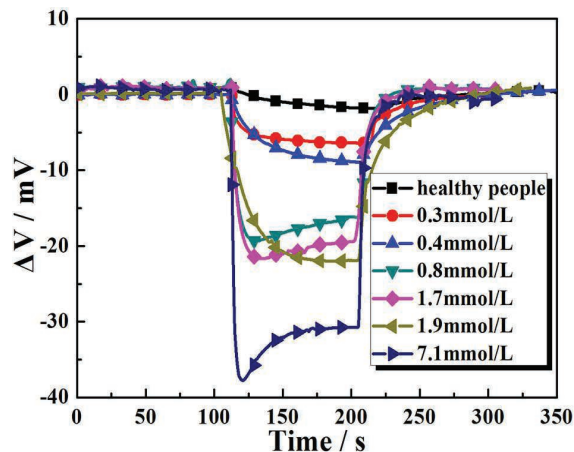


Fig. 2. The response and recovery transient curves of sensor to the volunteer of different blood ketone levels.

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