MEMS GAS SENSOR FOR KIDNEY DIESESE DETECTION

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Disease detection using non-invasive ways is being extensively explored worldwide. Here we present the sensing of low concentrations of ammonia, which is a marker of kidney issue in human body. Hence by monitoring the breath ammonia levels one can decide whether the person is suffering from kidney problem or not. There are other health issues viz-a-viz. diabetes, liver diseases, pulmonary tuberculosis, breast cancer, lung cancer, renal disease, acute asthma, rheumatoid arthritis, etc., which can be monitored using exhaled breath. For instance, acetone for diabetes, carbonyl sulphide, carbon disulphide, isoprene for liver diseases, pentane for rheumatoid arthritis [1-3], ammonia for kidney are used as specific biomarkers. Being a non-invasive way, breathe analysis for disease detection has various advantages such as easy sample collection, less complexity of breath compared to urine or blood, etc. [4].

Human breath consists of several gases and these gases are indicators for different diseases. Increasing ammonia levels in breath indicates kidney disease. Here we present a low power MEMS based gas sensor which can sense as low as 500 ppb concentration of ammonia with a response time of less than 30 seconds. Sputtered SnO_2 film with proper annealing is used as sensing layer. Repeated sensing cycles are used to verify the sensor repeatability. Microheater integrated in the device was characterized for reliability for 120 hours. The power consumption of the device for ammonia sensing is observed 25mW for the operating temperature 220 °C.

Device fabrication has been done using standard unit processes. Fig. 1 shows the intermediate steps of the device fabrication. Operating temperature was decided from the curve shown in Fig. 2, and the sensor response with varying ammonia concentration is shown in Fig. 3.

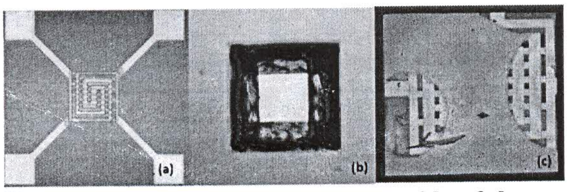

Fig. 1. Fabricated device a) front side of the device b-c) backside during silicon removal. (complete silicon is removed)

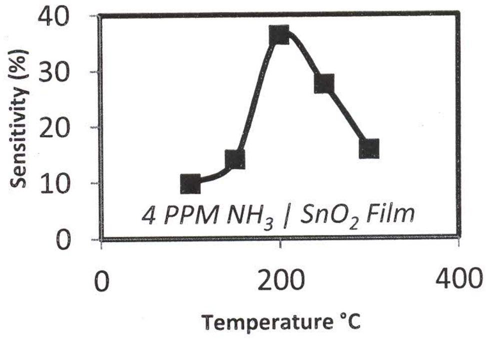

Fig. 2. Temperature optimization curve of SnO2 for ammonia sensing.

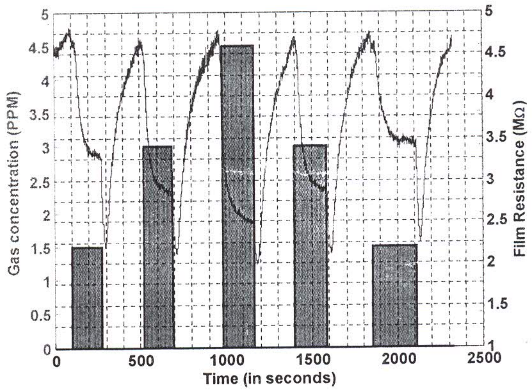

Fig. 3. Sensing characterization of sensor device for 1.5ppm, 3.0ppm and 4.5 ppm.

References

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