

# An Innovated Wireless RFID-Based Non-Floating Type Thermal Bubble Accelerometer on a Flexible Substrate

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## Abstract

This paper proposes an innovated method to integrate an active RFID tag with a thermal bubble accelerometer on a flexible substrate, e.g., PT, PET and PI, thus it can become a wireless acceleration sensor for easy usage and power saving in sports, hospital monitoring, air bag, game, navigation, exercising, etc. Because the thermal conductivity of the traditional Si is  $1.48 \text{ W}/(\text{cm-K})$ , which is about 25 times of the proposed flexible substrate, i.e.,  $0.06 - 0.0017 \text{ W}/(\text{cm-K})$ , thus the power leakage through the substrate can be saved. In this paper the heaters and the temperature sensors are deposited by E-gun evaporator on the surface of the flexible substrate without the traditional floating structures over a grooved chamber. Thus the new device is much simpler and cheaper. It is also more reliable in large acceleration impact condition without breaking the heaters and the temperature sensors hanging over the grooved chamber. In addition, the internal rectangular shape of the device chamber is replaced by a semi-cylindrical one to speed up the gas flow for heat convection. Moreover, the molecular weight of the proposed filling xenon gas ( $131.29 \text{ g/mol}$ ) is three times larger than the commercial one with  $\text{CO}_2$  ( $44.01 \text{ g/mol}$ ), thus both sensitivity and response speed can be increased. Comparisons of step input acceleration commend are made; the performances of sensitivity and kinetic energy response time for the proposed semi-cylindrical chamber filled with xenon gas are better than

the previous rectangular one by 15%  
and 43.2%, respectively.

Keyword : RFID-Based, Thermal Bubble Type, Non-Floating Type Accelerometer,  
Flexible Substrate, Semi- Cylindrical Shaped Chamber.