Wireless Thermal Bubble Type Accelerometer and Monitor System Design

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Abstract

Traditional thermal bubble type accelerometers are manufactured on silicon wafers, and consequently, their manufacturing costs are high. Moreover, traditional thermal bubble type accelerometers built on silicon wafers usually use silicon dioxide supports to support their heaters and thermal resistors. However, because silicon dioxide has low thermal conductivity (1.5 W/(m-K)), heat transfer in the accelerometers is adversely affected so that the temperature of the lower portion of a gas chamber is low, resulting in the poor sensitivity of the thermal resistors. In addition, the poor heat transfer also affects the sensitivity of the thermal resistors responding to acceleration. Thus, in order to increase sensitivity, traditional accelerometers need greater energy supply, increasing the working temperature in the accelerometers. Under high working temperatures, the silicon dioxide structure for supporting the heaters and the thermal resistors may expand and shrink every time the accelerometer is turned on and off, resulting in material fatigue and aging, and causing a short lifespan of the accelerometer. Furthermore, traditional accelerometers are filled with air or volatile liquids as a thermally conductive medium. However, air contains oxygen, which may oxidize the heaters. If volatile liquid is used, the volatile liquids may chemically react with the components in accelerometers, lowering their measurement accuracy after the accelerometers have been operated for a while, and reducing the lifespan of the accelerometers. In summary, traditional accelerometers need high temperature processes to manufacture, and have shortcomings such as high cost, high energy consumption, material oxidation, aging, and low performance. Therefore, a new accelerometer is required.

Keyword：Thermal bubble type accelerometer, Silicon wafer, Thermal conductivity, Flexible substrate, Xenon gas