Sensors and Materials, 2, 2 (1990) 099–106
MYU, Tokyo

S & M 0041

Microfabricated Amperometric Gas Sensors with an Integrated Design

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(Received January 22, 1990; accepted April 4, 1990)

Key words: amperometric sensor, chemical sensor, electrochemical sensor, gas sensor, microfabrication, Nafion, photolithography.

A microfabricated, three-electrode, amperometric gas sensor with an integrated design was constructed and tested. The electrodes were photolithographically etched onto a gold-coated silicon oxide surface of a 50.4-mm silicon wafer and spin-coated with a thin film of a solution of the solid electrolyte Nafion. The working electrode of the sensor was an ultrafine square grid (5 × 5 mm) with evenly spaced regions of gold and holes every 50 μm. The fixed-potential, steady-state response of this sensor was compared to that of a series of sensors with working electrodes having a coarser grid design, which we had previously constructed by using a less sophisticated microfabrication technology. The signal observed for the ultrafine grid sensor following exposure to test vapors greatly exceeded the response that would be expected on the basis of simple geometric considerations of microelectrodes.

1. Introduction

Microfabrication of electrochemical devices has numerous advantages over standard fabrication procedures. These advantages include precise control of structure, reproducible geometries, miniaturization, and potential for mass production. Moreover, miniaturized electrodes exhibit shorter response times in diffusion-limited regions and higher concentration sensitivity in electroanalytical applications.[1,2] Accordingly, various miniaturized electrode geometries have been studied,