

# A Novel Low Temperature Method to Make a Wireless Accelerometer

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## Abstract

This research proposes a novel low temperature manufacturing method to make a wireless accelerometer on a flexible substrate. The substrate deposition temperature is  $100^{\circ}\text{C}$  without causing any strain and stress problem. Since the thermal conductivity of the traditional Si is  $1.48\text{ W}/(\text{cm}\cdot\text{K})$ , which is 25 times of the flexible substrate, i.e.  $0.06\text{--}0.0017\text{ W}/(\text{cm}\cdot\text{K})$ , thus the power leakage through the substrate can be saved by the new design. The key technology is to integrate a thermal bubble accelerometer and a wireless RFID antenna on the same substrate, such that the accelerometer is very convenient for fabrication and usage. In this paper the heaters and the thermal piles are directly adhering on the substrate surface without the traditional floating structure. Thus the structure is much simpler and cheaper for manufacturing, and much more reliable in large acceleration impact condition without broken. Furthermore, the molecular weight of xenon gas ( $131.29\text{ g/mol}$ ) is much larger than carbon dioxide ( $44.01\text{ g/mol}$ ), thus the performance of the accelerometer will be increased. In addition, the shape of the chamber is changed as a semi-cylindrical one instead of the conventional rectangular type. The average sensitivity is increased by 15%. In addition, if one applies only xenon gas but keeping the rectangular chamber, then the response speed can be increased by 23%. Moreover, if one applies both Xe and the semi-cylindrical chamber, then the response speed can be increased by 43%.

Keyword : Flexible substrate. Low temperature deposition. Thermistors. Wireless accelerometer.