Sensors and Materials, Vol. 17, No. 8 (2005) 453–463
MYU Tokyo

S & M 0623

A Single-Axis Thermal Convective Gas Gyroscope

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(Received January 14, 2005; accepted June 27, 2005)

Key words: gas gyroscope, thermal convective, thermoresistive effect

In this paper, the design, simulation and fabrication of a single axis semiconductor gas gyroscope are presented. The sensor configuration consists of a piezoelectric pump and a micro-thermal-sensing element packaged in an aluminum case with diameter and length of 14 mm and 25 mm, respectively. This gas gyroscope utilizes thermal convective transfer and the thermoresistive effect of Si to detect the applied angular rate. Good agreement between the results of sensitivity simulations and the experimental data has been realized. The sensitivity is 0.15 mV/deg/s, which is 62 times higher than that of a gas gyroscope of the same design but with tungsten as the sensing element. Moreover, the power consumption of this gyroscope is only 5.5 mW, i.e. one fourth of that of the gyroscope with tungsten. Nonlinearity is 0.5% FSO, and the crosstalk is 0.5%. The resolution based on sensitivity and noise analyses (i.e., thermal noise and 1/*f* noise in the thermistors) is 0.04 °/s.

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