

Mercury-Vapor-Sensitive MOSFET with Gold Gate Membrane

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Mercury-sensitive silicon field-effect transistors with gold gate membranes have been developed. MOSFETs with the Au membrane exhibit a considerable increase of threshold voltage U_t , due to mercury vapor in ambient air. Threshold voltage dependence on mercury concentration C tends to saturation at $C \approx 2.5 \times 10^{-3} \text{ g/m}^3$. The time required for U_t to change after mercury vapor introduction is about 10 min. XPS experiments show nonzero mercury concentration in the gold membrane as well at the Au-SiO₂ interface.

1. Introduction

Since Lundstrom *et al.*⁽¹⁾ introduced the hydrogen-sensitive silicon field-effect transistor (FET) in 1975, much interest has been shown in chemical sensors based on metal-oxide-semiconductor (MOS) structures. MOS capacitors and MOSFETs with catalytic metals (Pd, Pt or Ir) or semiconductor (SnO_x) films as active membranes sensitive to various gases have been developed.⁽²⁾

On the other hand, gold is well known as a strong absorber of mercury. The parameters of thin gold films (*e.g.*, resistance and mass) change after their exposure to mercury vapor.^(3,4) Therefore the Au-SiO₂-Si structure appears to be mercury-sensitive. The possibility of mercury detection with MOS capacitors was proven by Winqvist and Lundstrom.⁽⁵⁾

In this paper, the silicon field-effect transistor with a gold gate membrane sensitive to mercury vapor is presented.