Reliability study of a platinum-based micro-hotplate for gas sensing applications

Mahanth Prasad and Vinod Kumar Khanna
Council of Scientific and Industrial Research-Central Electronics Engineering Research Institute
Pilani 333031, Rajasthan, India
Email: mahanth.prasad@gmail.com

Metal oxide gas sensors use a bottom hotplate on which the gas sensing film is deposited. The sensitivity towards a specific gas strongly depends on the temperature. To minimize the power consumption of the hotplate, different approaches have been tried. The MEMS hotplate reduces the power consumption by removing the bulk silicon under the membrane on which the hotplate is fabricated. This hotplate must be rugged and reliable to be able to function over a long period of time without any damage. In the present work, the reliability study of a double spiral platinum based micro-hotplate fabricated on a silicon substrate is reported. The hotplate structure consists of a platinum resister, SiO_2 membrane created using bulk-micromachining of silicon and a silicon substrate. A platinum resistor of 140 Ω was fabricated on a thin SiO_2 created using bulk-micromachining technique. The temperature coefficient of resistance (TCR) of platinum is measured and found to be 2.2×10^{-3}/ °C. The hotplate consumes 51mW when heated up to 564 °C. The reliability testing of fabricated structure was performed in pulse-mode operation. It was observed that the device can sustain at least 71 cycles pulse-mode operation at 230 °C with ultra-low resistance and temperature drifts. The maximum current capability of the structure is found to be 13.65 mA without any damage.