CMOS Compatible Gas Sensors

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Abstract

Gas sensors based on semiconductor metal oxide (SMO) films are a mature chemo resistive gas-sensing technology which has shown potential for CMOS integration on two fronts: First, the sensor can, with relative ease, be combined with digital and radio frequency circuits to ensure on-wafer integration of control and transmission circuitry, respectively. Secondly, the fabrication of the sensor can be carried out using mature CMOS technology, reducing the fabrication costs. However, a drawback of SMO sensors is that the surface reactions, necessary to initiate sensing, require high temperature operation on the order of 250- 500°C. To provide the high temperature, a heating element – the microheater – is required to be incorporated into the SMO sensor design. The design and material choices for these microheaters is being readily investigated in order to ensure a uniform temperature distribution, low power dissipation, and high resistance to electromigration and thermal stresses. Initial designs involved the use of aluminum, polysilicon, and gold, but these materials were found to exhibit low resistivity, poor contact properties, oxide formation at high temperatures, and electromigration. Platinum offered better properties, but at a much higher cost. Research is ongoing on several potential materials, including nickel and nickel alloys, due to their low temperature coefficient of resistance and high thermal conductivity. Materials like tungsten, nickel-chromium, Dilver P1, molybdenum, hafnium dibromide, titanium nitride, silicon carbide, tungsten, and tantalum-aluminum are all actively being studied. This talk will describe what properties we look for in a microheater film and which materials show the most promise today.

Biography

Dr. Selberherr was born in Austria, in 1955. He received the degree of *Diplomingenieur (*Engineer*)* in electrical engineering and the doctoral degree in technical sciences f0.25rom the *Technische Universität Wien* in 1978 and 1981, respectively. Prof. Selberherr has been holding the *venia docendi* on Computer-Aided Design since 1984. From 1988 to 1999 he was the Head of the Institute for Microelectronics. From 1998 to 2005 he served as Dean of the Faculty of Electrical Engineering and Information Technology. His current research topics are modeling and simulation of problems for microelectronics engineering. To find out more about Prof. Selberherr's achievements, visit https://en.wikipedia.org/wiki/Siegfried_Selberherr