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A Vacuum Microsensor for the Low-Vacuum Range

F. Völklein and W. Schnelle

Physikalisch-Technisches Institut Jena
Helmholtzweg 4
D-O-6900 Jena, Germany

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The design and testing of a new vacuum microsensor for measuring pressures in the range above 0.1 Pa are described. The sensor chip consists of an anisotropically etched $Si-SiO_2/Si_3N_4$ substrate, a thin-film thermopile and a heater, as well as an anisotropically etched silicon "bridge". The measuring principle is based on the variation of the generated thermoelectrical voltage with the pressure of the surrounding gas.

Valuable features of the sensor chip are its small size, low-cost batch fabrication and the possibility of signal conditioning by monolithic or hybrid integration. Measures for a complete ambient temperature compensation of the chip itself are described.

1. Introduction

Up to now, the well-known hot-wire vacuum meters of the Pirani type have been the most important vacuum gauges for the pressure range above 0.1 Pa. In the last few years, some attempts have been made to produce such Pirani gauges as thin-film microsensors (thermopiles or bolometers).[1-3] Applying thin-film technologies, photolithographic patterning and anisotropic etching, we have developed a vacuum microsensor with high sensitivity in the pressure range from 10^5 to 10^{-1} Pa.

The advantages of the sensor in comparison with conventional Pirani gauges are

a. reproducible batch and low-cost fabrication (nearly 400 sensor chips are produced on one 4-inch silicon wafer);