Sensors and Materials, 4 (1988) 187–207
MYU, Tokyo

S & M 0020

Comparison between Platinum and Iridium as Gate Metals in Ammonia-Sensitive Metal-Silicon Dioxide-Silicon Structures

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(Received February 22, 1989; accepted May 1, 1989)

Key words: gas sensors, ammonia, platinum, iridium, MOS capacitors, temperature dependence, stability, film structure, catalytic reactions

Ammonia gas-sensitive MOS capacitors with thin (6 nm) platinum or iridium gates are compared in the temperature range 40 to 265 °C in an ambient of synthetic air. Ammonia exposure gives rise to a potential change of the platinum or iridium surface. This surface potential change is supposed to be capacitively coupled to the silicon surface through the discontinuities in the thin metal film, which shifts the capacitance voltage curve of the MOS structure along the voltage axis. At low temperatures iridium showed the largest response to ammonia. Normally at higher temperatures (>100°C), platinum initially had a faster and larger response than iridium. Platinum showed a "burn-in" phenomenon, a reduction of the response to ammonia, during the ammonia exposure at high temperatures. The "burn-in" phenomenon was not observed for iridium. The reason for this is discussed in some detail. For platinum, the maximum voltage shifts (ΔV_{max}) increased with temperature over the whole temperature range. For iridium, ΔV_{max} had a maximum at about 200°C. This was one of the indications that the reaction kinetics are different on the platinum and iridium surfaces during ammonia exposure. A brief summary of suggested reactions between oxygen and ammonia on platinum and iridium surfaces is therefore also given.